Forward

On behalf of the Board of Trustees and International Scientific Commission of International Association for Teaching and Learning and International Society for the Scientific Research, I have the pleasure to furnish you herewith the Proceedings which herein contains a collection of the papers presented at International Conference on Science and Technology Education (ICSTE2012) organized by African Society for Scientific Research and African Association for Teaching and Learning in cooperation with Alvan Ikoku Federal College of Education, Owerri-Nigeria and other partners and collaborating journals. The conference was held October 22-26, 2012 at Alvan Ikoku Federal College of Education, Owerri, Nigeria.

The ICSTE series is an academic activity for interested scholars, educators, scientists, technologists, environmentalists, policy makers, corporate bodies and graduate students. The aim of the conference is to diffuse research findings and create a conductive environment for scholars to debate and exchange ideas that lead to development in science, technological and economic spheres of the global community.

Following the call for papers by the International Scientific Commission, papers we received more than 300 proposals from 27 different countries from all continents. As a commitment to the vision and mission of academic excellence and integrity, each paper was anonymously reviewed by two members of the editorial sub-committee of the Commission. This book of proceedings contains a selection of the papers presented at the conference.

We wish to express our sincere thanks to the Provost, Management, Staff and students of Alvan Ikoku Federal College of Education, Owerri for providing the venue and facilities for the conference and for being committed to towards ensuring the success of the conference. The Local Organising Committee led by Associate Professor Dr Anthonia U. Ejifugha played enormous role that ensure the realization of the project.

We thank all our institutional partners especially the European Scientific Institute and the Mediterranean Center for Social and Educational Research for their cooperation and support for the project. We express our profound gratitude to all and sundry especially our Special Guests, delegates, reviewers, the media, the Nigerian foreign missions and all the cooperating partners for their contributions in promoting this noble academic event.

Please read on!!!

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ACTIVE LEARNING: CREATING EXCITEMENT AND ENHANCING LEARNING IN A CHANGING ENVIRONMENT OF THE 21ST CENTURY

By

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BEING A KEYNOTE LECTURE DELIVERED AT THE INTERNATIONAL CONFERENCE ON SCIENCE AND TECHNOLOGY EDUCATION (ICSTE2012), ORGANISED BY AFRICAN ASSOCIATION FOR TEACHING AND LEARNING (AATL) AND AFRICAN SOCIETY FOR SCIENTIFIC RESEARCH HELD AT ALVAN IKOKU FEDERAL COLLEGE OF EDUCATION, OWERRI-NIGERIA. OCTOBER 22-26, 2012.
The environment is changing very fast, it is reshaping at a rapid pace specifically because the emergence of new technologies is changing the society, changing the way we live, the way we communicate and do business and also the way we learn. Consequently, our educational systems are facing significant pressure to change the way we educate our children too in order to adequately prepare them to live, learn, and work in a global, digital age. Education is all about change and creativity, therefore there should be creative models for engagement in learning in a shifting educational landscape. Education in the 21st century is different from what it used to be in the 17th or 18th century because of the changes overtime and subsequently the variations in the learners’ needs particularly in this world of technological advancement. In this setting, new information is worth more than old information and learning never stops. For Nigeria to be economically buoyant, technologically advanced, intellectually skilled, politically stable and morally upright and move up the ladder from developing to developed cadre there is need to make a change in the educational system. Teaching and learning process should be more effective by constant renewal in the knowledge impacted and shared with the students all the time. The mode of instruction delivery needs to change from traditional teacher-centred to new learning that is learner-centred and globally acceptable as is the case with the USA and other countries where education is undergoing a major paradigm shift (change) from traditional learning environments focused on the teacher as the “deliverer” of knowledge to new open learning environments focused on the learner as information seeker. Although the movement in the USA and other developed countries took root first at the primary and secondary levels of education, it has had an impact on tertiary education as well. Likewise, there should be turn of the tide in the Nigerian Educational System.

In this paper therefore, the following will be addressed:

- The Concept of Education;
- The Nigerian System of Education and the Challenges;
- Active Learning and its Constituents.
- Importance of Active Learning.
- Examples of Active Learning Strategies Incorporated into the classroom to create Excitement and Promote Learning;
- Some of my Research findings on Active Learning Strategies;
- Barriers to Active Learning and Overcoming them;
- Recommendations and conclusions.

**INTRODUCTION**

Education controls the development of any nation because no nation can rise above the products of its educational system (Ikoro 2005). The essence of education at any level is to produce knowledgeable, skilled and productive individual with a sound mind. The knowledge gained through education should be lasting, it should be utilised by the students throughout the lifetime. Orr (1991) asserts that:

“The goal of education is not mastery of subject matter, but of one's person. Subject matter is simply the tool. Much as one would use a hammer and chisel to carve a block of marble, one uses ideas and knowledge to forge one's own personhood. For the most part we labour under a confusion of ends and means, thinking that the goal of education is to stuff all kinds of arts, techniques, methods, and
information into the student's mind, regardless of how and with what effect it will be used”.

Likewise, Newman (2008) affirms that “any kind of knowledge, if it be really such, is its own reward. So, the pursuit of knowledge should not be looked at in terms of what it is going to do for you in the future. It should be looked at as beneficial in itself. Knowledge is something that you gain that cannot be taken away from you”.

This is clearly indicated in the Nigeria Philosophy of Education (2004) which is based on the integration of the individual into a sound and effective citizenry and equal educational opportunities for all citizens of the nation at the primary, secondary and tertiary levels – a meaningful and achievable philosophy of education which is geared toward learning in a changing environment and suitable for the progress of the country. A pertinent question here is “How far has the Nigerian educational system implemented this omnibus philosophy of education to ensure that students are learning in a changing environment?

NIGERIAN EDUCATIONAL SYSTEM AND CHALLENGES

Nigeria, a developing country for the past 52 years after her independence has been facing economic, social, political and educational challenges (Adegoke, 1998; Adomi 2005a; Buaari 2002; Okwudishu 2005; Plante and Beattie 2004). The educational challenges led to the introduction of different reforms in the educational system and switching from the 6-5-2 3 to 6-3-3-4 to 9-3-4. The reforms were designed to bring about developments in areas of needs through infusion of modern methods of teaching and curriculum implementation as indicated by the Federal Government of Nigeria, in the National Policy on Education (Federal Republic of Nigeria, 2004). In fact, the Nigerian government recognizes the prominent role of ICTs (Information and Communication Technologies) in the modern world and tries to integrate it into educational system. To actualize this goal, the document states that government will provide basic infrastructure and training at the primary school. The Federal Ministry of Education launched an ICT-driven project known as School Net (www.snng.org) (Federal Republic of Nigeria, 2006; Adomi 2005; Okebukola, 2004), which was intended to equip all schools in Nigeria with computers and communication technologies.

However, this seems to be an illusion as indicated in the reports by many investigators that this was never implemented. For instance Adomi and Kpangban (2010) in their investigation of the causes of low level of ICT application in Nigerian high schools found that “Limited/poor information infrastructure” ranks first; “Lack of/inadequate ICT facilities in schools” ranks second as earlier found by Okwudishu (2005); Plante and Beattie (2004) “Frequent electricity interruption” ranks third as reported earlier by Adomi, (2005a); Adomi, Omodeko, and Otole, (2004); Adomi, Okiy, and Ruteyan, (2003). This makes the few schools with ICT facilities unable to use them regularly. “Poor ICT policy/project implementation strategy” was also indicated as a factor. Additionally, a growing body of ERNWACA (Educational Research For West and Central Africa) researchers also reported that the quality of basic education in Nigeria is still threatened because of failure to plan, under funding or mismanagement of funds, poor maintenance culture and politicisation of educational policies and programmes (Adegoke 1998). Similarly, Busari (2002) observed that the present situation in the classrooms is not tailored to laying a sound basis for scientific and reflective thinking which is one of the aims of primary education. It was suggested that science teacher education programme should be restructured to
accommodate integrative learning strategies. Specifically, education constitutes of a major focus because it is believed that education is an instrument of national development and thus, it could be employed to achieve political, economic and social developments. The development of any nation requires the collective efforts of its citizens and all residents.

The formal education system in Nigeria includes:

- 6 years of primary schooling
- 3 years of junior secondary schooling
- 3 years of senior secondary schooling, and
- 4 years of university education, finally directing toward a bachelor's level degree in the majority of the courses.

The primary, secondary and post secondary levels had witnessed dramatic growth and tremendous changes. Today, at the university level, what used to be five universities between 1948 and 1965 had increased rapidly to 107 universities in 2012 (2012 University Web Ranking) catering for millions of students. Such growth was impossible without incurring a host of problems, several of which were so severe as to endanger the entire system of education as outlined in the Section 1 sub-section 4 of the Nigeria’s Philosophy of Education (2004) that:

a) Education is an instrument for national development; in this end, the formulation of ideas, their integration for national development and the interaction of persons and ideas are all aspects of education;

b) Education fosters the worth and development of the individual, for each individual’s sake, and for the general development of the society;

c) Every Nigerian child shall have the right to equal educational opportunities irrespective of any real or imagined disabilities, each according to his or her ability;

d) There is need for functional education for the promotion of a progressive, united Nigeria; to this end, school programmes need to be relevant, practical, and comprehensive, while interest and ability should determine the individual’s direction in education.(FRN, 2004).

Ubong (2011) analysed these omnibus provisions of what should be the country’s philosophy of education stated above and their corresponding philosophical concepts thus:

- Dewey’s multiple approaches to education delivery in a);
- Humanism in b);
- Egalitarianism in c);
- Progressivism, pragmatism, and individualism cum humanism in d).

Similarly, the Section 1 sub-section 5 of the Nigeria’s National Philosophy of Education, is based on:

a) the development of the individual into a sound and effective citizen;

b) the full integration of the individual into the community, and

c) the provision of equal access to educational opportunities for all citizens of the country at the primary, secondary, and tertiary levels both inside and outside the formal school system.

Similar to Ubong’s (2011) observation, these philosophical statements also have theoretical links to the different learning/developmental theories by Skinner, Thorndike, Piaget, Vygotsky, Pavlov, Watson and Information Processing Model which addressed the various strategies of actively engaging and conditioning learners to learn and develop in a changing environment.

Unfortunately, Nigeria is still faced with economic hardship which increased the engagement in nonacademic moonlighting activities among the teaching staff. Added to these difficulties were such factors as the lack of books and materials, no incentive for research and writing, the use of outdated notes and materials, and the deficiency of replacement of laboratory equipment.
especially with the remarkable growth from the five universities in 1965 to over 1000 universities in 2012. The graduates produced and the quality of the certificate cannot withstand the changing environment. It is no wonder that the number one university in Nigeria is ranked as the 1639th university among the universities in the world (Ranking Web of World Universities, 2012). The few good students produced continued to search for greener pastures and by 1990 the crisis in Nigerian education was such that it was predicted that by the end of the decade, there would be insufficient personnel to run essential services of the country! Thus, the theme of this conference is timely; it is time to change from traditional method of lecturing in our tertiary institutions and other levels of education to active learning in order to improve the quality of learning that theis exposed to the learner. It is time to invest in children’s education because “Today Youths; Tomorrow’s Leaders”- Kennedy (2012).

ACTIVE LEARNING AND ITS COMPONENTS

Investigators refer to active learning as anything that students do in a classroom other than merely passively listening to an instructor’s lecture. This includes everything apart from listening practices which help the students to absorb what they hear, to short writing exercises in which students react to lecture material, to complex group exercises in which students apply course material to "real life" situations and/or to new problems (Paulson and Faust 2010). Additionally, Chickering and Gamson (1987) further suggested that for students to be actively engaged, they must do more than just listen: they must read, write, discuss, or be engaged in problem solving. Most importantly, to be actively involved, students must engage in such higher-order thinking tasks as analysis, synthesis, and evaluation. Paulson and Faust (2010) further distinguished cooperative learning from active learning as covering the subset of active learning activities which students do as groups of three or more, rather than alone or in pairs; generally, cooperative learning techniques employ more formally structured groups of students assigned complex tasks, such as multiple-step exercises, research projects or presentations. They also distinguished cooperative learning from collaborative learning which refers to those classroom strategies when the instructor and the students work together in designing assignments, choosing texts, and presenting material to the class. Clearly, collaborative learning is a more radical departure from tradition of merely utilizing techniques aimed at enhancing student’s retention of material presented by the instructor.

A close examination of the description of active learning shows the theoretical links to some learning and developmental theories: Skinner’s Operant Conditioning Theory where the learner is active, functional and operates on the environment before being rewarded; Pavlov’s Classical conditioning where the learner is conditioned to learn and rewarded, Vygotsky’s Zone of Proximal Development and Social Cultural Perspective where the learner learns through the interaction with the social environment and so many others.

Considering the components of active learning strategies, (Mantyla, 1999) posits that good active learning activities are the same, whether presented in traditional or in online environments and activities should:

1) have a definite beginning and ending;
2) have a clear purpose or objective;
3) contain complete and understandable directions;
4) have a feedback mechanism; and
5) include a description of the technology or tool being used in the exercise.
He further suggests that when using active learning strategies, instructors/designers will want to consider the following:

1) Can learners complete the activity independently?
2) Will they need specific guidance before or during the activity?
3) Will visuals or other materials be needed?
4) Will they need to collaborate with other learners?
5) How do the learners ask questions?
6) Will there be formative or summative evaluation?
7) What tools will be available to support the activity, including technology, resources, and examples?
8) Should different strategies and tools provide multiple ways of experiencing learning? (Mantyla, 1999.)

THE NEED FOR ACTIVE LEARNING

For the past decades, the majority of college faculties still teach their classes in the traditional lecture mode in which professors talk and students listen, dominate college and university classrooms. Some scholars have criticized traditional method of teaching and argued that it is boring and found that it is one of the factors responsible for absenteeism among the tertiary education students around the globe. For instance, in their cross institutional study of the factors responsible for absenteeism from lectures among the 500 Nigerian and 500 Caribbean tertiary education students, Fayombo, Babalola and Olaleye (2012) found that academic or school-related reasons such as “The poor teaching skills of lecturers leading to boring lectures” top the list while personal, home and society related reasons were also identified. Similarly, in an earlier study at the University of Canterbury, New Zealand, Hunter and Tetley (1999) interviewed 168 full-time students about not only their reasons for not attending lectures but also their reasons for attending and found that tertiary education students will not miss lectures that were interesting and those considered important to their degree, those in which there was a lot of material given out, those where they liked the subject content or in which the lecturer was good, while those that they will not attend according to Gump, (2006) and Nicholl & Timmins,( 2005) also, were perceived as academy-centred such as: failure to connect the content of the lecture to assessment or the ‘real world’, unexciting and unchallenging lecturers. Thus, the students are likely to miss lectures because they are not actively involved in the classroom activities and the content of the lecture did not match the changing environment which are characteristics of traditional lecture method.

Some investigators also reported that active learning is important because: the amount of information retained by students declines substantially after ten minutes (Thomas, 1972); in those experiments involving measures of retention of information after the end of a course, measures of problem solving, thinking, attitude change, or motivation for further learning, the results tend to show differences favouring discussion methods over lecture method (McKeachie, Pintrich, Lin, & Smith, 1987). Numerous researchers and national reports also discussed the use of active learning strategies in the classroom as indicated in the following statements:

- all genuine learning is active, not passive; it is a process of discovery in which the student is the main agent, not the teacher (Adler, 1982);
- students learn what they care about and remember what they understand (Erickson, 1984);
learning is not a spectator sport, students do not learn much just by sitting in class listening to teachers, memorizing pre-packaged assignments, and spitting out answers, they must talk about what they are learning, write about it, relate it to past experiences, apply it to their daily lives. They must make what they learn part of themselves. (Chickering and Gamson, 1987);

The sort of teaching we propose requires that we encourage active learning and that we become knowledgeable about the ways in which our students hear, understand, interpret, and integrate ideas. (AAC Task Group on General Education, 1988, p. 25);

“One must learn by doing the thing, for though you think you know it you have not certainty until you try”. (Sophocles, 5th c. B.C.)

Regarding the need for active learning, some investigators also pointed out the limitations of traditional method of teaching. Turner (nd) in her presentation on “Learning in a Digital World: The Role of Technology as a Catalyst for Change in the University of Education, Winneba, Ghana”, claims that traditional method has some characteristics/limitations because:

1) it does not meet the diverse needs of many learners with different learning styles and capabilities as we have in schools today;
2) it does not cater for problem solving skills needed by students in the real world which requires the ability to see a problem from multiple points of view by the students;
3) there is no flexibility in traditional method, therefore learners are not encouraged to reach their full potentials;
4) of rigid assessment, relying on written tests that cannot assess the full range of one’s achievements and potentials.

Contrarily, Bonwell (1996) summarised the major characteristics/advantages associated with active learning strategies thus:

1) Students are involved in more than passive listening;
2) Students are engaged in activities (e.g., reading, discussing, writing)
3) There is less emphasis placed on information transmission and greater emphasis placed on developing student skills;
4) There is greater emphasis placed on the exploration of attitudes and values
5) Students’ motivation is increased (especially for adult learners)
6) Students can receive immediate feedback from their instructor
7) Students are involved in higher order thinking skills (analysis, synthesis, evaluation)

Hence the need for active learning, a learner centred method in the changing environment.

ACTIVE LEARNING STRATEGIES

The techniques of active learning are those activities which an instructor incorporates into the classroom to foster active learning (Paulson & Faust 2010). It is proposed that strategies promoting active learning be defined as instructional activities involving students in doing things and thinking about what they are doing (Chickering & Gamson 1987).

In The University of the West Indies, CaveHill Campus, the University authority recognised the need for learners to be active in the classroom and be actively engaged therefore, lecturers have been encouraged to undergo the Certificate in University Teaching and Learning (CUTL) Training to improve their teaching skills so that they can use the active learning techniques and consequently be more effective in classroom teaching. I incorporated some of these techniques into the classroom activities during the Developmental Psychology II (97 students) and Learning.
Theory and Practice lecture (178 students) lectures to make my psychology students active in the class, to create excitement and also promote learning. These various techniques of active learning have been described and categorized in different ways by the researchers. Below are some examples of active learning strategies that I incorporated into my lectures to make learning fun and at the same time promote it. The examples of active learning strategies that can be adapted in the classroom included those categorized by Paulson and Faust (2010) but not limited to:

1) Cooperative Learning Exercises: For more complex projects, where many heads are better than one or two, students may work in groups of three or more. As the term "cooperative learning" suggests, students working in groups will help each other to learn. Generally, it is better to form heterogeneous groups (with regard to gender, ethnicity, and academic performance), particularly when the groups will be working together over time or on complex projects; however, some of these techniques work well with spontaneously formed groups. Cooperative groups encourage discussion of problem solving techniques ("Should we try this?" etc.), and avoid the embarrassment of students who have not yet mastered all of the skills required.

- **Role Playing** - Here students are asked to "act out" a part. In doing so, they get a better idea of the concepts and theories being discussed. Role-playing exercises can range from simple distinguishing concepts such as “positive reinforcement”, “negative reinforcement”, “punishment” etc as done in my Learning Theory and Practice class to the complex role plays of different parental styles of childrearing and their contributions to the social development during the childhood stage as role-played in my Developmental Psychology class.

- **Game Show** - Many will discard the idea that one would literally play games in a university setting, but occasionally there is no better instructional tool. This strategy is good for late lectures, for young and old students in full time or part time programmes. My courses were usually between 7pm and 9pm when many students will be very tired and even hungry, but when it’s game time they wake up and participate in the lecture. The game show helps to stimulate their sensory abilities, make them to be actively engaged and at the same time learn. In particular, there are some concepts or theories which are more easily illustrated than discussed and in these cases, a well-conceived game may convey the idea more readily. For example, students may be introduced to new concepts or facts that are hard to convey through lectures.

- **Cooperative Groups in Class/ Group Discussions** – The instructor may pose a question to be worked on in each cooperative group and then circulate around the room answering questions, asking further questions, keeping the groups on task, and so forth. After an appropriate time for group discussion, students are asked to share their discussion points with the rest of the class. The ensuing discussion can be guided according to the "Questions and answers" techniques. This strategy was used effectively especially during the tutorial classes.

- **Panel Discussions** - Panel discussions are especially useful when students are asked to give class presentations or reports as a way of including the entire class in the presentation. Student groups are assigned a topic to research and asked to prepare presentations. Each panelist is then expected to make a very short presentation, before the
floor is opened to questions from the audience. The key to success is to choose topics carefully and to give students sufficient direction to ensure that they are well-prepared for their presentations.

- **Debates** - provide an efficient structure for class presentations when the subject matter easily divides into opposing views or ‘Pro’/‘Con’ considerations. Students are assigned to debate teams, given a position to defend, and then asked to present arguments in support of their position on the presentation day on topic like “Is learning incremental or insightful?” The opposing team should be given an opportunity to rebut the argument(s) and, time permitting, the original presenters asked to respond to the rebuttal. This format is particularly useful in developing argumentation skills (in addition to teaching content).

2) **Exercises for Individual Students:** These techniques according to Paulson and Faust (2010) are aimed at individual students and therefore can very easily be used without interrupting the flow of the class. These exercises are particularly useful in providing the instructor with feedback concerning student’s understanding and retention of the material. They are especially designed to encourage students' exploration of their own attitudes and values and to increase retention of material presented in lectures and texts. Here are some examples:

- The "One Minute Paper" – This is a highly effective technique utilised frequently when teaching to check students’ progress, both in understanding the material and in reacting to course material. I asked students to take a blank sheet of paper, then posed a question either specific or open-ended, and gave them one or perhaps two or 5 minute(s) to respond by writing it down. Some sample questions for Developmental Psychology course include: "What are Chromosomal abnormalities?" and for Learning Theory and Practice course; "What is the difference between positive reinforcement and negative reinforcement?" and so on. Another good use of the minute paper is to ask questions like "What was the main point of today’s class material?" This tells you whether or not the students are viewing the material in the way you envisioned. Additionally, the one or five minute paper helps to find out whether the active learning techniques used during the lecture were effective or not.

- Muddiest (or Clearest) Point - This is a variation on the one-minute paper, when the instructor wishes to give students a slightly longer time period to answer the questions at the end of a class period or at a natural break in the presentation; e.g. "What was the "muddiest point" in today's lecture?" or, perhaps, you might be more specific, asking, for example in Developmental Psychology Lecture on “Biological beginnings": "What (if anything) do you find unclear about the concept of 'Chromosomal Abnormalities/Genetic Influences' ('Traits' 'Genes', 'Alleles', 'Chromosomes' 'Deoxyribonucleic Acid' 'Sex Determination' 'etc.')", or in Learning Theory and Practice class, “What (if anything) do you find unclear about “Information Processing Model Theory?”

- Affective Response - Again, this is similar to the above exercises when students are asked to report their reactions to some facet of the course material - i.e., to provide an emotional or evaluative response to the material. Obviously, this approach is limited to those subject areas in which such questions are appropriate. However, it can be quite a useful starting point for courses in social sciences and education, particularly as a precursor to theoretical analysis. This is very useful because many students don’t like theories. For example, students in Learning Theory class were asked of their feelings about Thorndike’s Theory or Gestalt Psychology, before presenting what other theorists
think of the concepts of the theory or its applicability to learning situations. By having several views "on the table" before the theories were presented, students can be helped to see the material in context and to explore their own beliefs.

- **Reading Quiz** - Clearly, this is one way to coerce students to read assigned material! Active learning depends upon students coming to class prepared. The reading quiz can also be used as an effective measure of students’ comprehension of the readings to gauge their level of sophistication as readers. Further, by asking the same sorts of questions on several reading quizzes, students will be guided as to what to look for when reading assigned text. If you ask questions like "What are the basic concepts in Piaget’s Cognitive Development Theory?" (As I asked my Psychology students in Learning Theory and Practice Class), you are telling the students that it is the details that count, whereas questions like "What reason did Piaget give for a child’s inability to conserve at the preoperational stage?" highlights issues of justification.

- **Clarification Pauses** - This is a simple technique aimed at fostering "active listening". Throughout a lecture, particularly after stating an important point or defining a key concept, stop, let it sink in, and then (after waiting a bit!) ask if anyone needs to have it clarified. You can also circulate around the room during these pauses to look at student notes, answer questions, etc. Students who would never ask a question in front of the whole class will ask questions during a clarification pause as you move about the room.

3) **Share/Pair**: Grouping students in pairs allows many of the advantages of group work students have the opportunity to state their own views, to hear from others, to hone their argumentative skills, and so forth without the administrative "costs" of group work (time spent assigning people to groups, class time used just for "getting in groups", and so on). Further, pairs make it virtually impossible for students to avoid participating thus making each person accountable.

- **Discussion** - Students are asked to pair up and to respond to a question either in turn or as a pair. This can easily be combined with other techniques such as those under "Questions and Answers" or "Critical Thinking Motivators". For example, after students have responded to statements, such as "Learning is not mediated by ideas" with 'true' or 'false', they can be asked to compare answers to a limited number of questions and to discuss the statements on which they differed. In science classes, students can be asked to explain some experimental data that supports a theory just discussed by the lecturer. Generally, this works best when students are given explicit directions, such as "Tell each other why you chose the answer you did".

4) **Questions and Answers**: While most of us use questions as a way of prodding students and instantly testing comprehension, there are simple ways of tweaking our questioning techniques which increase student involvement and comprehension. Though some of the techniques listed here are "obvious", we will proceed on the principle that sometimes bears repeating (a useful pedagogical principle, to be sure!).

- The Socratic Method: The instructor tests student’s knowledge (of reading assignments, videos, lectures, or perhaps applications of course material to a wider context) by asking questions during the course of a lecture. Typically, the instructor chooses a particular student, presents her with a question, and expects an answer forthwith; if the "chosen" student cannot answer the question presented, the instructor chooses another (and
another) until the desired answer is received. This method has come under criticism, based on claims that it singles out students (potentially embarrassing them), and/or that it favours only a small segment of the class (i.e., that small percentage of the class who can answer any question thrown at them). In addition, once a student has answered a question they may not pay much attention as it will be a long time before the teacher returns to them for a second question. In spite of these criticisms, we feel that the Socratic method is an important and useful one; the following techniques suggest variations which enhance this method, avoiding some of these pitfalls.

- **Wait Time** - Rather than choosing the student who will answer the question presented, this variation has the instructor waiting before calling on someone to answer it. The wait time will generally be short (15 seconds or so) - but it may seem interminable in the classroom. It is important to insist that no one raise his hand (or shout out the answer) before you give the OK, in order to discourage the typical scenario in which the five students in the front row all immediately volunteer to answer the question, and everyone else sighs in relief. Waiting forces every student to think about the question, rather than passively relying on those students who are fastest out of the gate to answer every question. When the wait time is up, the instructor asks for volunteers or randomly picks a student to answer the question. Once students are in the habit of waiting after questions are asked, more will get involved in the process.

- **Demonstrations with questioning (video clips)**. A video could be shown to the class to illustrate some theories (Piaget’s Theory of Cognitive development) or abstract concepts (hereditary transmission). This will concretize the theories or the concepts or the topic being discussed and make it clearer. For instance, I showed videos during the Learning Theory and Practice lectures to demonstrate in concrete terms the concepts of the different learning theories and also the different stages of human development from conception to adolescence during the Developmental Psychology lectures. In the absence of a psychology laboratory, showing videos can help the students to have a practical experience that will aid their understanding of the topics discussed.

- **Student Summary of another Student's Answer** - In order to promote active listening, after one student has volunteered an answer to your question, ask another student to summarize the first student's response. Many students hear little of what their classmates have to say, waiting instead for the instructor to either correct or repeat the answer. Having students summarize or repeat each others' contributions to the course both fosters active participation by all students and promotes the idea that learning is a shared enterprise. Given the possibility of being asked to repeat classmates' comments, most students will listen more attentively to each other.

- **Quiz/Test Questions** - Here students are asked to become actively involved in creating quizzes and tests by constructing some (or all) of the questions for the exams. This exercise may be assigned for homework and then evaluated (perhaps for extra credit points). In asking students to think up exam questions, we encourage them to think more deeply about the course material and to explore major themes, comparison of views presented, applications, and other higher-order thinking skills. Once suggested questions are collected, the instructor may use them as the basis of review sessions, and/or to model the most effective questions. Further, you may ask students to discuss the merits of a sample of questions submitted; in discussing questions, they will significantly increase their engagement of the material to supply answers. Students might be asked to discuss
several aspects of two different questions on the same material including degree of
difficulty, effectiveness in assessing their learning, proper scope of questions, and so
forth as done for Gestalt Psychology and they came up with these two different questions
on the same topic; “With reference to Gestalt theory of learning, justify the view that ‘the
whole is more than the sum of its part” or “With reference to Gestalt theory of learning,
justify the view that ‘learning is insightful’

5) Immediate Feedback: These techniques are also designed to give the instructor some
indication of students’ understanding of the material presented during the lecture. These
activities provide formative assessment rather than summative assessment of student
understanding. Formative assessment is evaluation of the class as a whole in order to provide
information for the benefit of the students and the instructor, but the information is not used as
part of the course grade; summative assessment is any evaluation of student performance which
becomes part of the course grade. For each feedback method, the instructor stops at appropriate
points to give quick tests of the material; in this way, she can adjust the lecture mid-course,
slowing down to spend more time on the concepts students are having difficulty with or moving
more quickly to applications of concepts of which students have a good understanding.

➢ Finger Signals - This method provides instructors with a means of testing student
comprehension without the waiting period or the grading time required for written
quizzes. Students are asked questions and instructed to signal their answers by holding up
the appropriate number of fingers immediately in front of their torsos (this makes it
impossible for students to "copy", thus committing them to answer each question on their
own). For example, the instructor might say "one finger for 'yes', two for 'no'", and then
ask questions such as "Is learning easily observable?". Or, the instructor might have
multiple choice questions prepared for the overhead projector and have the answers
numbered (1) through (5), asking students to answer with finger signals. In very large
classes like mine, the students can use a set of large cardboard signs with numbers written
on them. This method allows instructors to assess student knowledge literally at a glance.

➢ Quotations - This is a particularly useful method of testing student understanding when
they are learning to read texts and identify an author's viewpoint and arguments. After
students have read a representative advocate of each of several opposing theories or
schools of thought, and the relevant concepts have been defined and discussed in class,
put on the overhead projector a quotation by an author or a theorist whom they have not
read in the assigned materials, and ask them to figure out what position that person
advocates. In addition to testing comprehension of the material presented in lecture, this
exercise develops critical thinking and analysis skills. This would be very useful, for
example, in discussing the various types of learning theories.

RESEARCH FINDINGS ON ACTIVE LEARNING STRATEGIES AS TOOLS FOR
PROMOTING LEARNING.
Many proponents of active learning suggest that the effectiveness of the strategies has to do with
students’ attention span during lecture. Wankat (2002) suggested that student attention span
during lecture is roughly fifteen minutes while Hartley and Davies (1978) in their earlier
investigation reported that the number of students paying attention begins to drop dramatically
with a resulting loss in retention of lecture material. The same authors found that immediately
after the lecture, students remembered 70% of information presented in first ten minutes of the
lecture and 20 percent of information presented in last ten minutes. It was suggested that breaking up the lecture might work because students’ minds start to wander and activities provide the opportunity to start fresh again, keeping students engaged. Thus, after incorporating the active learning strategies into my classroom activities for about eight weeks, I gave my students the Active Learning Strategies Questionnaire to fill to find out whether the strategies are actually enhancing their learning with PowerPoint being the tool/technology used for some of them. Below are the students’ ratings on each of the active learning strategies and PowerPoint presentation.

Results
Research Question 1: What is the profile of students’ ratings on PowerPoint Presentation?

Table 1: Profile of students’ ratings on PowerPoint presentation (n=158).

<table>
<thead>
<tr>
<th>S/N</th>
<th>Items</th>
<th>SD</th>
<th>D</th>
<th>A</th>
<th>SA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PowerPoint Presentation facilitates active learning</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>3.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>65</td>
<td></td>
<td>41.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>88</td>
<td></td>
<td>55.7</td>
</tr>
<tr>
<td>2</td>
<td>I love the images and pictures on the slides, they help my understanding in this course</td>
<td>1</td>
<td>0.6</td>
<td>1</td>
<td>0.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>72</td>
<td></td>
<td>45.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>84</td>
<td></td>
<td>53.2</td>
</tr>
<tr>
<td>3</td>
<td>The slides stimulate my sensory abilities during lecture</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>1.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>85</td>
<td></td>
<td>53.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>71</td>
<td></td>
<td>44.9</td>
</tr>
<tr>
<td>4</td>
<td>The slides are usually too busy, too many images</td>
<td>94</td>
<td>59.5</td>
<td>47</td>
<td>29.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td>0.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>16</td>
<td></td>
<td>10.1</td>
</tr>
<tr>
<td>5</td>
<td>The slides are usually too long and boring</td>
<td>88</td>
<td>55.7</td>
<td>53</td>
<td>9.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td>1.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>15</td>
<td></td>
<td>9.5</td>
</tr>
</tbody>
</table>

The result on table 1 revealed that PowerPoint is an effective tool or technology for active learning strategy with 97% agreeing that it facilitates active learning; while 99% also agreed that it helped their understanding during the lectures, while 99% also reported that it stimulated their sensory abilities during lectures etc.

Research Question 2: What is the profile of students’ ratings on Discussion?

Table 2: Profile of students’ ratings on Discussion (n=158)

<table>
<thead>
<tr>
<th>S/N</th>
<th>Items</th>
<th>SD</th>
<th>D</th>
<th>A</th>
<th>SA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Discussion helps me to clarify points discussed during lecture</td>
<td>1</td>
<td>0.6</td>
<td>4</td>
<td>2.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>94</td>
<td></td>
<td>59.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>59</td>
<td></td>
<td>37.3</td>
</tr>
<tr>
<td>2</td>
<td>Discussion promotes active learning</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>80</td>
<td></td>
<td>50.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>74</td>
<td></td>
<td>46.8</td>
</tr>
<tr>
<td>3</td>
<td>Discussion makes me to be lively during lectures</td>
<td>0</td>
<td>0</td>
<td>14</td>
<td>8.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>86</td>
<td></td>
<td>54.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>58</td>
<td></td>
<td>36.7</td>
</tr>
<tr>
<td>4</td>
<td>Answering questions in the class helps in self assessment</td>
<td>1</td>
<td>0.6</td>
<td>8</td>
<td>5.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>92</td>
<td></td>
<td>58.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>57</td>
<td></td>
<td>36.1</td>
</tr>
<tr>
<td>5</td>
<td>Discussion disrupts the flow of the lecture</td>
<td>87</td>
<td>55.1</td>
<td>66</td>
<td>41.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td>0.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4</td>
<td></td>
<td>2.5</td>
</tr>
<tr>
<td>6</td>
<td>Discussion during the lecture is a</td>
<td>62</td>
<td>39.2</td>
<td>88</td>
<td>55.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td>1.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>6</td>
<td></td>
<td>3.8</td>
</tr>
</tbody>
</table>
The result shown on table 2 revealed that 97% agreed that discussion helps in clarification of points discussed during lecture, majority (97%) also opined that it promotes active learning while 91% stated that it makes them lively during lectures, 94% agreed that it helps in self assessment.

**Research Question 3: What is the profile of students’ ratings on Group work?**

**Table 3: Profile of students’ ratings on Group Work (n=158)**

<table>
<thead>
<tr>
<th>S/N</th>
<th>Items</th>
<th>F</th>
<th>SD</th>
<th>D</th>
<th>A</th>
<th>SA</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Group activities facilitate active/cooperative learning</td>
<td>2</td>
<td>1.3</td>
<td>24</td>
<td>15.2</td>
<td>82</td>
</tr>
<tr>
<td>2</td>
<td>Group activities aid my understanding in this course</td>
<td>5</td>
<td>3.2</td>
<td>24</td>
<td>15.2</td>
<td>82</td>
</tr>
<tr>
<td>3</td>
<td>Group work enhances my academic achievement</td>
<td>19</td>
<td>12</td>
<td>24</td>
<td>15.2</td>
<td>82</td>
</tr>
<tr>
<td>4</td>
<td>Group work limits my intellectual capability</td>
<td>17</td>
<td>10.8</td>
<td>24</td>
<td>15.2</td>
<td>82</td>
</tr>
<tr>
<td>5</td>
<td>Group work is too stressful because of the uncooperative attitudes of some group members</td>
<td>63</td>
<td>39.9</td>
<td>24</td>
<td>15.2</td>
<td>82</td>
</tr>
</tbody>
</table>

Table 3 showcases students’ ratings indicating that majority of them (84%) agreed that group activities facilitate active/cooperative learning; 86% indicated that group activities aid their understanding in this course and 75% were of the opinion that it enhances their academic achievement. Interestingly, 75% still reported that it is detrimental to their intellectual capability while 40% indicated that it is too stressful. This is one of the risks of active learning when students may not want to participate in active learning activities. This is in consonance with the assertion that students too seemed to prefer traditional method of lecturing, resist non-lecturing approaches because active learning alternatives provide a sharp contrast to the very familiar passive listening role (Bonwell 1996)

**Research Question 4: What is the profile of students’ ratings on Role play?**

**Table 4: Profile of students’ ratings on Role Play (n=158)**

<table>
<thead>
<tr>
<th>S/N</th>
<th>Items</th>
<th>SD F</th>
<th>SD %</th>
<th>D F</th>
<th>D %</th>
<th>A F</th>
<th>A %</th>
<th>SA F</th>
<th>SA %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Role play or promotes student engagement in lecture</td>
<td>0</td>
<td>0</td>
<td>8</td>
<td>5.1</td>
<td>93</td>
<td>58.9</td>
<td>57</td>
<td>36.1</td>
</tr>
<tr>
<td>2</td>
<td>Role plays create excitement during lectures</td>
<td>5</td>
<td>3.2</td>
<td>12</td>
<td>7.6</td>
<td>72</td>
<td>45.6</td>
<td>69</td>
<td>43.7</td>
</tr>
<tr>
<td>3</td>
<td>Role play helps me to reflect on the topics taught in this course</td>
<td>1</td>
<td>0.6</td>
<td>11</td>
<td>7.0</td>
<td>91</td>
<td>57.6</td>
<td>55</td>
<td>34.8</td>
</tr>
<tr>
<td>4</td>
<td>Role play facilitates students’ creativity</td>
<td>1</td>
<td>0.6</td>
<td>13</td>
<td>8.2</td>
<td>98</td>
<td>62.0</td>
<td>46</td>
<td>29.1</td>
</tr>
<tr>
<td>5</td>
<td>Role play makes the lecture to be rowdy and noisy</td>
<td>91</td>
<td>57.6</td>
<td>52</td>
<td>32.9</td>
<td>2</td>
<td>1.3</td>
<td>13</td>
<td>8.2</td>
</tr>
<tr>
<td>6</td>
<td>Role play is just a form of entertainment</td>
<td>76</td>
<td>48.1</td>
<td>44</td>
<td>27.8</td>
<td>18</td>
<td>11.4</td>
<td>20</td>
<td>12.7</td>
</tr>
</tbody>
</table>
In table 4, 95% agreed that roleplay promotes student engagement in lecture, 89% reported that it creates excitement during lectures, while 92% agreed that it helps them to reflect on the topics taught in this course while 91% stated that it enables them to be creative. etc

Research Question 5: What is the profile of students’ ratings on videos?

Table 5: Profile of students’ ratings on videos (n=158)

<table>
<thead>
<tr>
<th>S/N</th>
<th>Items</th>
<th>SD</th>
<th>D</th>
<th>A</th>
<th>SA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Videos promote active learning during lectures</td>
<td>0</td>
<td>2</td>
<td>90</td>
<td>66</td>
</tr>
<tr>
<td>2</td>
<td>Videos create mental images of the topics taught</td>
<td>0.6</td>
<td>0</td>
<td>82</td>
<td>75</td>
</tr>
<tr>
<td>3</td>
<td>Videos facilitate retrieval of learning materials</td>
<td>0.6</td>
<td>1</td>
<td>79</td>
<td>77</td>
</tr>
<tr>
<td>4</td>
<td>Watching videos during lectures is exciting</td>
<td>1</td>
<td>7</td>
<td>87</td>
<td>63</td>
</tr>
<tr>
<td>5</td>
<td>Watching videos is just a form of entertainment</td>
<td>52.5</td>
<td>51</td>
<td>85</td>
<td>59</td>
</tr>
<tr>
<td>6</td>
<td>Watching videos during lectures is a waste of time</td>
<td>44.3</td>
<td>84</td>
<td>70</td>
<td>4</td>
</tr>
</tbody>
</table>

Table 5 revealed that 99% of the participants agreed that video show promotes active learning during lectures, 99% again reported that it creates mental images of the topics taught, 99% also indicated that video shows facilitated the retrieval of learning materials while 85% agreed that watching videos during lectures is exciting.

Research Question 6: What is the profile of students’ ratings on Game Show?

Table 6: Profile of students’ ratings on Game Show (n=158).

<table>
<thead>
<tr>
<th>S/N</th>
<th>Items</th>
<th>SD</th>
<th>D</th>
<th>A</th>
<th>SA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Game activities enhance active learning in this course</td>
<td>0.6</td>
<td>3</td>
<td>81</td>
<td>73</td>
</tr>
<tr>
<td>2</td>
<td>Game activity is good for self assessment</td>
<td>2.5</td>
<td>10</td>
<td>85</td>
<td>59</td>
</tr>
<tr>
<td>3</td>
<td>Game activities make the lecture lively and interesting</td>
<td>0</td>
<td>11</td>
<td>80</td>
<td>67</td>
</tr>
<tr>
<td>4</td>
<td>No need for the game, too childish</td>
<td>39.9</td>
<td>86</td>
<td>63</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>Game activities waste time during lectures</td>
<td>49.4</td>
<td>78</td>
<td>78</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 6 revealed that game show enhances learning in this course as indicated by 98% of the respondents, 91% also agreed that game activity is good for self assessment while 93% agreed that game show makes the lecture to be lively and interesting, 94% also disagreed that it was too childish while 6% agreed.

Research Question 7: What is the profile of students’ ratings on Five minute paper?

Table 7: Profile of students’ ratings on Five Minute Paper (n=158).

<table>
<thead>
<tr>
<th>S/N</th>
<th>Items</th>
<th>SD</th>
<th>D</th>
<th>A</th>
<th>SA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Game activities enhance active learning in this course</td>
<td>0</td>
<td>2</td>
<td>90</td>
<td>66</td>
</tr>
<tr>
<td>2</td>
<td>Game activity is good for self assessment</td>
<td>0.6</td>
<td>0</td>
<td>82</td>
<td>75</td>
</tr>
<tr>
<td>3</td>
<td>Game activities make the lecture lively and interesting</td>
<td>0</td>
<td>1</td>
<td>81</td>
<td>73</td>
</tr>
<tr>
<td>4</td>
<td>No need for the game, too childish</td>
<td>39.9</td>
<td>86</td>
<td>63</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>Game activities waste time during lectures</td>
<td>49.4</td>
<td>78</td>
<td>78</td>
<td>1</td>
</tr>
</tbody>
</table>
Five minute paper ensures students’ participation in the lecture

<table>
<thead>
<tr>
<th>S/N</th>
<th>Items</th>
<th>SD</th>
<th>D</th>
<th>A</th>
<th>SA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Five minute paper ensures students’ participation in the lecture</td>
<td>3</td>
<td>1.9</td>
<td>26</td>
<td>16.5</td>
</tr>
<tr>
<td>2</td>
<td>Five minute paper keeps me on my toes.</td>
<td>1</td>
<td>0.6</td>
<td>31</td>
<td>19.6</td>
</tr>
<tr>
<td>3</td>
<td>Five minute paper helps to monitor students’ progress</td>
<td>1</td>
<td>0.6</td>
<td>19</td>
<td>12.0</td>
</tr>
<tr>
<td>4</td>
<td>Five minute paper is a waste of time</td>
<td>10</td>
<td>6.3</td>
<td>23</td>
<td>14.6</td>
</tr>
<tr>
<td>5</td>
<td>Five minute paper is like a test</td>
<td>17</td>
<td>10.8</td>
<td>91</td>
<td>57.6</td>
</tr>
</tbody>
</table>

Five minute paper ensures students’ participation in the lecture, 80% agreed that it kept them on their toes, while 87% agreed that it enhances their academic progress. It may not be surprising to see that, 79% agreed that it’s a waste of time while 42% reported that it is like a test, of course students don’t like test so they may not welcome anything that is similar to test even when you tell them that it is not a test.

Research Question 8: What is the profile of students’ ratings on clarification pauses?

Table 8: Profile of students’ ratings on clarification pauses (n=158)

<table>
<thead>
<tr>
<th>S/N</th>
<th>Items</th>
<th>SD</th>
<th>D</th>
<th>A</th>
<th>SA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Clarification pauses foster active listening during lectures</td>
<td>3</td>
<td>1.9</td>
<td>8</td>
<td>5.1</td>
</tr>
<tr>
<td>2</td>
<td>Clarification pauses help in clarifying points that are not clear</td>
<td>2</td>
<td>1.3</td>
<td>6</td>
<td>3.8</td>
</tr>
<tr>
<td>3</td>
<td>Clarification pauses encourage students to ask questions</td>
<td>3</td>
<td>1.9</td>
<td>4</td>
<td>2.5</td>
</tr>
<tr>
<td>4</td>
<td>Clarification pauses waste time during lectures</td>
<td>1</td>
<td>0.6</td>
<td>6</td>
<td>3.8</td>
</tr>
<tr>
<td>5</td>
<td>Clarification pauses distort free flow of lectures</td>
<td>1</td>
<td>0.6</td>
<td>16</td>
<td>10.1</td>
</tr>
</tbody>
</table>

Finally, the result on table 8 showed that 93% of the participants concurred that clarification pauses foster active listening during lectures, 95% stated that it helps in clarifying points that are not clear, 94% said that it encourages the students to ask questions. Amazingly, majority still reported that clarification pauses waste time during lectures and that it distorts free flow of lectures. Some students are always in a hurry to leave the class, so anything done in the class apart from lecturing is time wasting.

In order to have a quick glance at the varying degrees of the students’ agreement that active learning strategies promotes learning, the data was plotted on two charts. Figure 1 revealed the various degrees of the students’ agreement regarding active learning strategies promoting learning while figure 2 revealed that video is the best active learning strategy among this sample.

Figure 1: Chart showing students’ responses on active learning strategies promoting learning.
Key: The three bars indicated the students’ responses on active learning strategies promote learning. 1) Discussion; 2) Group Work; 3) Role Play; 4) Videos; 5) Game Show; 6) 5 Minute Paper; 7) Clarification Pauses; with the percentages.

<table>
<thead>
<tr>
<th></th>
<th>Discu.</th>
<th>Gr.Wk</th>
<th>Rol. Pl</th>
<th>Video</th>
<th>Game</th>
<th>5min paper</th>
<th>Clar. Pauses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prom L 1</td>
<td>97%</td>
<td>84%</td>
<td>95%</td>
<td>99%</td>
<td>98%</td>
<td>82%</td>
<td>93%</td>
</tr>
<tr>
<td>Prom L 2</td>
<td>97%</td>
<td>85%</td>
<td>89%</td>
<td>99%</td>
<td>91%</td>
<td>80%</td>
<td>95%</td>
</tr>
<tr>
<td>Prom L 3</td>
<td>91%</td>
<td>75%</td>
<td>92%</td>
<td>99%</td>
<td>93%</td>
<td>87%</td>
<td>94%</td>
</tr>
<tr>
<td>Average</td>
<td>95%</td>
<td>81%</td>
<td>92%</td>
<td>99%</td>
<td>94%</td>
<td>83%</td>
<td>94%</td>
</tr>
</tbody>
</table>

Figure 2: Chart showing the best active learning strategy that promotes learning.

These findings lend credence to the earlier reports that active learning strategies are important (Chickering & Gamson, 1987; Ericksen, 1984; McKeachie, et. al., 1987) and can be incorporated in the classroom activities (Bonwell & Eison, 1991; Mantyla, 1999; McKeachie & Svinicki 2006; Paulson & Faust, 2010 and Prince, 2004). As good as the active learning strategies are however, there are many obstacles or barriers preventing faculty from using them as evident in the findings of this study on some of the strategies. Bonwell (1993) outlined some barriers to active learning:
A. You cannot cover as much course content in the time available;
B. Devising active learning strategies takes too much pre-class preparation;
C. Large class sizes prevent implementation of active learning strategies;
D. Most instructors think of themselves as being good lecturers;
E. There is a lack of materials or equipment needed to support active learning approaches;
F. Students resist non-lecture approaches, as observed by The National Association of Teachers (1907) many years ago that “Students today depend too much upon ink. They don’t know how to use a pen knife to sharpen a pencil. Pen and ink will never replace the pencil”

**Overcoming the Barriers**

Bonwell (1996) asserts that there are two primary sets of obstacles that prevent faculty from using active learning strategies in the classroom: (1) the six potential obstacles noted above, and (2) the fact that using active learning strategies involves risk. With respect to the six commonly reported obstacles, the following should be noted:

1. Admittedly, the use of active learning strategies reduces the amount of available lecture time that can be devoted to content coverage. Faculty who regularly use active learning strategies typically find other ways to ensure that students learn assigned course content (e.g., using reading and writing assignments, through their classroom examinations, etc.)

2. The amount of pre-class preparation time needed to implement active learning strategies will be greater than that needed to "recycle old lectures;" it will not necessarily take any more time than that needed to create thorough and thoughtful new lectures.

3. Large class size may restrict the use of certain active learning strategies (e.g., it is difficult to involve all students in discussion in groups larger than 40) but certainly not all. For example, large classes can be divided into small groups for discussion activities, writing assignments can be read and critiqued by students instead of the instructor.

4. Most instructors see themselves as good lecturers and therefore see no reason to change. Though lecturing is potentially a useful means of transmitting information, teaching does not equal learning; this can be seen clearly in the painful disparity between what we think we have effectively taught, and what students indicate they have learned on the examination papers that we grade.

5. The lack of materials or equipment needed to support active learning can be a barrier to the use of some active learning strategies but certainly not all. For example, asking students to summarize in writing the material they have read or to form pairs to evaluate statements or assertions does not require any equipment.

6. Students resist non-lecturing approaches because active learning alternatives provide a sharp contrast to the very familiar passive listening role to which they have become accustomed. With explicit instruction in how to actively participate and learn in less-traditional modes, students soon come to favor the new approaches.

A second set of potentially more difficult obstacles to overcome involves increasing one's willingness to face two types of risks.

1. There are risks that students will not: participate actively; learn sufficient course content; use higher order thinking skills; enjoy the experience
2. There are risks that you as a faculty member will not: feel in control of the class; feel self-confident; possess the needed skills; be viewed by others as teaching in an established fashion. However, faculty should continue to remember the philosophical statement by Habbert Otto that
"Change and growth take place when a person has risked himself and dares to become involved with experimenting with his own life."

Though the classroom use of active learning strategies will always involve some level of risk, by carefully selecting only those active learning strategies that are at a personally comfortable risk level, you can maximize your likelihood of success.

**RECOMMENDATIONS AND CONCLUSION**

No doubt, for learning to reflect the changing environment, among the Nigerian students, all the stakeholders (the faculty members, the students, the parents, the government) in Education must be prepared to change what they do in order to change how they are doing it. All the stakeholders should realise that "nothing is permanent except change" as stated by Napoleon Hill, the great philosopher and that "The more things change, the more they remain the same" - Alphonse Karr. These philosophies should be embraced to change their outlook to life; that changes are inevitable for success and progress in life. The following recommendations are therefore addressed to the stakeholders thus:

1. **The Faculty Members:**
   
   a. The Faculty Members who are directly in contact with the students in the class should be the first change agent to implement active learning strategies in their teaching. Thus, the reformation of instructional practice in higher education in Nigeria must begin with the effort of the faculty members who must also be willing to change from their traditional, more convenient and less mentally tasking approach to the learner-centred method of teaching which although is highly complex and hectic to practice but is more exciting and more rewarding in terms of knowledge impartation.
   
   b. Learning should be fun through lecturer’s efforts by adopting a teaching approach that is centred on 3 basic building blocks: Effective, Engaging, and Enjoyable. This involves spending quality time in planning and structuring the lectures thus making each one effective in the impartation of knowledge by engaging the students and making it enjoyable for them. It should be realised that in this changing environment, new information is worth more than old information and learning never stops.
   
   c. It has also been suggested that an excellent first step is to select strategies promoting active learning that one can feel comfortable with. Such low-risk strategies are typically of short duration, structured and planned focused on subject matter that is neither too abstract nor too controversial, and familiar to both the faculty member and the students. This was earlier suggested by Seth Godin, an American entrepreneur, author and public speaker that “Tools matter, because tools impact the way you interact. You don’t need to use every tool, but every tool you use, you must use well”
   
   d. Lecturers’ needs should be identified and their skills be enhanced through various training programmes and seminars so as to change their orientation from the traditional lecture method to interactive and innovative lecture method. A step towards this has been taken by The University of the West Indies, Cave Hill Campus, Barbados by encouraging all faculty to undergo the Certificate in
University Teaching and Learning (CUTL) training to enhance lecturer’s teaching skills.

2) The Students:

a. Many investigators asserted that there are risks that students will not participate actively; learn sufficient course content; use higher order thinking skills; enjoy the experience being shared in the class. It is imperative that the the students develop interests in their academic work; be present at lectures and be actively involved. Bulunuz and Jarret (2009) assert that there is a connection between interest and effort. The more a person is interested in a subject, the more effort he will put into it. He further described an interested person as being engaged, engrossed or entirely taken up by an activity because of its recognized worth. Suffice to say therefore that students’ interests will also sustain their lecture attendance and participation, they must be self driven as this intrinsic motivation is stronger than the extrinsic motivation from lecturers, parents and the society and therefore yields better result in learning.

b. There is a popular adage that “you can drag a horse to water but you cannot force it to drink unless it is thirsty”. It is when the students are thirsty for knowledge that that they go for lectures and participate. They should not frustrate the lecturer’s efforts as quality time would have been spent in preparing and incorporating the active learning strategies into the lectures. “Lecturers open the door, but the students must enter by themselves and be actively involved in the lecture”.

3) The Government:

a) Pertaining to Nigeria, the government should make efforts to implement the national philosophy of education and addresses the causes of low level of ICT application in Nigerian high schools like: limited/poor information infrastructure; lack of/inadequate ICT facilities in schools; frequent electricity interruption which makes the few schools with ICT facilities unable to use them regularly; poor ICT policy/project implementation strategy” was also indicated as a factor.

b) Attention should be paid to the funding of Education at all levels which is still threatening the quality of Nigerian Education. Efforts should be made to maintain the existing facilities such as the replacement of laboratory equipment especially with the remarkable growth from the five universities in 1965 to over 1000 universities in 2012 to ensure their continuous use.

c) Politicisation of educational policies and programmes should be eradicated so that all learners will have equal opportunities; books and materials should be funded, there should be incentives for research and writing, to eradicate the use of outdated notes and materials by lecturers.

d) Lecturers’ and teachers’ salaries should be paid on time, to avoid strikes. The practices of active learning strategies need a lot of motivation an investment. Computers must be supplied to schools and there should be internet connections. Electricity must be regular because of the use of technology.

5) Parents
a) Parents’ efforts are also vital to students’ attendance and participation at lectures. They should provide the financial, moral, social and emotional support essential for their wards’ regular attendance at school and participation in class activities. They should not shift the financial responsibilities to the students and should avoid unnecessary demands from them and at the same time, the parents should guide against over pampering the students so that they will have self discipline, respect their lecturers and find it valuable to attend lectures and participate in class activities.

In conclusion, active learning strategies are effective in engaging learners and assisting them in creating their own learning experiences in the changing environment. Active learning strategies make learning to be fun and they motivate students’ attendance at lectures and to also participate. To enhance the competence and intellectual capability of the Nigerian learner therefore, the models for active learning should be embraced. It is time to change from the traditional and rigid method to the globally accepted learner – centred method; it is time to invest in the lives of “Today's Youth, Tomorrow's Leaders” through sound education which is the key to bright future. It is time to redeem the image of the country in the international world by curbing the menace of the corruption that constitutes the cog in the wheels of Nigeria’s progress. "Nothing endures but change. There is nothing permanent except change. All is flux, nothing stays still."- Heraclitus

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EVALUATION OF EDUCATIONAL REFORMS AND HUMAN CAPITAL DEVELOPMENT IN A GLOBAL AGE

By

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BEING FULL TEXT OF A GUEST LECTURE DELIVERED AT THE INTERNATIONAL CONFERENCE ON SCIENCE AND TECHNOLOGY EDUCATION, ORGANISED BY AFRICAN ASSOCIATION FOR TEACHING AND LEARNING (AATL) AND AFRICAN SOCIETY FOR SCIENTIFIC RESEARCH HELD AT ALVAN IKOKU FEDERAL COLLEGE OF EDUCATION, OWERRI-NIGERIA. OCTOBER 22-26, 2012
First of all, I would like to express my sincere appreciation to the African Association for Teaching and Learning (AATL), the African Society for the Scientific Research and Alvan Ikoku Federal College of Education for hosting the International Conference on Science and Technology Education in this beautiful Eastern Heartland city of Owerri. I have enjoyed your warm welcome and hospitality.

I am honored to have the possibility to speak with you at this important international conference on education. I must also congratulate the organizers for having chosen such a relevant topical theme.

This is a very outstanding moment for me to be with so many great people in such a remarkable meeting. I feel overwhelmed with the opportunity to share some of ideas about education and technology and their relationships with sustainable development.

Preamble
Our concern is lecture is basically an evaluation of the National 10 – year Development Plan on Educational Reforms and The part of NEEDS policy on the making of Millennium Development Goals. MDGs in 2005. The Policy provisions were critically evaluated as to what extent they have gone midway into the Targeted year 2015. It was found that by year 2010, the implementers of these 10 – years Development plan have not gone near 45% of what should be 100% by 2015. The UBE and MDGs goals may end up as mere pipe dreams and a drain on the national resources if double Efforts are not made now to strengthen the resolve to achieve these set goals. It was recommended that all the policy options in all the section of our educational system must be vigorously pursued in order to attain these goals we have set for our nation Nigeria

INTRODUCTION
The evaluation of Educational Reforms and Human Capital Development in Nigeria of our Vision in 2010 is to be based on the recent development plans which are linked to the 1999 Constitution. The current reform policy of the government revolves around the 10 – year Strategic plan by the Federal Ministry of Education as well as the NEEDS document (2004). The Reform is intended to overhaul the entire education sector and to promote quality education. For life - skills acquisition, Job creation and poverty eradication. It will put in place a sound Frame work that will enable implementing to widen access, increase equity and enhance the quality of educational provision.

The National Economic Empowerment and Development Strategy (2004) is not just a plan, it Defines a process of development anchored on a clear vision, sound values and enduring Principles. The most recent articulation of the vision of NEEDS is embodied in the 2001 Kuru Declaration as follows:

To build a truly great African Democratic country, politically united, integrated and stable, Economically prosperous, socially organized, with equal opportunity for all and responsibility From all, to become the catalyst of (African) Renaissance and making adequate all-embracing Contributions, sub-regionally and globally (p.27).
THE STRATEGIC FRAMEWORK FOR POLICY GUIDELINES AND REFORMATION:

**Figure 1:** The strategic framework for policy Guideline for Reforms and Human Capital Development.

Source: Seven Point Agenda: The Nigerian Project on Human capital Development.


Figure 1: is highly instrumental to the guidelines the Nigeria Authorities are expected to Follow in reaching some decisive goals on human capital development in our Educational system. As much as the government is fully abreast of the need to create Wealth and provide full employment in order to reduce poverty; the real sector growth Is underpinned by an array of other problems as shown in the schema. The Human Capital development and Health is seen central in the entire reformation process.

The underground problems and issues are not to be neglected for they are equally very Important in the entire scheme. This strategic framework therefore gives the foundation On which the reformation in education and the human capital development was based. Therefore the final outcome of this evaluation process will take a full account of how The originating policy statements by the governments where achieved partly or wholly. The cross-cutting issues as shown in this schema are equally very important to the total Outcome of this exercise.

THE PROJECTED GOVERNMENT POLICIES FOR REFORMATION & HUMAN CAPITAL DEVELOPMENT:

The main policy that guided the Nigerian government at the Federal, State and Local Levels given other challengers are as follows: It was envisaged by these tiers of Governments
that when these policies were successfully implemented that sustainable and desirable changes were very feasible. These include:

- Provision of adequate resources for the entire education sector and improving the efficiency and effectiveness of the use of available funds for the implementation of The MDGs and UBE program, especially at the state level. The current levels of public spending is insufficient to fill the financing gap to achieve UBE and improve the quality and relevance of post-basic education in Nigeria. Further increase in support to the educational sector through additional resources mobilization from domestic (including the private sector), development partners and other interventional agencies is required.
- Physical Rehabilitation of all secondary and primary schools in the country using additional 0.1% besides the 2% contribution to the Educational Tax Fund (ETF) and partnering with private sector.
- Develop at least 10% computer and internal access in all primary schools, at least 30% in all secondary schools and at least 70% in all tertiary institutions.
- Encourage local internet companies to sponsor connectivity to schools.
- Provision of free textbooks in primary and secondary schools.
- Strengthening the capacity of the ministry of education and its relevant institutions at all levels of government for planning and management and the operationalizing of the federal government 10-year Education Sector Plan.
- Design and implementation of the state education reforms based on the ongoing Federal Education reforms.
- Removing barriers to girl’s basic education especial; in the Northern regions and boys schools drop-out in the Southern region including community mobilization and advocacy, recruitment and development of woman teachers and improvement of physical facilities.
- Design and implement strategies to increase school enrolment, train, increase and retain the number of teacher at all levels of education. The currents efforts by the Federal Government to provide one meal per day for every pupil at the primary school level should be sustained.
- Preparation of a National Post Basic Education Strategy, focused on Science and Technology, quality innovation in line with the objective of NEEDS that will re-align education with needs of labour market.

These were the basic policy thrust to guide the implementation of the modern reforms in Education and ensure that there is complete improvements in the development of human Capital in Nigeria at all fronts. In addition to the educational sector reforms’, there is other Initiatives that have been introduced by the current government for the implementation of Government’s 10-year Strategic Plan (2006 – 2015). These are what we shall term as structural And
institutional reforms. (The Seven Point Agenda: - The Nigeria project (2006). These new Areas focused on the following:-

**STRUCTURAL AND INSTITUTIONAL REFORMS:**

It is instructive to remark that in July 2006, the Federal Government lunched a major Restructuring of the Federal Ministry of Education and a reform packaged for the entire Education sector. One of the outcomes of the restructuring exercise is the drafting of a Federal 10 - year Sector Plan with a re-classification of Education system as follows:

**A. BASIC EDUCATION:**

This incorporates early childhood care and development and primary and junior Secondary Education anchored on the UBE program. The Federal Government through The UBE program aims to tackle gender disparities in enrolment, attendance and low Completion rates. The current primary net enrolment is about 61% and 7.8 million Children are currently still out of school. An estimated 35% of the relevant age group Attends junior secondary schools.

**B. SENIOR SECONDARY EDUCATION:**

The objective is to develop a framework for implementing the public/private Partnership model for management of unity schools. Other goals include reforming Sciences, technology, technical and vocational education to increase its relevance to the economy and labour market. It also aims to attract and retain teachers, encourage Private Sector Participation and encourage student enrolment at senior secondary school levels.

**C. SPECIAL EDUCATION:**

The aim of the Federal Government is to develop a formula for funding adult and non-Formal special needs and nomadic education.

**D. TERTIARY EDUCATION:**

The vision is to advance Nigeria’s economic growth and global competiveness through The provision of accessible, affordable, relevant and high quality education in tertiary Institutions.

**E. UNIVERSAL BASIC EDUCATION PROGRAMME:**

The current government introduced the UBE program in 1999, making it compulsory for Every child to receive nine years of “free” education. The Child Right of 2003 also provides a Legislature framework to protect children and secure their basic rights, including the right to Education. The introduction of the UBE program is in line with the Federal Governments Effort to achieve education –related. Millennium Development Goals (MDGs.) Concerned

With the achievement of education related MDGs, the Federal Government established the Assessment and monitoring committee on the MDGs Chaired by the President to fast-track Decision making and guide and monitor the implementation of MDGs related Policies and Programs in all sectors of the economy.

**F. POST--BASIC EDUCATION INITIATIVES:**
At the post basic education level, Nigeria has adopted a strategic vision for tertiary Education with emphasis on science and technology. Current Education policies call for Increased enrolment in Science and Technology program. Improved research and Technology infrastructure and strong quality assurance mechanism.

G. PERFORMANCE ANALYSIS OF PAST EDUCATIONAL OPERATION. (2001-2005).

There have been remarkable improvements in education sector with adult literacy rate Rising from 57% in 2001 to 62% in 2005 primary school enrolment rose from nineteen Million in 2001 to over 26 million in 2005 as shown in figure 1.

![Fig.1 Primary School Enrolment](#)

Source: The Nigeria Project Agenda (pg. 63)

In the primary school category, the percentage of females in educational institution rose To 53% in 2005 from 51% in 2001. However there was a decline in the percentage of female In both the secondary and tertiary institution from 44% in 2005. The tertiary institution also Witnessed a decline in the number of females from 45% in 2001 to 43% in 2005 with the Implementation of the UBE program, the number of primary school rose from slightly over Forty-nine thousand in 2001 to over fifty-nine thousand schools in 2005. (See figure 2:
The Federal Government total Expenditure on education from 2001 to 2005 averaged 6% Of the overall budget with the exception of 2002 which had a percent of almost 11% see figure3 this is well below the UNESCO bench mark that recommends budgetary expenditure on Education of at least 20% of the overall total budget.

**OTHER MAJOR CHALLENGES FACING HUMAN CAPITAL DEVELOPMENT:**

**a. The Equity and Access to education:**

Despite significant efforts since the lunch of the UBE program, Nigeria is falling behind In its progress towards achieving the education related MDGs and Education for all (EFA) Goals. Nation – wide, 64% of school – age boys and 53% of school – age girls attend Primary school. There are large gender income and regional disparities in enrolment Rates. Enrolment rate of
girls in some Northern States are only around 20%. The cost of Schooling both direct and indirect opportunity costs remains the key reason for low enrolment and for dropping out of school.

b. Quality and Relevance of Education:
The quality of education in Nigeria is very weak for obvious reasons. These Weaknesses also vary from one state to another and within the states. There is Inadequate systematic and reliable information on students learning outcomes the (World Bank Policy –DFID-USAID on Nigeria Education policy notes) remarks that the Learning outcomes in primary schools are weak. And vary considerably across the Different states.

It remarked that the main contributory factors to low learning outcomes are:

i. The poor condition of learning environment to support effective teaching and learning e.g. poor condition of physical facilities, shortage of textbooks and essential instructional materials.

ii. Ineffective pre and in-service teachers training.

iii. Outdated curricula.

c. Inadequate funding:
Inadequate funding is the bane of Nigerian Educational system. Whereas, the UNESCO prescription for countries to spend between 20 – 26% of their annual budget on Education. Nigeria can hardly go beyond 3 – 6%. The 2010 Budget also reflects this dismally low level of funding education in Nigeria. The figures shown earlier on the three tables reflects that the funding of education in Nigeria is grossly inadequate to meet the MDGs requirement on Education. Not to tack of Human capital development needs at whatever level in Nigeria.

d. Monitoring and Evaluation:
It is evidently clear and glaring that the work of monitoring and evaluation of the educational administration is further hampered due to shortage of needed quality data for information dissemination and make appropriate decisions in government cycles.

CONCLUSION

It is here concluded that the much talked about reformation in education in other to achieve the desired human capital development is yet to be fully pursued with vigor. The school enrolment of students and pupils at the secondary and pre – basic educational offering are yet to go near the MDGs targets. The claim that meeting MDGs goals are attainable in 2015 is a mere pipe dream. Too many challenges are now acting as barriers to make the achievement of the MDGs goals a reality. We can simply highlight problems of poor funding, shortage of educational facilities, government in debtedness to foreign lenders and internal debt over – hang which they service even now in 2010.

We would like to conclude that due to constant reports of corruption and capital flight to other developed countries from Nigeria, achieving Human Capital Development within the remaining period before 2015 is a mere wishful thinking.
RECOMMENDATIONS
1. The existing policy on the provision of adequate resources for the entire education Section as well as the utilization of the available funds for true implementation of the MDGs and UBE program should now be done with more vigor than before.
2. The physical rehabilitation of all primary and secondary school facilities should be Stepped up more than before.
3. The (ETF) Educational Tax Fund should learn to give more funds that their use is institutionally supervised, so that the money is not unduly diverted to other uses by individuals.
4. The ICT education at all levels must now be pursued with more vigor. The use of Computers should be made compulsory at all levels of our school system.
5. The provision of the appropriate textbooks in all schools must be made mandatory.
6. The condition of the school library must seriously be tackled now more than ever before.
7. The general management of Education must be left in the hands of the professional educators not the ordinary civil servants who know little to nothing about what to do with our educational system.
8. The girl – child education in the entire school system must be seriously handled.
9. The Drop – out syndrome must be made a thing of the past.
10. The provision of qualified and efficient teachers is a sine-qua-non if our educational system is to grow above what it is now.
11. The development of post – basic education that emphasizes science and technology must be vigorously pursued now more than the mere lip service educational offering we have had in the past.

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MATHEMATICAL GIFTEDNESS IN EARLY CHILDHOOD

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Abstract
Mathematical giftedness is noticeable, many a times, at a very young age. There are children who can do the 4 elementary operations of addition, subtraction, multiplication, and division while still in kindergarten; others understand the meaning of "functions" at age 6-7; some children who ask "deep" mathematical questions, such as: "is zero the average between plus infinity and minus infinity?" when in elementary school. Unlike in many other areas, these children cannot be satisfied with enrichment in mathematics; they need the combination of both enrichment and substantial acceleration in order to get an answer to their needs, which are far above these of their peers. In this presentation suggested ways for nurturing the young mathematical children are to be offered, such as the use of art. The gaps between the mathematically gifted and his peers will be demonstrated, and thus the conclusion, that unless extra-curricular math is supplied – the young mathematically gifted might be highly frustrated.

In addition, a few cases of mathematically gifted children are to be presented, from my experience as a private tutor when I was still in high school, as math teacher in high school, as a mother and as an educational psychologist.

Introduction
There are two main attitudes towards nurturing mathematically young gifted children.
1. Nurturing the child in a variety of subjects, including mathematics. This attitude is based on the belief that all children must be exposed to a similar extra-curriculum experience, and any child, no matter how gifted, should have a life similar as much as possible to that of her or his peers.
2. Nurturing the child mathematically, usually through private (1985 BBC News; Grant, 1998) or group (e.g. David, 2008) acceleration. Families who espouse this belief will sometimes invest substantial efforts in order to finance extra math lessons, certainly will not move in order to get a better math education for their child, and most certainly will not split so that one of them serves as private mentor to the mathematically gifted child (see, for example, Grant, 1998; Nicol & Wright, 2000).

Since nowadays the practice of exposing math prodigies to the public, as is the case in music prodigies, no longer exists, mathematically gifted children do not usually have to move around the globe from giving "performances", and the age they must leave home for better math education is relatively higher in comparison to that of the musical prodigy. The life story of Prof. Ruth Lawrence, who started studying in at age 11, is thus an exception (Grant, 1998).

Both attitudes are based on the belief of parents that their choice is "the best one for the child". The parents from the first group "know" that "it is better for a child" not to move but live in the same house for as long as possible; to have as many friends as possible; to be active in as many areas as possible – in short – to be as "normal" as possible. Parents from the other group claim that all great mathematicians were far beyond their peak at age 30, if not earlier, and thus if the child "wastes" time he is not to be a mathematician, and that "is not good". It is both a pity for
him, being so talented and loving math so much, and a waste for humanity, as he will not have the time to make the contributions he is capable of.

Parents from both groups ignore three main issues making their argument irrelevant:

I. There is no way to conclude from the past anything about the age at which a certain person will – or will not – utilize his talents to the fullest. Life expectancy, as well as life quality, rises every decade, and the way mathematicians work has changed tremendously: while in the past a mathematician used to work on his own, now many mathematicians have maintained steady working group for years, etc.

II. Even if the statistics about the age of active mathematicians are valid, namely, they include a large enough group, we must not forget that each mathematician was a person of his – or her own, so there is no "group of mathematicians" in the statistical sense, but rather a large group of people, living in different places, in different times, under different conditions, who were also mathematicians;

III. The issue of "opinions" has no importance when an individual wishes to fulfill her or his abilities. Thus, we can see that when we interview people who had become role models in different areas, many of them tell about a childhood deprived of many joys – comfort, free play, close friendships with peers, sometimes even good family relationships. However, many of them say: "but I would have never chosen to live differently had I been a child again". Of course, this is not the case among girl prodigies who were exploited as singers or actresses and later developed an eating disorder, drug or alcohol addiction or any kind of psychological disorder, blaming their parents for "pushing too hard". But when parents want their child to be a "math genius" there is a limit to what they can do: even a bulldozer cannot push hard enough to make a child who does not have both the urge and the talent become a mathematician.

The role of art in nurturing mathematical giftedness

There are many mathematically gifted children participating in the activities of The Young Persons' Institute (2012) located on the Tel Aviv University premises. However, as the founder and the head of the Institute, Dr. Erika Landau, deeply believes in the importance of emotional maturity (Landau, 1999), the institute, which is one of the largest in the world, does not concentrate on the development of mathematical giftedness. The course "mathematical thinking" is offered to young children, but these children are not necessarily mathematically gifted but rather children who have scored in the 3 upper percentiles in one of the cognitive ability examinations. Thus, the "mathematical thinking" course is intended to develop their abstract and logical thinking along with their social and emotional abilities.

Along the years I have performed many interviews with some of the leaders of nurturing mathematical giftedness in Israel. I interviewed Prof. Beno Arbel (David, 1996), who headed the acceleration program in mathematics at the Tel Aviv University (David, 2001a, 2008) for three decades, and Yoav Breuer, a mathematics teacher in several enrichment programs for the gifted at the central part of Israel (David, 1999). They had both presented a similar rationale regarding the working definition of mathematical giftedness, as well as the mathematical content to which, in their opinion, young mathematically gifted children should be exposed. Along the years they had been nurturing hundreds of mathematicians to be, and they both agreed that the common means used in order to identify giftedness in general, such as the Szold Institute examinations identifying percentile 97+ or even 99+, or teachers' evaluations that might be, in some cases,
more accurate,\(^1\) have a too low ceiling, and thus cannot screen the mathematically gifted children suitable for the Tel Aviv University acceleration program and in many cases not even the enrichment math classes.

**On defining "mathematical giftedness"**

There are many definitions of "mathematical giftedness" (e.g. Bicknell, 2009; Bicknell, & Coenders, 2010; Kontoyianni et al., 2012; Krutetski, 1976; Lubinski et al., 2001). When referring to early childhood, when children are still in pre-school, most mathematically gifted children have not been officially diagnosed yet and thus have no "mathematically gifted" label. However, consider an 18-months old who declares aloud the floor each time the elevator stops; a 2-year old counting perfectly up to 50; a 3-year old who understands the meaning of subtraction; a 4-year old understanding what is a negative number or a 5-year old asking: "is zero the average between plus infinity and minus infinity?" These are not imaginary children, nor children quoted in academic writings. I have met ALL these children in my long, varied life as a mother, a counselor to gifted children and their families, as educational intern in 19 kindergartens, and lecturer in three teachers colleges and universities, where I had hundreds of pre- and in-service kindergarten and school teachers as BA and MA students.

It can be concluded that the importance of an "imperative definition" to mathematical giftedness in the early year is negligible. However, it is of crucial importance for teachers and mental health professionals to identify this phenomenon and understand it in order to be able to support the child and the family when the natural environment does not supply a suitable answer to the child's unique needs.

Here comes the political correctness issue: why are the references in this article in the masculine? The answer has to do with statistics: the large majority of mathematically gifted children at the level described in this article are male. This has been the situation in ALL programs described in the literature. SMMPY, the acceleration program in math for children scoring 700+ in the quantitative part of the SAT before age 13 had, from its beginning in the early 70is, 16 times as many boys as girls (Benbow, Lubinski, & Hyde, 1997; Benbow, Lubinski, Shea, & Eftekhari-Sanjani, 2000). The Israeli situation regarding the most prestigious program for the mathematically gifted in Israel, that of the Tel Aviv university, is about the same (David, 2001b, 2005a, 2005b 2008a, 2008b; Zorman & David, 2000).

**My affair with mathematical giftedness: In a nutshell**

I have spent most of my life with mathematically gifted people – sometimes they were shorter than one meter. But just as Molière's MONSIEUR JOURDAIN had been speaking in prose without knowing it all his life, I had not known, until age 30, that most males in my life had been mathematically gifted. For example; my young brother, born when I was already 11, started reading at age 3 and when entering school, a month before his 6\(^{th}\) birthday, the headmistress refused to have him in grade 1 and thus he started directly in grade 2 in spite of my parents' objection. The source of this objection was the "déjà vu" they had experienced: my older brother, 13 months my senior, started school when barely 5, with huge gaps between his cognitive development and his fine motor skills, as well as emotional ones. The explanation

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\(^1\) Teachers know the children and are expected to be aware if they have any special gifts even in cases when they had not been identified in the routine process of identification for giftedness that includes, in Israel, the whole population (Freeman, 2010).
given to the unavoidable class skipping by the school staff of my younger brother was: "A child with such a high level of verbal development cannot be in class with 39 children who can hardly express themselves verbally, let alone read fluently". Not even one person mentioned the fact that he excelled in math: obviously, this ability did not 'disturb' the teachers... At age 13.5 he was accepted to grade 10 in a Yeshiva high school far from home, and needed to learn grade 9 math because in his former school mathematics was not taught during that year. Only when I found out that in the 4 weeks I taught him math he completed both grade 9 and grade 10 math, and he did not have to learn this subject for the next year, I realized that maybe this phenomenon, of being able to learn 10 or 20 times quicker than what is consider "normal", might be something worth noting.

As it happened, my brother was not my first mathematically gifted student. Generations of Ultra-Orthodox children living in my neighborhood preceded him. Every summer some of these children, learning mainly the Holy Scriptures until age 13-14, were sent to me in order to help them fill the gaps in mathematics and English in order to be able to continue their studies in Yeshiva high schools. Then they would be able to take the matriculation examinations, acquire good quality higher education and be able to provide for their families when married. These children used to study with me after school (not sure if that's what you mean) [at age 12-13], but as their summer vacation was shorter than in the state schools, their first weeks of learning sessions were in July, late in the afternoon – when they were back from school, in the hottest weeks of the year in Israel. Usually I tried to organize "learning groups" of 3-4 children, but in many cases the variety in the group regarding the pace of learning was so large that I had to teach each child individually. Every year there was at least one boy who would always ask for more homework or more difficult tasks; in many cases these gifted children would find harder problems by themselves. I was considered a good teacher, as my students passed the entrance examinations given to all students who wanted to learn in a good Yeshiva high school, but looking back I can conclude that most of the work was done by my students. They came to me, in the few weeks they did not have school, every day for tutoring, and then were doing their daily homework. I had the privilege of teaching children with high abilities and a very high motivation level, so it is understood why they did very well not only in the entrance examinations, but during their studies in the next 4 years.

However, my most vivid memory is not of one of these students who put a lot of effort in order to be accepted to a new school, but rather two brothers who learnt mathematics with me for the sake of learning: "Lishma".² They were the 13 and 14-year old sons of my former neighbor, who has been serving as the chief rabbi of a large Israeli town for the last three decades. They boys, usually coming from the Yeshiva in the evening, could study with me only on Fridays, when they had a short school day, but I could not start teaching them before 2 o'clock in the afternoon as I had to take the bus back home from Ramat Gan, where my school was located. During the year they had a 2-hour class every Friday, I cannot recall having to cancel the class even once – except for the two weeks I suffered from a bad flu. Their father explained to me that in their school they learnt math only until grade 4, while he wanted them to know some algebra, geometry, trigonometry is possible – and anything else I chose. As I did not have to prepare the

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² The Ramban (Maimonides, 1138-1204) cites the Sifri [the Midrash book on Devarim, The Book of Deuteronomy] that one should not learn Torah in order to be called wise, in order to sit in yeshiva, or for some other reward, but rather one should learn for its own sake. It seems according to Ramban that the concept of "lishma" is not an order or a specific commandment, but rather is part of the general obligation.
boys for external examinations, and did not have to follow any given curriculum, I started with rehearsing simple fractions, decimal fractions and percentages, moved to basic geometry and very quickly found myself suggesting interesting problems in number theory, combinatorics, and at the end of the year – analytic geometry. The younger boy was quicker than the elder, but this did not get in my way of advancing swiftly, when both boys were active and enthusiastic participants. These two boys were not my only Friday afternoon students during that year. In the first meeting, and then – in the second, when I realized that their father was standing at the door during the whole class, I thought he wanted to be sure I was good enough a teacher for his sons. But when he made no remarks and kept standing at the door I became puzzled. Only after a few more weeks he explained, that when he had been a child he had been fascinated by mathematics, but had no opportunity to study beyond elementary arithmetic. He also asked if I did not mind if he kept on standing at the door during all my learning sessions with his sons so he could learn too "without being in the way". Naturally I agreed. I have no idea if the rabbi could understand everything without active participation or doing homework; maybe he did do the homework given to his sons secretly… In any case – this experience with the rabbi and his two sons gave me a clue, while still at age 17, to the phenomenon fascinating generations of math educators and psychologists: mathematical giftedness among children.

Can mathematical giftedness be always identified before starting school?

In spite of the fact that mathematical giftedness in early childhood is a most fascinating phenomenon, when a young child demonstrates mathematical abilities that many adults do not, it should not be ignored that many mathematically gifted children show their special abilities only when already in school. There are many reasons that explain this: in some cases the child is not verbally gifted, so he cannot speak about his math abilities, so quite often they "do not count". In other cases the child's parents do not encourage such exceptional math abilities, and his peers might even call him nasty names when he expresses his interest in math, so only when in school his talent is "discovered". It also happens that the subject the child is interested in is not necessarily arithmetic, where math giftedness is obvious at a very young age, but those based on a wide knowledge base and thus needing some years in order to flourish.

Although the child who "speaks mathematics" is fascinating (not sure this is what you meant), this ability does not have to be problematic before school age. Until age 6, when the child is still in kindergarten, his teachers, in spite of their narrow math education (David, 2002), do no force him, in most cases, to "learn" what he had already known at age 2. In spite of the common belief, neither do the child peers interfere with the work the mathematically gifted child prefers to do. In some cases some more capable children even ask him to teach them, and if the kindergarten teacher does not object, the teaching and learning of mathematics becomes a collaborative activity open to anybody interested.

What happens to the mathematically gifted child in school?

At the beginning of grade 1 the situation regarding math learning is changed. The mathematically gifted child is supposed to "study arithmetic" 5 hours a week along with the other children. There is no "way out" for him: to read a book, to play with dolls or blocks, to do the puzzle kept especially for him, as was the case in kindergarten. From age 6 to 12, when, as known from many written biographies and personal testimonies, most mathematicians had shaped their professional identity, the mathematically gifted child has to overcome a main problem. On the one side, he wants to advance in math learning. On the other – he has to build his psychological, social, and emotional identity, as "one of the group". This is very difficult without nurturing of his math abilities, most important to him as a person.
Many studies have shown that in order to be at the top in any area, thousands, or even tens of thousands hours are needed to be invested in practicing, learning and rehearsing. This is also the case in mathematics. Thus, the argument heard frequently both by educators and parents: "the child needs to have a balanced life", used as an excuse to drive the child away from math, is a little unclear. Indeed, all children need to have friends, a variety of activities, and family connections. But the exact amount of time a mathematically gifted child "should" dedicate to math is flexible. Who knows when exactly the child is "in equilibrium"? When is it "ok" to do math 5 hours a day and when is it not? There are no rules; the only rule that must guide parents and teachers is the answer to the question: "is my child happy doing math?"

**Case studies: two vignettes**

1. Guy

A few years ago a worried mother told me about her 8-year old son who used to fall asleep while doing math: his exercise book would fall down, the pencil drop each evening to (not sure what you mean) the floor. I first tried to find out why the child was so tired. The mother explained that the child was a gifted basketball player, practicing on a regular basis in a well known sport union, as well as an outstanding judoka. "It seems quite clear to me why the child is so tired", I said, but then the mother said: "I asked him time and again to restrain his math learning pace, but he would not listen". "What do you mean"? I asked. "Maybe you can explain to him that he is already doing grade-5 mathematics, and being ahead of his class by two years must be enough". It was very difficult to explain her that actually Guy far behind his true abilities in math, as he had to do all the exercises in the learning materials before getting access to a new math subject, and as he was bored with every subject after he understood it, a process that took him about 10% of the expected time, he was actually exercising too much in order to get the award – exercises related to the next subject.

2. Adam and Allen

Adam and Allen are 6-year old children living in a village in the northern part of Israel. As the village is quite small and the parents insist that the children do not leave it before school, the kindergarten they visit consists of 3, 4, 5, and even some 6-year olds. When the children have to start school they can choose one of the three in their municipality; they usually prefer the closest one, which is located about 20 km from their village.

The twins' mother is 30-year old woman; their father is 15 years her senior: this is his second marriage. He has a 15-year old daughter by his first wife, who also lives in the same village. Allen is well developed, mature and physically strong girl. Adam is much shorter, suffers from allergies and a constantly runny nose, as well as poor appetite. However, at age 3 he already mastered addition and subtraction up to 10, and at 5 he not only knew how to multiply and divide, but understood the meaning of these operations. When I met him he mastered complicated excises with fractions, and was fascinated by the power concept. In spite of that, the mother decided both twins had to delay entering grade 1 by a full year. As Adam was given the title: having "a low maturity level", the only solution offered for him was to leave him in kindergarten for an extra year, with some children who were hardly out of nappies. The decision to leave Allen there as well seems inevitable: "twins cannot be separated..."

We can conclude that the life track of a child with extreme math abilities is determined, with high certainty, by the home. The talent is a necessary condition, but if the parents do not have enough knowledge, or they themselves lack the support needed in order to be able to support the bringing up of a mathematically gifted child they would prefer, in many cases, actions to the
disadvantage of their (I know what you've been saying here, but I insist on "child") and leave no space for his extra-ordinary abilities.

**Examples of math problems**

Here are some examples to problems that, when given to young children can help us identify mathematical giftedness. A mathematically gifted child, especially when very young, does not necessarily solve all, or even one of them. The interest he shows, and his trying to get the right answer, are of more importance.

- Sheikh Abdallah had 17 camels. He gave half to his first born son, a third – to the second and one ninth, namely 2 – to the third. How is it possible?
- How many times in 24 hours the minutes clock hand will cover that of the the hours (though rare, non-digital clocks still exist…)?

**Summary and Conclusion**

Many studies written about "mathematical giftedness" actually mean: "high math ability". The exceptions are those of Feldman & Goldsmith, (1986) or Gross (1999), along with all the studies from The Study of Mathematically Precocious Youth (SMPY) project (see, for example, the publication list of SMPY's two main investigators: Benbow, 2012, and Lubinski, 2012). Many of these studies, including some of the SMPY ones, are case studies, including the only Israeli published study (David, 2005b). As the reference is to a group whose frequency is about 1 to 50,000, it is hard to have a large enough group in order to conclude definite statistical findings about them.

However, it must be clear that the old argument whether "gifted children should get enrichment or accelerated education" has no meaning when we refer to this special group. They need massive acceleration along with deep math learning, creative teaching and hand-tailored programming. A detailed case study describing such a child and the way he had been tutored in order to develop not only his math ability, but his personality as a whole is to be published elsewhere (David, in press).

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SECONDARY SCHOOL STUDENTS' ATTITUDE TOWARDS ENVIRONMENTAL ISSUES IN KARACHI METROPOLIS, PAKISTAN

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This paper examined high school students’ attitudes toward the environmental issues (pollution of air and water, overuse of resources, global changes of the climate etc.) with respect to school system. The questionnaire-based Relevance of Science Education (ROSE) Project was used to collect data from 10th grade 312 students. Data was analyzed using (SPSS) the non-parametric equivalent of the independent t-test. The results of the study indicate that there were significant difference between government and private schooling systems students’ attitudes. Private schools students reported to have a significantly high degree of positive attitude towards environmental issues as compared to their government counterparts. The results of the study provide significant insights into students’ attitude towards environmental issues towards discipline in both government and private secondary schools. Based on the results of the study, some recommendations have been put forward for policy and practice. Furthermore, the results of the study can be used as a base line for further studies. The authors offer suggestions, based on the results, for further research to identify reasons for differences between government and private school, so as to improve environmental education in Pakistani schools.

Keywords: Environmental attitude, Environmental education, Secondary school, gender, school systems

INTRODUCTION

Environmental degradation has emerged as a serious issue in the world today. Human factor is the largest contributor to the environmental degradation (Makki, Abd-El-Khalick, & Boujaoude, 2003) which might pose serious threats to sustain life on earth (Gore, 1993). Therefore, there is a dire need to pay serious attention towards protecting life on earth. As teacher and teacher educator, it is our prime responsibility to take measures to overcome this problem. UNESCO\(^3\) (2005) emphasizes the role of education in shaping attitudes, values, and behavior, while developing the capacities, skills, and commitments needed for building a sustainable future.

Dunlap, Gallup, & Gallup (1993) conducted an international survey on environmental values. In this survey, twenty four countries all over the world including developed and developing nations had participated. From each country, around one thousands sample selected. The survey's results showed that citizens of many developing nations were highly concerned about the state of the environment.

\(^3\)United Nations Educational, Scientific and Cultural Organization
Studies generally tend to examine students’ environment attitudes in relation to environmental knowledge, interest, behavior as well as socio-economic variables (e.g., Huang & Yore, 2003; Makki, Abd-El-Khalick, & Boujaoude, 2003; Negev, Sagy, Garb, Salzeberg & Tal, 2008) have been carried out all around the world in developed as well as developing countries. Lavonen and Meisalo (2004) examined the Finnish students’ environmental attitudes across gender. They found overall positive attitude towards environment across gender. In a comparative study by Huang and Yore (2004), they reported that both Canadian and Taiwanese 5th grade students held positive behaviour and attitudes towards the environment. Moreover, they expressed a high emotional disposition toward the environment and high concern about environmental problems and issues as well as a moderate level of environmental knowledge. Makki, Abd-El-Khalick, and Boujaoude’s (2003) study showed that Lebanese high school students held positive environmental attitudes but had inadequate environment knowledge. Young students’ environmental attitudes were also investigated by many Turkish researchers (e.g., Alp, Ertepinar, Tekkaya, & Yilmaz, 2007; Taskin, 2009; Tuncer, Ertepinar, Tekkaya & Sungur, 2005). In one of these studies, Cavas, Cavas, Tekkaya, Cakiroglu, Kesercioglu, (2009) found that Turkish students generally have favorable attitudes and interest toward environmental issues. They seemed to be eager to find solutions to environmental problems and show optimistic trends about the future.

In ROSE (Relevance of Science Education) study Sjoberg & Camilla (2004) conducted survey in forty countries of the world. As part of ROSE study, the researcher examined how students relate environmental challenges. They found that students did not seem to be pessimistic about the global future. They put trust in themselves that they personally could influence what happens with the environment. However, the study showed no significant gender differences regarding environmental issues. Results of the study revealed that in general students have positive attitude towards environmental protection.

In summary, research studies which are carried out all over the world showed that students have positive attitude towards protection of environment. They are eager to find solutions of environmental issues.

Furthermore, school may play some role in the formation of students’ views on the environment (Tuncer, Ertepinar, Tekkaya and Sungur, 2009). Kuhlemeier, Bergh, and Lagerweij (1999) also seems to agree by saying that, the student population (family background or prior achievement); the enthusiasm, experience and competence of the team of teachers; the curricular offering; the quality of instruction; and the social climate (Gamoran and Nystrand, 1994) may all play a part to develop attitude of students.

In Pakistan, government and private schooling systems are following the same curriculum (National curriculum, 2009). However, there is difference in teaching methodologies and resources in both the systems. This study aims to explore students’ attitude with respect to school system to know the environmental attitude of students. However, there is dearth of research studies which have been carried out to explore differences in students'/teachers’ attitude towards environment across school systems. However, only a couple of studies have been carried out to address this issue all-around the world. A study was carried out by Tuncer, et al (2009) in Turkey to explore environmental attitudes of young people across school system. Results showed that students from the private school scored higher than their government counterparts. Another study was carried out by Shobeiri, Omidvar & Prahallada (2006) to know the environmental attitude of teachers of Iran and India across school system. Result showed that overall there is no significant difference in public and private school teacher environmental attitude.
In Pakistan, few studies have been carried out to explore students’ learning outcomes in various subjects including science (Mirza, Munawer and Hameed, 1994, Das, Pandey, and Zajonc, 2006, LEAPS 2007, p.31). These studies have found that private children at private school have performed better as compared to their government counterparts in science and other subjects. As science is closely related to environmental education, it was important to find out whether this difference in achievement translates in children attitude as well. These were the main reasons to select the variable (i.e. school system) to explore further through the study. Having said that, I am cognizant of the fact that there are number of other factors (Socioeconomic status, classroom practice, Media) which contribute to environmental attitude. However, keeping in mind the scope of this study, one variable was selected.

STATE OF ENVIRONMENTAL EDUCATION

Some researchers argue that formal environmental education helps students to develop more favorable attitudes towards environment (e.g. Lee, 2008). Therefore, it is reasonable to look at the environmental education context in Pakistan within this study. The Environmental Education (EE) in Pakistan is in its very beginning stages. There is not a well-established environmental education policy for Pakistan. It is important to note that in Pakistan, EE is not taught as a separate subject. However, EE concepts like energy, greenhouse effect, pollution; microorganism, recycling, and ecosystem have been incorporated in the science curriculum of the primary and secondary classes. Moreover, textbooks of Urdu, English, Social Studies and Islamic Studies at primary and secondary levels also carry some environmental education concepts, which are presented as part of content in various chapters. There is very little attempt to make connections between concepts, especially between science and environment and vice versa. Furthermore, the textbooks lack guidelines for teachers to teach these concepts not only to create awareness and develop attitudes, interests and skills among students but also to equip students with strategies to take action in order to preserve the earth’s natural resources and to deal with environmental issues.

An overview of the discussion presented above appear to indicate that although there is no separate environmental education course in the secondary education in Pakistan, environment related ideas are intended to provide to all students from both the science and non-science groups through different subject areas. However, curriculum review revealed that most of the topics related to environment failed to portray adequately the relationship between human activity and the quality of environment in the presentation of content. Furthermore, National Education Policy (2009) has not given attention to the area of environmental education. Rabia (2010) argues that by keeping in view the importance of EE, environmental education should be given proper attention. For example, it is important to relate EE with daily life as this strategy would help to develop positive attitude towards environmental issues.

PURPOSE

The study aimed to investigate secondary school students’ attitude towards environmental issues across school system.

RESEARCH QUESTION
What is the difference in environmental attitude of secondary school students of government and private system in Karachi, Pakistan?
METHODOLOGY

Cross-Sectional Survey

The purpose of my study was to investigate the attitude of Grade Ten students towards environment. Accordingly, I opted for quantitative approach, which seemed to be most appropriate as it aims to identify what a situation is like and the direction in which it is going (Punch, 2005). There was no manipulation of variables required in the study and it only aims in describing the current attitude and differences across existing variables (i.e. school system and gender). An additional advantage of this design, according to Fraenkel & Wallen (2006) is that “it is quicker to conduct and cheaper to administer” (p.397). It produces a “snapshot” of a population at a particular point in time. (Cohen, Manion & Morrison, 2000)

This cross-sectional survey, involving the questionnaire proved to be an effective way of assessing environmental knowledge and attitude from large group as surveys can directly collect information from people about their ideas, feelings, and social and educational background (Fink & Kosecoff, 1998, p.1)

Furthermore, attitude is a positive or negative thinking about a person, object or issue (Abell and Lederman, 2007). Therefore, asking directly from individuals through an attitudinal survey research method was the most logical method for gathering information on attitude. (May, 2003).

Description of the Questionnaire

The questionnaire consists of 23 items divided into two parts. Part A, in which participants were asked to provide information about name, gender, age, and class and school system. In Part B, relevant section of ROSE questionnaire was used. It is a Likert-type scale which includes ten sections (A to I). I chose section D which contains 18 items that focuses on students’ attitude towards environmental issues column ranging from disagree to agree.

Sample

The ROSE questionnaire was translated from English to Urdu by five researchers working in the fields of Science Education, Urdu language and English language. Pilot study carried out for reliability. For drawing a representative, Multi stage cluster sampling sample of grade ten students from private and government schools of Karachi, I encountered two major constrains:

- Geographical spread of the target population
- Partially or complete unavailability of listing of schools

Keeping in mind the above constrains, from the eighteen towns, those towns were selected, which are half an hour’s traveling distance from AKU-IED. Of the eighteen towns, seven towns fulfilled this criterion. Of the seven selected towns, two towns were randomly selected in the first stage of sampling. In the second stage, 10 schools were selected from two towns through random sampling using SPSS. In the third stage, grade ten students were selected from each school by setting the criteria that the whole class will be included if the class size is thirty or more than thirty. Application of the questionnaires in the classroom took forty minutes.

The sample of the study consist 312 students (154 girls and 158 boys) who were enrolled in the 10th grade. A direct administration procedure was used for the survey.

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4 http://www.ils.uio.no/forskning/rose/
5 Aga Khan University, Institute for Educational Development
Data Analysis

Data was analyzed by using SPSS. Inferential analysis was used for comparing the mean scores of students’ environmental attitude across systems. Group comparison (Mann-Whitney) was used to find out differences across school systems. This analysis was carried out in two steps: (i) overall comparison; (ii) item-wise comparison. Before, comparing group analysis was carried out on overall score to explore general trends across all items.

Results

This section begins with a subsection of overall attitude of students followed by presentation of results at two levels to answer the two main research questions.

OVER ALL ATTITUDE OF STUDENTS TOWARDS ENVIRONMENTAL ISSUES

Table 3 shows the overall attitude of students at secondary level in Karachi, Pakistan. An examination of table shows that students hold moderately positive attitude in most of the items of ROSE questionnaire (section D “Me and environmental challenges”). The participants responses were distributed among the five options (i.e. strongly disagree, disagree, neutral, agree, strongly agree).The findings revealed that Pakistani students generally have moderately favourable attitudes towards environmental issues. They seemed to be eager to find solutions to environmental problems and showed optimistic trends about the future.

<table>
<thead>
<tr>
<th>Items</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Threats to the environment are not my business (-)</td>
<td>2.50</td>
<td>1.44</td>
</tr>
<tr>
<td>2. Environmental problems make the future of the world look bleak</td>
<td>3.74</td>
<td>1.29</td>
</tr>
<tr>
<td>3. Environmental problems are exaggerated (-)</td>
<td>3.17</td>
<td>1.26</td>
</tr>
<tr>
<td>4. Science and technology can solve all environmental problems</td>
<td>3.29</td>
<td>1.20</td>
</tr>
<tr>
<td>5. I am willing to have environmental problems solve even if this means sacrificing many goods</td>
<td>3.79</td>
<td>1.00</td>
</tr>
<tr>
<td>6. I can personally influence what happened with the environment</td>
<td>3.59</td>
<td>0.95</td>
</tr>
<tr>
<td>7. We can still find solutions to our environmental problems</td>
<td>4.26</td>
<td>0.92</td>
</tr>
<tr>
<td>8. People worry too much about environmental problems (-)</td>
<td>3.14</td>
<td>1.32</td>
</tr>
<tr>
<td>9. Environmental problems can be solved without big changes in our way of living (-)</td>
<td>2.56</td>
<td>1.29</td>
</tr>
<tr>
<td>10. People should care more about protection of the environment</td>
<td>4.24</td>
<td>1.04</td>
</tr>
<tr>
<td>11. It is the responsibility of the rich countries to solve the environmental problems of the world</td>
<td>2.67</td>
<td>1.34</td>
</tr>
<tr>
<td>12. I think each of us can make a significant contribution to environmental protection</td>
<td>4.13</td>
<td>1.05</td>
</tr>
</tbody>
</table>
What follows is detailed analysis at item level.

The students scored highest in item 7 which is about the vision for future. It is worth mentioning that the students scored (M = 4.26). Students’ images of the future affect actions in the present, they try to adapt what they imagine and acts that they wish for future. Future images are influenced by the background, experiences, knowledge. By knowing the youth's images of the future; we can better understand their present motivation, choices and actions. The images students’ hold of the future will make the future of country. Showing positive attitude regarding finding solutions to environmental problems suggest that students seem more concerned about the environmental problems. They own the problems and are enthusiastic to solve them. It is interesting to note that the youth of Pakistan is ready to take action for their better future.

It is quite surprising to note that students scored relatively higher (M =4.24) in item 10, which is about protection of environment. They think that it is important for the society that environmental problems should be solved. Students showed their concern for environmental issues and they want to protect the environment by their personal contribution. This attitude shows their determination towards protection of environment.

For item 12, which deals with the feeling of influence environmental problem, students have demonstrated an overall positive attitude (M= 4.13). Interestingly, students seem to be more motivated towards taking action instead of depending on other sources to solve environmental issues. They think that each of them can make significant contribution to environmental protection. They have demonstrated more positive attitude in terms of understanding their own responsibility to solve environmental problems. The average low score on the negatively worded item (environmental problems should be left to expert) indicates that in general students have shown their sense of responsibility to participate in solving environmental problems. It is heartening to observe that in general students have demonstrated more positive outlook for influencing the development.

Responding to the item 15, which is about whether animals should have the same rights to live as people, students showed positive attitude (M =3.91). This item is related to the biocentric value. The positive attitude of student shows that they recognize the pleasures and pains of non-human subjects to be considered. They might be of the view that at least some of what counts in ethics is common to our kinship with animals, not just specific to our species. Common sense first and science later teaches that we humans have many similarities with animals. For survival on planet earth, all members of ecosystem are equally important. Positive attitude towards same right of life of animals is encouraging in the sense that students love and care for animals.

On the other hand, in three items (4, 11, 17) students showed their less positive attitude. It is interesting to see that both items 4 and 11, which focus on external sources (i.e. technology and rich countries) to solve problems, have scored relatively lower. It is encouraging to observe
that in general participant students have demonstrated their sense of responsibility and relatively less reliance on external sources. Item 17 (almost all-human activity is damaging for environment) is regarding the protection of nature. Relatively low scores show that the students believe that not all-human activity is damaging for environment. By doing environmental friendly activities, they can protect their environment.

Overall results reveal that in general students have moderately favourable attitude towards environmental issues. They seem to be eager to find the solutions to environmental problems and show optimistic trends about the future.

COMPARISON BETWEEN TYPES OF SCHOOLS

This section presents the results of a comparative analysis between government and private school students’ attitude towards environmental issues at the secondary level.

FIGURE 1: Comparative Overview of Students’ Attitude across School

Figure 2 presents a comparative overview of overall attitude of students across school system.

The results shows that on average, students from private schools have demonstrated more positive attitude (M= 3.71; SD= 0.28) as compared to government school students (M=3.40; SD=0.43). The difference was found to be significant [U= 7024.000;  p<0.01]. Interestingly, the three outliers at the lower end shown in the visual graphics were all boys. Further analysis was carried out to explore detailed patterns at item level.

Item-wise analysis

The table 4 presents a detailed analysis at item level by comparing the mean scores and the standard deviation of government and private schools students’ attitude towards environment.

<table>
<thead>
<tr>
<th>Items</th>
<th>Government M(SD)</th>
<th>Private M(SD)</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Threats to the environment are not my business (-)</td>
<td>3.1(1.5)</td>
<td>1.9(1.1)</td>
<td>U= 6.712; p&lt;0.001</td>
</tr>
<tr>
<td>2. Environmental problems make the future of the world look bleak</td>
<td>3.4(1.4)</td>
<td>4(1.0)</td>
<td>U=9.544; p &lt;0.001</td>
</tr>
<tr>
<td>3. Environmental problems are exaggerated (-)</td>
<td>2.9(1.1)</td>
<td>3.5(1.3)</td>
<td>U=8.500; p&lt;0.01</td>
</tr>
<tr>
<td>4. Science and technology can solve all environmental problems</td>
<td>3.0(1.3)</td>
<td>3.5(1.0)</td>
<td>U=9.514; p&lt;0.001</td>
</tr>
<tr>
<td></td>
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<td>---</td>
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</tr>
<tr>
<td>5. I am willing to have environmental problems solve even if this means sacrificing many goods</td>
<td>3.9(1.1)</td>
<td>3.6(0.8)</td>
<td>U=8.634; p&lt;0.001</td>
</tr>
<tr>
<td>6. I can personally influence what happened with the environment</td>
<td>3.6(1.1)</td>
<td>3.6(0.8)</td>
<td>U=1.120; p&gt;0.05 (ns)</td>
</tr>
<tr>
<td>7. We can still find solutions to our environmental problems</td>
<td>4.2(1.1)</td>
<td>4.3(0.6)</td>
<td>U=1.155; p&gt;0.05 (ns)</td>
</tr>
<tr>
<td>8. People worry too much about environmental problems (-)</td>
<td>3.3(1.3)</td>
<td>2.9(1.2)</td>
<td>U=9.800; p&lt;0.01</td>
</tr>
<tr>
<td>9. Environmental problems can be solved without big changes in our way of living (-)</td>
<td>2.6(1.3)</td>
<td>2.6(1.2)</td>
<td>U=1.187; p&gt;0.05 (ns)</td>
</tr>
<tr>
<td>10. People should care more about protection of the environment</td>
<td>4.0(1.2)</td>
<td>4.4(0.8)</td>
<td>U=9.819; p&lt;0.01</td>
</tr>
<tr>
<td>11. It is the responsibility of the rich countries to solve the environmental problems of the world</td>
<td>2.4(1.2)</td>
<td>2.9(1.3)</td>
<td>U=8.980; p&lt;0.001</td>
</tr>
<tr>
<td>12. I think each of us can make a significant contribution to environmental protection</td>
<td>3.9(1.3)</td>
<td>4.3(0.8)</td>
<td>U=1.088; p&gt;0.05 (ns)</td>
</tr>
<tr>
<td>13. Environmental problems should be left to the expert (-)</td>
<td>2.5(1.2)</td>
<td>2.2(1.1)</td>
<td>U=1.044; p&lt;0.05</td>
</tr>
<tr>
<td>14. I am optimistic about the future</td>
<td>3.6(1.3)</td>
<td>3.7(0.9)</td>
<td>U=1.134; p&gt;0.05 (ns)</td>
</tr>
<tr>
<td>15. Animals should have the same right to life as people</td>
<td>4.0(1.3)</td>
<td>3.8(1.0)</td>
<td>U=1.027; p&lt;0.05</td>
</tr>
<tr>
<td>16. It is right to use animals in medical experiments if this can save human lives</td>
<td>3.4(1.4)</td>
<td>3.5(1.0)</td>
<td>U=1.191; p&gt;0.05 (ns)</td>
</tr>
<tr>
<td>17. Almost all human activity is damaging for environment</td>
<td>2.8(1.4)</td>
<td>3.8(1.0)</td>
<td>U=6.923; p&lt;0.001</td>
</tr>
<tr>
<td>18. The natural world is sacred and should be left in peace</td>
<td>3.3(1.5)</td>
<td>4.0(1.0)</td>
<td>U=9.113; p&lt;0.001</td>
</tr>
</tbody>
</table>

The results depict that there are significant difference among government and private school students’ attitudes regarding environment. Private school students scored higher than their government counterparts on most of the items. However, it was surprising to observe that government schools’ students had an edge over their private counterparts on two positively stated items (i.e. 5 and 15). It is argued that private school students seem more willing to solve environmental problem; however, when it comes to sacrificing goods to solve these issues

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6 ns: not significant
government schools have clearly exhibited more positive attitude. Similarly, government school students have shown more concern about animals’ right to life.

It is important to note that the difference between the two school systems was not significant on six items including statement number 6, 7, 9, 12, 14 and 16. Interestingly, both the groups have exhibited an optimistic outlook for finding solutions of environmental problems (“we can still find solutions to our environmental problems” and “I am optimistic about the future”). Similarly, both groups are confident that environmental problems can be solved through “personal influence” and “significant contribution to environmental protection”. As far as the “level of changes required to solve environmental problems” is concerned both groups have equally shown a positive attitude towards this. In other words, sample students in both groups seem to have realised that they have to make drastic changes in their life style to ‘fix’ environmental problem – the first step is realizing and taking steps towards solving environmental problems. Students’ from both systems are inclined towards ‘saving human life’ even if that means ‘sacrificing animal life’. However, it would be unfair discussing results on item 16 without referring to students’ views on item 15. Comparing an overall score on the two items indicates that on average students from both groups have shown relatively more positive attitude towards (government M = 4.0; private M= 3.8) equality of human and animal right to life (item, 15). However, when it comes to sacrificing animal life for saving human life, the score of both groups (item 16) have gone down (government M= 3.4; Private M= 3.5).

Based on results of overall comparisons, it was expected that private school would show positive attitude on majority of the items. As expected, private school students have shown more positive attitude on item 1, 2, 4, 8, 10, 11, 13, 17 and 18. Of these nine items, the first five focuses more on students’ attitude towards environment in terms of their sense of responsibility (e.g. people should care more about protection of the environment) and possible strategies to solve environmental issues (e.g. science and technology can solve all environmental problems). On the other hand, the last two emphasizes more on students’ environmental attitude through their bio-centric values (e.g. the natural world is sacred and should be left in peace). It is also interesting to note, that the students seemed to value their own contribution in solving environmental issues instead of putting this important responsibility on others. Relatively lowest score (from both groups) on item 11 (it is the responsibility of rich countries to solve the environmental problem of the world) is a manifestation of their sense of responsibility.

**DISCUSSION**

This section discusses the results in light of literature. Discussion is organised in two sections according to the research questions: (i) Comparison across school system; (ii) comparison across gender.

**Comparison across School System**

Comparison across school systems revealed that private school students claimed a more positive attitude towards environment than students from government schools.

This result is in contrast to the study of average environmental attitudes in government and private, state-dependent schools in 12 European countries (Avram and Dronkers, 2011). A majority of those studies found that there is no difference in environmental attitude of private and government schools system. There are only two exceptions to this general pattern. In particular, students in private government-dependent schools in Portugal have, on average, higher scores on the environment attitudes scale compared to their peers in public schools.
Whereas the results are in align with the results of the study of Tuncer et al (2005), in which they found that in Turkey students’ attending private schools were more aware of environmental problems, individual responsibility and national environmental problems, and had more positive attitudes toward solving the problems.

Item wise detailed analysis showed that private school students have shown a more positive behaviour about their personal contribution in environment protection (item 12). However, they seemed reluctant in sacrificing many goods (item 5) to solve environmental problems. This pattern indicates a lack of concern towards environmental problem on part of private school students. How to interpret these findings? Blake’s (1999) model may help to see barriers between environmental concerns and actions. He identifies three barriers to action: individuality, responsibility, and practicality. According to him, individual barriers are the ones that reside within the person, having to do with attitude and temperament. He claims that barriers are especially influential in people who do not have a strong environmental concern. Environmental concern is therefore outweighing by other conflicting attitudes. This seems to be the case with private education system students as well. They showed positive attitude for contributing to the protection of environment, however when the time comes for sacrificing goods, they seem reluctant to do so.

Although the evidence from the data reported that young people are not overwhelmingly optimistic about the future, environmental issues are clearly a matter of concern for them. Such issues deserve explicit curriculum attention. However, there are significantly different views of private and government education systems students about a range of environment-related matters, including how to respond to the challenges related to the environment. It is thus important in any programme of environmental education to address directly some of the issues that divide students in their responses to the 18 statements (e.g., the extent to which individual action and/or sacrifice can bring environmental benefits) so that they can appreciate that, there are different ways of thinking about environmental challenges and responding to them. Underlying such thinking will be an understanding of different ways of explaining the origins of the present difficulties faced by the environment, whether in terms of risk society theory or not (Beck, 1992). The need is for diversity, sensitivity, and experimentation in planning and teaching programs of environmental education and encouraging students to ask appropriate questions and search for answers rather than simply acquiring a body of environmental knowledge. The goal should be to enable students to engage in an informed conversation with expertise about the environment and help them develop the confidence and skill to add to it and, when appropriate, to challenge it.

It would be important to dig these differences across system further. In Pakistan, government and private schools are following the same curriculum that is the National Curriculum of Pakistan. One possible explanation of this difference could be that, in most of the statements, private students positive attitude shows that they may have more exposure to environmental issues as compared to government schools through environmental project works and different teaching strategies. Teachers, working in private schools may have better awareness as compared to government schoolteachers (Larijani, 2010). Another reason could be that in private schools, the recent developments might be emphasized more, encouraged to participate in various programs on environment related issues, which is not so prominent in government schools. Even, Dinakara (2000) reported significant difference in environmental awareness between government and private school teachers. However, Sabhlok (1995) reported
that government teachers were found to be well aware as compared to the private school
teachers.

Given that many environmental problems and their solutions are science related, there is
clearly a role for school science education in such an engagement. However, environmental
education is not simply a matter for science educators. To the extent that such education requires
the accommodation of the personal, social, and economic with the science as an integral whole, it
constitutes a challenge to a conventional subject-based curriculum and pedagogy.

To protect and conserve the Environment, emphasis should be given to EE in both
government and private system of education. In any of these education systems, teachers play a
very significant role in developing a greater awareness about environment among students. This
calls for a radical change in the way we think, live and work. Hence, it is clear that sustainable
development calls for a paradigm shift in our educational systems right from the school level up
to the university level. In fact, a sustainable way of life cannot be achieved without an
appropriate education system designed to internalize the principles of sustainability in the life
and work of our youth.

Since, it is a government initiative to make EE an integral part of formal education
through its national curriculum framework, considerable work is being done in the direction of
integrating environmental concepts into the existing curriculum, developing new strategies,
preparing instructional material for effective implementation of EE in the both systems.
However, there is a dire need of training teachers in both the education systems of Pakistan, so
that students of both the systems can develop their critical thinking skills to act positively
towards environment in future as citizen of Pakistan.

RECOMMENDATIONS

For policy, it is recommended that teacher-training institutes should include
environmental issues in their curriculum. Mere inclusion of topic would not work therefore, it is
important to train teachers in pedagogical strategies to orient them as how to teach environmental
education to students for critical thinking, problem solving, and action. For practice it is
suggested that teachers both in government and private schools must re-examine traditional
teaching strategies such as chalk-and – talk method that mostly do not match the learning styles
of students. Teachers need to use variety of innovative teaching strategies such as cooperative
learning strategies, while delivering their lessons. Besides that teacher should use problem
solving teaching methods, so that critical thinking in students could be developed. Student
should be encouraged to take positive actions in daily life so that they could be able to act
positively in their practical life in future. In other words, action oriented pedagogy could be
considered a first necessary step towards realizing and solving environmental problem. The heart
of teaching lies in interaction and discussion with students. In the light of the results of the study,
it is suggested that teachers must appreciate and encourage interactions and discussions in the
classroom so that students can express and justify themselves.

CONCLUSION

The results of the study give us the overall impression of moderate attitude of students
towards environmental issues. However, for positive changing of the prevailing level of attitude
and hope among youth, there is a need of bringing change in different levels. For example, some
rethinking need to be done regarding curriculum content and structure, teaching methods, teacher
education and in-service training, and development of suitable resources. It is my hope that these efforts will make youth of Pakistan environmentally informed and friendly citizen.

REFERENCES


THE INVESTIGATION OF CZECH LOWER SECONDARY SCHOOL PUPILS TOWARD SCIENCE SUBJECTS

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Abstract

The contribution is focused on the investigation of the Czech lower secondary school pupils toward science subjects (biology, chemistry, physics and geography). The curriculum of the Czech Republic included these subjects in the group call “Man and Nature”. The published studies showed, the pupils’ attitudes toward science subjects are relatively negative. This kind of subjects belongs among the least favorite. The physics and chemistry ranked very often at as the least favorite. In our study was the questionnaire with 25 Likert type items used. Only for the subject geography was used 27 items. It is due to the position of geography, this subject is standing between science and social subjects, so the character of several items was different from the items for other science subjects. The construct validity was established by factor analysis, which divided items into 4 (geography, chemistry and physics) or 3 (biology) dimensions. The dimension are not homogenous, some items are in other dimension in one subject and in other dimension in second subject. The pupils perceived the biology as the most positive and chemistry and physics are perceived as the least favorite subjects. The conclusion contains implications for further research.

Keywords: attitudes, lower secondary school pupils, questionnaire, science subjects

Introduction

The Czech educational system in the last twenty years passed through some changes. The last one included the science subjects in the group called “Man and Nature”. The science subjects incorporated in this group are biology, chemistry, geography and physics. The biology, geography and physics are taught all 4 years of lower secondary education (level ISCED II) in the Czech Republic. The chemistry is taught only two years. In the Czech Republic (also in other countries) is the decreasing interest about science subjects. The government knows about this situation, but its answer is only increasing of subsidy for the teaching of foreign languages and decreasing of teaching hours for science subjects. So it can cause big damages, because science is an important component of the cultural heritage of every country. It provides the most important explanations we have of the material world. In addition, some understanding of the practices and processes of science is essential to engage with many of the issues confronting contemporary society.

There are many investigations, which are focusing on the problematic of the perceptions of the science subjects. Some researchers are evaluating science subject in general view, and some are evaluating separately biology, chemistry, physics and geography. It is nonsense to write about every of study and their results, so below are presented only the results of the most important investigations. The problematic of attitudes of learners toward science is important for investigators for a relatively long time. As Osborne et al (2003) stated the attitudes toward science subjects are decreasing. These authors used data from the other investigators. The original results say about the same problem – attitudes toward science are decreasing. For
instance, Hendley, Parkinson, Stables, and Tanner’s (1995) study of 4023 Key Stage 3 pupils in Welsh schools uses overall means obtained from a Likert questionnaire. Their findings show that, out of the four core subjects – science, English, mathematics and technology – science is the least popular. This view of science is confirmed by a smaller scale qualitative study based on interviews with 190 pupils (Hendley, Stables, and Stables 1996). When asked which three subjects they liked best, science was ranked fifth out of 12 subjects. However, this contrasts strongly with the response to the question ‘Which three subjects do you like least?’, where science emerged as the most disliked subject and, interestingly, least preferred by boys. Hendley, et al. concludes that science is a ‘love–hate’ subject that elicits strong feelings in pupils. Other recent research into subject preference has been conducted by Colley, Comber, and Hargreaves (1994), who found that there were significant gender differences among 11-year-old to 13-year-old pupils with girls favoring English and humanities, and boys favoring science. It was brief view on the science subjects overall. But there is amount of studies focusing on the individual science subjects. For instance Trumper (2006) investigated attitudes of Israeli students toward biology and he found out relatively positive attitudes toward this subject. The next analysis was focused on the comparison of boys and girls, girls achieved higher score in comparison with boys. Prokop, Tuncer and Kvasnicak (2007) investigated the effect of field program on students’ attitudes toward biology. Authors found out positive increase of attitudes toward biology after the field program. Moreover, students displayed better understanding concepts like ecosystems and food webs. In the next study Zeidan (2010) investigated the attitudes toward biology and perceptions of the biology learning environment among grade 11 students in the cities and villages in the Palestine. These data were used to determine whether there were significant differences in and interactions between the attitudes toward biology and perceptions of the classroom learning environment for students of different genders and residency. Furthermore, it analyzed the relationship between the attitudes toward biology and perceptions of the biology learning environment. The students expressed positive attitudes toward biology. There were no significant difference between residence and females had got positive attitudes toward biology in comparison with boys. The attitudes toward chemistry was investigated for instance by Cheung (2009). The purpose of his quantitative study was to examine the interaction effect between grade level and gender with respect to students' attitudes toward chemistry lessons taught in secondary schools. Salta and Tzougraki (2004) investigated 11th grade Greek students’ attitudes regarding the difficulty, the interest, the usefulness of chemistry course, and the importance of chemistry. Gender and study specialization differences in students’ attitudes toward chemistry were examined for this population. Report card grades for the chemistry course were used to measure students’ achievement in chemistry and its correlation with students’ attitudes toward chemistry was explored. Students at 11th grade in Greek high schools consider the chemistry course neither difficult nor easy. The students’ attitudes regarding the interest of chemistry course are also neutral. Although there are no differences between boys’ and girls’ attitudes regarding the interest, usefulness, and importance of chemistry, girls, more than boys, tend to express negative attitudes regarding the difficulty of chemistry courses. Our study suggests that the correlation between attitudes toward chemistry and achievement in chemistry is low up to moderate. The correlation was stronger between difficulty and achievement, indicating that a positive attitude regarding difficulty of chemistry course is more necessary for students in achieving high scores. The investigation of pupils’ attitudes toward physics was realized by Stefan and Ciomos (2010). The sample size was created by Italian pupils, who considered physics for demanding, but on the
other the physics is perceived as interesting subject. Authors found out, that the most important factor, which is influencing the attitudes toward physics, is a teacher. The similar result was presented in the study of Angell et al. (2004).

The attitudes toward geography are investigated at least with comparison of other science subjects. Brook (1977) examined the general attitudes towards geography held by ninth and tenth grade students and college students. Education level, gender, and students’ individual conceptualizations of geography were examined as possible influences on their attitudes towards geography. The results were not significant among independent variables. Detailed results showed that the youngest students in this case ninth grade) had better attitudes towards geography in comparison with the older ones (tenth grade and college students). The influence of grade level was also investigated from fourth grade to sixth grade in the study of Sack and Petersen (1998) who found a decreasing interest in geography the higher the grade level of respondents. The same authors examined gender differences in attitudes towards geography and found that boys had more positive attitudes towards geography in comparison with girls.

On the previous lines was provided the brief possibilities of the investigation of attitudes toward science subject. Some of the subjects (biology, chemistry, physics) are investigated in higher level in comparison with geography. On the majority of cases is used quantitative approach with the Likert type questionnaires as the main research tool. In the some cases is used interview.

Methodology
Participants
The number of respondents participated on the investigation of attitudes toward physics was 390, toward biology it was 496, toward geography it was 540 and toward chemistry it was 379. The selection of respondents was random. All of participants attended lower secondary schools, where the style of teaching was conventional without any alternative methods incorporated into teaching process.

The instrument
The research tool was the questionnaire contained 25 Likert type items with five possibilities (strongly disagree – slightly disagree – not disagree/ not agree – slightly agree – strongly agree). There was the effort to use similar questionnaire for all science subject. The specific position of the geography (somewhere between social and science subjects) compelled authors to use different items in the questionnaire.

The questionnaire for geography was dividing into four parts (1. Geography as a school subject; 2. Geography and the environment; 3. Importance of geography; 4. Relevance of geography for pupils life). The chemistry and physics questionnaire was also divided into four parts (1. Interest about chemistry/physics; 2. Relevance of chemistry/physics; 3. Future life and chemistry/physics; 4. Chemical/Physically experiments). The biology items was distributed into 3 dimensions (1. Interest about biology; 2. Relevance of biology; 3. Biological experiments). The items from category “Future life and <subject>” were in this case incorporated into category “Relevance of biology”.

Copies of the questionnaire were administered Czech lower secondary schools. Students were informed that the questionnaire was anonymous and that it was not a test but rather a research attempt to explore attitudes towards geography. Administering of the questionnaires was random. No time limit was given for the finalization of the questionnaire, but the longest time
Analysis of data

The obtained data were coded into numbers following: strongly disagree – 1; slightly disagree – 2; not disagree/not agree – 3; slightly agree – 4; strongly agree – 5. It was valid for positive items, the negative items were coded reversely. The total score of individual participants provides a composite index of attitudes towards geography. A low score reflects a relatively negative attitude and a high score reflects a relatively positive attitude toward individual science subjects. The score between <2.75, 3.25> indicated neutral attitude toward subjects.

The acquired data was subsequently processed with factor analysis with Varimax rotation and factors/areas/dimensions with eigenvalues greater than 1.0 were derived. The reliability of the questionnaire was calculated using Cronbach’s alpha coefficient. The values of reliability were high for every questionnaire (α = 0.86 – 0.89). These values indicated acceptable reliability of the questionnaire (Nunnaly 1978). The high value of reliability coefficient in our study implies that the instruments used for investigation of students’ attitudes towards science subjects are reliable and its usage for further analysis is appropriate.

The analysis of obtained data was following. There was used percentage evaluation in the analysis of items. The descriptive statistical methods (mean score, standard deviation) was used due the determination of perception of the science subjects, if the attitudes toward them are positive, negative or neutral. The inductive statistic (ANOVA, t-test, Pearson product moment) was used for the determination of significant differences (between boys and girls, ...) and to determine the strength of the relationship. The multidimensional statistics (factor analysis, Cronbachs alpha) are presented above, their main using was into the determination of validity and reliability.

Findings

In this chapter we introduce some basic results of the analysis of attitudes toward science subjects. On the figure 1 are shown the values of score for the individual subjects. The highest score achieved biology (x = 3.45) and the lowest one chemistry (x = 3.27). There is possible to observe two interesting aspects. First of them is, the all subjects are perceived positively, although the chemistry and physics achieved boundary values, but the value are still positive. Second thing, the biology is perceived by lower secondary school pupils the most positive from all subjects. The chemistry is the worst evaluated subject in the tight sequence with physics.

Figure 1 The mean score for the individual subjects.
The next analyses are focused on the evaluation of the dimension, which was created by factor analysis. There are necessary three different approaches. The first approach is to evaluate only geography, because this subject is placed little bit different in comparison with other science subjects. As it is possible to observe on the figure 2 the dimension “The Relevance of geography for pupils life” was evaluated the most positive. Also the category “Geography and the environment” was evaluated positive. Other two categories was evaluated as negative.

Figure 2 The mean score of the dimensions regarding to geography

The next approach is to evaluate physics and chemistry dimension together, because the factor analysis divided items into these dimensions. However further analysis is little bit problematic, because the items in the dimensions are not similar. For example in the first dimension “Interest about <subject>” 8 chemical items, but 10 physical items. We can see, that as in “geography” the dimension “Relevance of <subject>” was evaluated the most positive. The lowest score was found out in the dimension “Future life and <subject>”.

Figure 3 The mean score of the dimensions regarding to chemistry and physics
The last approach is to evaluated dimension regarding to biology. This subject is evaluated separately due the fact, the items regarding to biology was divided into three dimensions. As we can see on the figure 4 all dimension regarding to biology was evaluated positive. The most positive was evaluated the category “Experiments” and as in the previous subjects the lowest score pupils achieved in the category “Interest”.

Figure 4 The mean score of the dimensions regarding to biology

Conclusion

In this contribution were delineated the basic results of the Czech lower secondary school pupils toward science subjects. In the conditions of the Czech Republic are biology, chemistry, physics and geography included among science subject in the group called “Man and Nature”. In the contribution we provided the basic literature review. In this part of the text are described basic studies, which are focused on the problematic of science subjects’ attitudes. Our contribution is, that in the region of Czech Republic was not realized study of this character. The methodology and results part is focused on the description of the sample size, the description of the instrument tool, which was used for the finding of attitudes toward science subjects. The attention is devoted to description of the data analysis, mainly the using of factor analysis, which divided items into dimension. The results described the basic findings, the overall attitudes toward science subjects and the distribution of score among dimension.

There are many possibilities how to evaluate data, one of this is find out the influence of demographic variables like gender or year of study on pupils attitudes toward science, next to find out relationship among dimensions.

This contribution presented only basic results, the more detailed information about this kind of research could be consulted on the conference,
References


CONSTRUCTION OF A PRIMARY DRY CELL BATTERY FROM CASSAVA JUICE EXTRACTS (THE CASSAVA BATTERY CELL)

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ABSTRACT
The liquid extract from cassava, a tropical root tuber widely consumed in Nigeria, The Gambia and in some other West African countries, is a big environmental hazard and constitute great nuisance as it pollutes the soil and air to a high degree, particularly the soil. Due to its very acidic nature, it becomes toxic to the soil and destroys the plants and nutrients in the soil. If extracts flow or is passed into the soil surroundings, it releases a very unpleasant odour into the air.As a result of this observable pollution hazard caused by this substance, I deemed it appropriate to research into how, this pollutant to soil and air can be controlled and also in the process the liquid extract from cassava, which is wasted and causes environmental damage, can be positively utilized to serve the society and mankind.Since it contains significant amount of acid, the following research hypothesis is drawn:The chemical nature of the liquid extract from cassava containing a mineral acid HCN, can be harnessed and used as an electrolyte for; a Dry cell battery; and The liquid extract from cassava, which is wasted and causes environmental damage, can be positively utilized to serve the society and mankind and thus constitute a means of pollution control.The cassava tubers contain a significant amount of cyanogenic glycosides, which hydrolyses to form hydrocyanic acid (HCN).

INTRODUCTION
The concentration of hydrocyanic acid (HCN) in cassava tuber varies in different species of cassava. There are two major species of cassava viz: sweet cassava and bitter cassava. The sweet cassava has lower level of hydrocyanic acid, while the bitter cassava has a high level of the acid, about 490mgkg-1. The tuber stores a lot of water, but this could be eliminated by dehydrating the liquid juice which is the store of the acid. Hydrocyanic acid is poisonous; hence cassava tubers are carefully and elaborately detoxified before being consumed. By its chemical nature, hydrocyanic acid has both cation (H⁺) and anion (CN⁻). When it undergoes dissociation the products are: HCN $\rightarrow$ H⁺ + CN⁻
With these dipolar characteristics, it could undergo electrolytic process involving the exchange of ions and flow of electrons; this can constitute an electric current.

The materials utilised include crushed cassava paste/juice (electrolyte), carbon black, manganese (IV) oxide powder, zinc can, carbon rod, cassava grater, absorbent material. The apparatus needed are voltmeter, ammeter and milliammeter, circuit wires, crocodile clips, electric bulbs.

The following tests were carried out:

i) Test for electromotive force, (e.g.) of the battery cell

ii) Test for current output of the battery cell

iii) Test with a load of 2.5volts electric bulbs.

The battery (cassava battery cell) generated of electromotive force (E.M.F) of 2.0volt and a current (I) of 60MA = 0.06A. And three of this was able to brightly light up a 2.5volts electric bulb; and produced a total electromotive force (E.M.F) OF 3.05volts and total current of 202MA =0.22A. These results led me to the conclusion that the cassava battery cell functioned well like other batteries, which can be improved on.

And that cassava juice (liquid) which is considered and drained away as waste material is a good electrolyte which could serve as a local cheap and economical source of electric power generation.

CHEMICAL COMPONENTS OF CASSAVA EXTRACT

The cassava tuber contains the following chemical compounds viz; water, carbohydrate, protein, traces of fat, fibre, mineral matter and glycosides, which undergo hydrolysis to form hydrocyanic acid (HCN), the rate of hydrolysis could be accelerated by soaking the cut-tubers in water or by raising the temperature of the soaked tuber to about 75°C. Hydrocyanic acid (HCN) has a concentration of about 490mgkg⁻¹ tuber (Onwueme I.C, 1978), in bitter cassava specifically, the store of the acid. The concentration of hydrocyanic acid (HCN) in cassava tuber varies in the different species of cassava. There are two major species of cassava viz: sweet cassava and bitter cassava. The sweet cassava has lower level of hydrocyanic acid, while the bitter cassava has a high level of the acid evenly distributed through the tuber. Other factors like low potassium content; high Nitrogen contents in soils, wet soil region, also contribute to high level of hydrocyanic acid in cassava. NOTE: HYDROCYANIC ACID IS POISONOUS; hence cassava tubers are carefully and elaborately detoxified before being consumed.

Hydrocyanic acid (HCN) by its chemical nature has both Cation (H⁺) and anion (CN⁻) (i.e. +ve and –ve ions) when it undergoes ionic decomposition the products are;

\[ \text{HCN} \rightarrow \text{H}^+ + \text{CN}^- \]

With this dipolar characteristic, it could undergo electrolytic processes involving the exchange of ions and flow of electrons. This can constitute an electric current.

PRIMARY DRY CELL BATTERY (E.G. THE Leclanché cells).

Primary cell with a nominal open circuit voltage of 1.5 Volts produced in very high volumes. Chemistry based on a zinc anode and a cathode/depolariser of manganese dioxide which absorbs the liberated hydrogen bubbles which would otherwise insulate the electrode from the electrolyte. It uses a carbon rod as the cathode current collector with an electrolyte of
ammonium chloride. Its variants have been in use for over a century. The performance of Leclanché cells improved by 700% between 1920 and 1990.

Also referred to as Zinc- Carbon Cells or Dry Cells (not to be confused with Solid State Cells) despite having an aqueous electrolyte since in modern cells the electrolyte of ammonium chloride and zinc chloride is produced in gel form or held in porous separators to reduce potential leakage if the cell becomes punctured.

Variants include

- Zinc carbon (Carbon cathode)
- Zinc chloride (Ammonium chloride electrolyte replaced by zinc chloride)
- Alkaline manganese (Ammonium chloride electrode replaced by potassium hydroxide)

Advantages are as follows:

Inexpensive materials, Low cost, Available in a wide range of sizes including AAA, AA, C, D and 9Volt sizes. Suitable for a wide range of consumer applications, Interchangeable with alkaline batteries

Applications

General purpose, low cost applications such as: Toys, Remote controls, Flashlights, Clocks, Consumer applications etc.

HYPOTHESES:
Since it contains significant amount of acid, the following research hypothesis is drawn: The chemical nature of the liquid extract from cassava containing a mineral acid HCN, can be harnessed and used as an electrolyte for; a primary Dry cell battery; and The liquid extract from cassava, which is wasted and causes environmental damage, can be positively utilized as a control of soil and air pollutions.

THE CONSTRUCTION
MATERIALS/APPARATUS USED
The first step I took in the construction of the cassava battery cell was to gather all the relevant materials needed for the project.
MATERIALS: - Crushed cassava paste/ juice (Electrolyte) Carbon black and Manganese (IV) oxide powder (Depolarizer); Zinc Can (Cathode); Carbon rods (Anode); Cassava grater, Absorbent material (Tissue paper).
APPARATUS: - Voltmeter, Ammeter and Milliammeter, Circuit wires, Crocodile clip, Electric bulbs (2.5v).

PROCEDURES
STEP I: The first step followed was to make a grater, which I used to grate the freshly peeled cassava tuber.

This was made by perforating some holes on a rectangular zinc slate of about 9cm² in area, with a 5cm – sized nail from one side of the slate so that sharp openings are produced at the opposite side. The rectangular zinc slate was then nailed to a stick of 4cm × 2cm × 1cm in dimension to serve as the comfortable handle.

The peeled cassava tuber was soaked in water for about two days before it was grated; (this is to increase the rate of hydrolysis of the cynogenic glycosides to Hydrocyanic acid within the tuber). After soaking the fresh, peeled cassava tuber for two days, it was grated, after which transferred into a scarf where it was pressed and squeezed to extract the juice from the paste. The extracted juice was bottled and kept for one day to give way for further hydrolysis reaction.

STEP II

The formation of the Cathode mix called Bobbin. This was made in two different ways. The first Cathode mix is a moderately thick paste and the second was a very thick paste. The Cathode mix is a composition of mixture of the extracted cassava juice (acidic); Manganese (IV) oxide powder and Carbon black obtained from Generator plant Exhaust pipe.

The positive electrode (Anode) is the carbon rod, taken from an old U2-Sized dry cell battery. The negative electrode (Cathode) is a zinc can (milk can and the zinc container of a U2-Sized battery).

STEP III: MAKING THE CASSAVA BATTERY CELL

The Cathode mix was put into the zinc can, which inside base was placed a sizeable round cardboard paper, and the inside was walled with an absorbent material (tissue paper) to act as a separator.

The Cathode mix filled (¾) three –quarter part of the zinc can. This was done with the two different Cathode mix respectively.

The carbon rod (Anode) was impregnated into the middle part of the cathode mix. So the battery cell was now made and ready for testing. Below is the diagram of the cassava primary battery cell.

The following tests were carried out:

i. Test for the electromotive force (E.M.F)
ii. Current output
iii. Test with a 2.5 volts electric bulb.

STEP IV: TESTS

i. Test for electromotive force (E.M.F) of my battery cell:

A voltmeter was connected across the terminals of the battery cell(s).
ii. TEST FOR CURRENT OUTPUT FROM MY BATTERY CELL: This was carried out with a milliammeter and an Ammeter. The battery was connected to a milliammeter and ammeter respectively in series.

iii. TEST WITH A 2.5 VOLTS ELECTRIC BULB: The bulb was connected to the battery cells in this manner; first to one cell; then to two cells together and lastly to three cells connected together.

RESULTS
ELECTROMOTIVE FORCE (E.M.F) READINGS FROM VOLTMETER. (Error in voltmeter = ± 0.1volt)

<table>
<thead>
<tr>
<th>NO OF CELLS</th>
<th>E.M.F IN VOLTS (V) ± 0.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.0 volts</td>
</tr>
<tr>
<td>2</td>
<td>2.0 volts</td>
</tr>
<tr>
<td>3</td>
<td>3.0 volts</td>
</tr>
</tbody>
</table>

FLASH CURRENT READINGS FROM AMMETER.

<table>
<thead>
<tr>
<th>NO OF CELLS</th>
<th>CURRENT (I) IN MA &amp; A</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>60 MA = 0.06A</td>
</tr>
<tr>
<td>2</td>
<td>130 MA = 0.13A</td>
</tr>
<tr>
<td>3</td>
<td>202 MA = 0.22A</td>
</tr>
</tbody>
</table>

Error in Ammeter (I) = ± 0.5MA AND ± 0.005A

TEST WITH 2.5 VOLTS ELECTRIC BULB.

<table>
<thead>
<tr>
<th>NO OF CELLS CONNECTED</th>
<th>observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NOT LIT</td>
</tr>
<tr>
<td>2</td>
<td>FAINTLY LIT(bulb light but glows dimly)</td>
</tr>
<tr>
<td>3</td>
<td>BRIGHTLY LIT(bulb lights up brightly)</td>
</tr>
</tbody>
</table>

CONCLUSION
The battery (cassava battery cell) generated of electromotive force (E.M.F) of 2.0volt and a current (I) of 60MA = 0.06A. And three of this was able to brightly light up a 2.5volts electric bulb; and produced a total electromotive force (E.M.F) OF 3.05volts and total current of 202MA =0.22A. These results led me to the conclusion that the cassava battery cell functioned well like other batteries, which can be improved on.
And that cassava juice (liquid) which is considered and drained away as waste material is a good electrolyte which could serve as a local cheap and economical source of electric power generation.
RECOMMENDATIONS
I. Manganese (IV) oxide (MnO$_2$). The possible local source within our environment from which Manganese (IV) oxide could be obtained or extracted should be research on so that every material used in the construction of the battery would be those that can be obtained cheaply and locally from our environment without the foreign dependence.
II. If possible, the actual and accurate, life span of the battery should be carefully measured on continuation with this project.

References
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FACTORS AFFECTING THE EFFECTIVE USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES IN TEACHER TRAINING

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ABSTRACT
This study was conducted to assess the factors effecting teachers’ use of information and communication technologies (ICTs) in teacher training institutions. Use of E-mail, MS Word, MS Excel, MS Power Point and Internet browsing was also determined in the study. Factors like lack of training, lack of technical support, lack of peer support, slow connectivity, power failure, lack of quality software, lack of quality hardware, lack of software, lack of knowledge, lack of confidence, lack of peer support, lack of realization of advantages, lack of time, not enough Internet connections, lack of hardware, limited lab hours, lack of software, these technologies are expensive, and these technologies have has no relevancy with B.Ed/M.Ed and MA Education course were used in the study.

Keywords: ICTs, Teacher Training, Barriers

INTRODUCTION
Education has got paramount importance in the 21st century due to emergence of globalization and increasing global competition. Doubtless to say that in this fast changing and competitive world, education and technology are the master keys for respectable survival, growth and development. ICTs have played vital role in the advancement of teachers’ professional development throughout the world and these are helpful for continuing professional development of teachers. The current and emerging communication and information technologies provide unique opportunities to continue the professional development of teachers and other educators. (UNESCO, 2005)
National Education Policy 1998-2010 (1998, p.88) has given special emphasis for the integration of ICTs in education in these words, “The investment in information technology infrastructure and its network will bring our institutions of higher education on the world map”.
ICTs can play a vital role in the professional development of teachers and administrators, consequently in enhancing quality of education. To improve education in Pakistan, the needs of our teachers, head teachers, and administrators must be addressed holistically. ICT can enhance teaching quality by supporting and reinforcing the use of innovative teaching practices. It can allow educators to access a wide array of materials, reducing isolation and permitting peer-exchanges (GOP, 2003).

TEACHERS PROFESSIONAL DEVELOPMENT AND ICTs
In this information era technological skills are essential for teachers’ professional
development. These skills are essential for every teacher training programme because other skills can be enhanced through the usage of information and communication technologies. Following skills are necessary for teachers in this era:

- To use ICT for their own purposes and to help students to use these technologies.
- Use of Word processing (MS Word).
- Use of Spreadsheets (MS Excel).
- Using emails
- Searching for information on the Internet. (UNESCO 2005)

ICTs based programmes are very interesting and motivating for the learners as they are engaged in these programmes keenly. These programmes facilitate them in the acquisition of basic skills which ultimately increase the quality of teacher training programmes. ICTs can enhance the quality of education in several ways: by increasing learner motivation and engagement, by facilitating the acquisition of basic skills, and by enhancing teacher training (UNDP-APDIP, 2002).

BARRIERS TO THE UPTAKE OF ICTs BY TEACHERS

There are several barriers in the proper use of ICTs and their nature varies from area to area for example lack of availability of paraphernalia is the major problem in developing countries while level of their use is the key concern for developed countries. Nevertheless key problems are lack of hardware, lack of quality of hardware, lack of training, lack of software, lack of quality of software, lack of technical support, lack of peer support, lack of time, lack of organization, lack of confidence lack of funding, connectivity problem and power failure etc. (BECTA, 2004)

Regarding personal computers (PCs) there are many people especially the students who cannot easily purchase the computer and its related accessories. No doubt designing and implementing successful teacher professional development programmes which employ ICT is neither easy nor inexpensive. (Carlson and Gadio (2002)

In some researches it is found that in pre-service phase some teachers feel frustrated during the use of these ICTs. Beggs (2000) pointed out that new technologies, when first encountered, bring mixed feelings of anxiety, fear, as well as frustration, which sometimes lead to not using the new technologies. I have observed similar reactions among tutors in the teacher training colleges, where the training of tutors did not fully materialize because the trained tutors who were expected to train others were not knowledgeable enough to competently train others. Studies in the UK identified three main obstacles that limited ICT uptake by student teachers: student access to computers, the ICT policy adopted by initial teacher training providers as well as lack of encouragement for students to use ICT in teaching practices (Murphy 2000).

RESEARCH METHODOLOGY

Population and Sampling

The population of the study consisted of Departments of Education in public sector universities of Pakistan. A sample of 50 academicians and 300 students of B.Ed, M.Ed, MA Education, and MS leading to PhD Education was drawn conveniently.
Administration of Research Tool and Data Analysis

It was a survey study and to elicit the opinion of the respective respondents, two questionnaires one for teachers and the other for students were constructed, validated and administered for data collection.

Table 1: Reliability coefficient of the questionnaire

<table>
<thead>
<tr>
<th>Sr.No</th>
<th>Focused Area</th>
<th>No. of Items</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Utilization of ICTs</td>
<td>5</td>
<td>3.46</td>
<td>.75</td>
<td>.90</td>
</tr>
<tr>
<td>2</td>
<td>Skills to Use ICTs</td>
<td>18</td>
<td>3.25</td>
<td>.81</td>
<td>.96</td>
</tr>
<tr>
<td>5</td>
<td>Overall</td>
<td>23</td>
<td>3.36</td>
<td>.78</td>
<td>.93</td>
</tr>
</tbody>
</table>

Data Collection and Analysis

37 out of 50 from academicians and 191 out of 300 from students were returned back. Collected data was analyzed by using mean and percentage formulas.

Table 2: Utilization of ICTs

<table>
<thead>
<tr>
<th>S.No</th>
<th>Item</th>
<th>Respondents</th>
<th>N</th>
<th>%</th>
<th>N</th>
<th>%</th>
<th>N</th>
<th>%</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Teachers</td>
<td>21</td>
<td>38</td>
<td>28</td>
<td>50</td>
<td>07</td>
<td>12</td>
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<tr>
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<td>22</td>
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<td>35</td>
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<td>Word processing</td>
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<td>19</td>
<td>34</td>
<td>33</td>
<td>59</td>
<td>04</td>
<td>07</td>
<td>---</td>
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<tr>
<td></td>
<td></td>
<td>Students</td>
<td>49</td>
<td>16</td>
<td>151</td>
<td>49</td>
<td>65</td>
<td>21</td>
<td>26</td>
<td>08</td>
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<td>3</td>
<td>Spreadsheets</td>
<td>Teachers</td>
<td>---</td>
<td>---</td>
<td>10</td>
<td>18</td>
<td>32</td>
<td>57</td>
<td>14</td>
<td>25</td>
</tr>
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<td></td>
<td></td>
<td>Students</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>98</td>
<td>32</td>
<td>153</td>
<td>50</td>
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<td>PowerPoint</td>
<td>Teachers</td>
<td>07</td>
<td>12</td>
<td>28</td>
<td>56</td>
<td>16</td>
<td>29</td>
<td>05</td>
<td>09</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Students</td>
<td>---</td>
<td>---</td>
<td>23</td>
<td>08</td>
<td>119</td>
<td>39</td>
<td>158</td>
<td>52</td>
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<td>5</td>
<td>Online /digital library</td>
<td>Teachers</td>
<td>24</td>
<td>43</td>
<td>27</td>
<td>48</td>
<td>05</td>
<td>09</td>
<td>---</td>
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<tr>
<td></td>
<td></td>
<td>Students</td>
<td>65</td>
<td>21</td>
<td>106</td>
<td>35</td>
<td>77</td>
<td>25</td>
<td>52</td>
<td>17</td>
</tr>
</tbody>
</table>

It is evident from table: 1 that teachers are most fluent in the use e-mails as more than 80% teachers are creating, reading or sending e-mails often and always. While more than 57% students are also using their e-mails frequently. Anyhow 27% students are rare user of e-mails and it is a matter of concern that about 13% students have never used e-mails. Similarly more than 90% teachers are using word processing frequently. Students are slightly less inclined (65%) towards the use of Microsoft Word. Exercise of spreadsheets (MS Excel) is not up to satisfactory level among teachers as 18% teachers are frequently using this technology and 57% are using this technology rarely. Perhaps teachers use MS Excel only during the preparation of result. This practice is very poor among students as none of the students use this technology frequently and only 32% students use this technology rarely. Teachers are fluent in creating and presenting their lectures through power Point while as more than 68% teachers are frequently using MS Power Point. Students are less inclined towards the use of MS Power Point as only 8% are frequent user and more than 50% have never used this technology. Both teachers (more than 90%) and students (56%) are fluent user of online/digital library.
Table 3: Barriers in the utilization of ICTs

<table>
<thead>
<tr>
<th>S. No</th>
<th>Item</th>
<th>Respondents</th>
<th>SA</th>
<th>A</th>
<th>U</th>
<th>DA</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Lack of hardware</td>
<td>Academicians</td>
<td>11</td>
<td>23</td>
<td>2</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Students</td>
<td>95</td>
<td>91</td>
<td>2</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>7</td>
<td>Lack of Quality hardware</td>
<td>Academicians</td>
<td>11</td>
<td>21</td>
<td>3</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Students</td>
<td>76</td>
<td>10</td>
<td>5</td>
<td>6</td>
<td>--</td>
</tr>
<tr>
<td>8</td>
<td>Lack of training</td>
<td>Academicians</td>
<td>21</td>
<td>16</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Students</td>
<td>128</td>
<td>57</td>
<td>3</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>9</td>
<td>Lack of software</td>
<td>Academicians</td>
<td>16</td>
<td>17</td>
<td>4</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Students</td>
<td>91</td>
<td>87</td>
<td>6</td>
<td>2</td>
<td>--</td>
</tr>
<tr>
<td>10</td>
<td>Lack of quality software</td>
<td>Academicians</td>
<td>17</td>
<td>18</td>
<td>2</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Students</td>
<td>67</td>
<td>51</td>
<td>46</td>
<td>28</td>
<td>--</td>
</tr>
<tr>
<td>11</td>
<td>Lack of technical support</td>
<td>Academicians</td>
<td>12</td>
<td>23</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Students</td>
<td>114</td>
<td>61</td>
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<td>--</td>
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</tr>
<tr>
<td>12</td>
<td>Lack of peer support</td>
<td>Academicians</td>
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<td>21</td>
<td>7</td>
<td>2</td>
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</tr>
<tr>
<td></td>
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<td>Students</td>
<td>36</td>
<td>12</td>
<td>18</td>
<td>1</td>
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</tr>
<tr>
<td>13</td>
<td>Lack of time</td>
<td>Academicians</td>
<td>7</td>
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</tr>
<tr>
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<td>68</td>
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<tr>
<td>14</td>
<td>Limited lab hours</td>
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<td>17</td>
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</tr>
<tr>
<td>15</td>
<td>Lack of organization/ administration</td>
<td>Academicians</td>
<td>2</td>
<td>7</td>
<td>10</td>
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<td>6</td>
</tr>
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</tr>
<tr>
<td>16</td>
<td>Lack of realization of advantages</td>
<td>Academicians</td>
<td>2</td>
<td>6</td>
<td>11</td>
<td>13</td>
<td>5</td>
</tr>
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<td></td>
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<td>52</td>
<td>47</td>
<td>38</td>
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</tr>
<tr>
<td>17</td>
<td>Lack of confidence</td>
<td>Academicians</td>
<td>3</td>
<td>7</td>
<td>11</td>
<td>13</td>
<td>2</td>
</tr>
<tr>
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<td></td>
<td>Students</td>
<td>102</td>
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<td>25</td>
<td>13</td>
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</tr>
<tr>
<td>18</td>
<td>Power failure</td>
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<td>5</td>
<td>2</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Students</td>
<td>111</td>
<td>37</td>
<td>31</td>
<td>4</td>
<td>--</td>
</tr>
</tbody>
</table>

It is evident from table: 5 that dominant majority of both academicians and students (more than 95%) are of the view that lack of hardware and quality hardware is the major problem in the use of these ICTs. Likewise dominant majority of both academicians and students (more than 80%) are agreed that lack of software, quality software, technical support, peer support, limited time of computer labs and power failure are the barriers to uptake these ICTs. Students are of the view that lack of organization is also a problem (61%) while academicians are of the view that this is not an important problem (49%). While 100% academicians and 97% students agreed with the statement that lack of training is the key problem for them.

CONCLUSION

The most common uses of ICTs among teachers and students in teacher training institutions are; e-mailing word processing, online library, academic studies and getting latest news while use of spreadsheets (excel) is unsatisfactory among both teachers and students. lack
of training, lack of technical support, Lack of peer support, slow connectivity, power failure, lack of quality software, lack of quality hardware, lack of software, lack of knowledge and lack of confidence as top 10 barriers among teachers. Sequence was changed among students as lack of hardware, lack of quality hardware, lack of software, lack of quality software, lack of training, lack of technical support, lack of peer support, slow connectivity, power failure and lack of confidence were arrayed as top 10 barriers/problems. Therefore, a more holistic approach may be used for the training of both groups and emphasis may also be given on the maximum deployment of computers and internet connectivity.

REFERENCES


PSYCHOLOGICAL BEHAVIOUR AND ENVIRONMENTAL MANAGEMENT: PERSPECTIVES ON DEGRADING RURAL LIVELIHOOD

Prakash Naraian Kalla
Rajasthan Agricultural University
Bikaner Rajasthan
India

ABSTRACT
Agricultural extension with its basic philosophies, scope, principles and applications strive to support the existing rural environment encompassing livelihoods: social, physical, financial, human and natural (natural resources) capitals to a great extent. Farming systems vary with agro-ecological conditions and no single intervention will work as a magical cure for improving farm productivity. Revival of agricultural dynamism calls for corrective steps to deal with the near collapse of the extension systems in most states and the decline in agricultural research universities. The technologies and approaches with ‘top-down’, technology-driven projects: local, decentralized, community-based, people-centered alternatives are available. Problems of scarcity of water, depleted aquifers, declining groundwater tables, and drought proneness have been successfully tackled by water harvesting endeavors in Ralegan Siddhi village in Maharashtra, Sukhomajri in Haryana, and Alwar in Rajasthan only the need of the hour is to properly revive our old conventional systems for sustainable future and livelihood.

Keywords: Water resources, Environment, Rural, People centered

INTRODUCTION
Rural environment represents the framework of regulations, institutions, and practices in villages defining parameters for the sustainable use of environmental resources while ensuring security of livelihood and a reasonable quality of life. While the scope of environmental infrastructure is often narrowed down to the provision of suitable water supply, sewerage, and sanitation it has within its purview (a) acquisition, protection, and maintenance of open spaces, (b) clean up and restoration of degraded lands, (c) integration of existing wildlife or habitat resources, (d) sustainable approaches to controlling flooding and drainage, (e) developing river corridors and coastal areas, and (f) forest management. Rejuvenation of natural resources through activation of watersheds, renewal of wastelands along with enhancement of farm productivity, is a component of environmental infrastructure that is attaining increasing importance as expanding anthropogenic activity stresses natural resources beyond their natural regeneration capability. The focus here is on natural resources, common properties, and rejuvenation of rural environment, especially the water resource.

METHODOLOGY
The study was undertaken in the year 2008-09 in the nearby villages of Banasthali Vidyapith in the Tonk district of Rajasthan State. The researcher utilized the qualitative data interpretation methodologies for deriving analytical conclusions from 120 respondents. The data gathered for this analysis came from the written applications where candidates were asked to state their perspective of the most important issues concerning the rural environment with focus on water resources in 200 words or less. Responses were taken using the written/essay method or
oral interviews. The grounded theory approach was used for analysis and interpretation of the
data. Grounded theory is an inductive approach to data analysis that results in conclusions that
are deeply rooted in the data (Strauss & Corbin, 1998). When using grounded theory methods for
analysis, theory genus is taken from the data collected for a specific study; hence no literature
review was reported in this study as to not establish a prior cause and effect relationships among
the variables. The researchers began this analysis with the intent of better understanding
participants’ awareness and exposure to issues that influenced their lifestyle, agriculture,
information sources, awareness, community and water resources. When constructing grounded
theory, the emphasis was placed on building rather than testing theory through deductive
hypothesis testing. The researchers considered alternative meanings of phenomena in a
systematic and creative process. No attempts were made to generalize the findings of this
analysis to other populations. Findings were negotiated among the research team to increase
creditability.

RESULTS AND DISCUSSION

Personal and Socio Economic characteristics of the respondents

The result presented in table 1 indicated that majority of the respondents (54.17%) were
middle aged. With regards to level of education, it could observed that 41.67 percent of the
respondents studied up to primary level, followed by 32.50 percent of them had middle school
education. It was also observed that 46.67 percent of respondents belonged to small farmers
category followed by 42.50 percent under semi medium farmers category. Farmers possess land
holding from their ancestors and carry further the farming occupation with the major dependency
on agriculture and water resources for their livelihood and income generation. As a result, it is
quite possible that farmers with their land holding evince keen interest to know about the new
ideas and technologies and try to coordinate their resources to get the maximum results out of
their holdings and continuously depleting water resources. It was also found that 45 percent of the
respondents belonged to medium income category followed by 33.83 and 24.16 percent of the
respondents who belonged to low and high income category respectively. Most of the farmers
were having 2.51 to 5.00 acres of land and agriculture was the major source of income. They
lacked the subsidiary occupations also.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Characteristic</th>
<th>Frequency</th>
<th>Percentage</th>
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<td>Age</td>
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<tr>
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<td>Young (upto 35 years)</td>
<td>42</td>
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<tr>
<td></td>
<td>Middle (36 to 50 years)</td>
<td>65</td>
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<tr>
<td></td>
<td>Old (51 and above)</td>
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<td>10.83</td>
</tr>
<tr>
<td>2.</td>
<td>Education</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Illiterate (can’t read and write)</td>
<td>20</td>
<td>16.67</td>
</tr>
<tr>
<td>Primary (1-4)</td>
<td>50</td>
<td>41.67</td>
<td></td>
</tr>
<tr>
<td>Middle (5-7)</td>
<td>39</td>
<td>32.50</td>
<td></td>
</tr>
<tr>
<td>High (8-10)</td>
<td>9</td>
<td>7.50</td>
<td></td>
</tr>
<tr>
<td>PUC</td>
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<td>1.67</td>
<td></td>
</tr>
<tr>
<td>Graduate</td>
<td>0</td>
<td>0.00</td>
<td></td>
</tr>
</tbody>
</table>

3. **Family size**

| Small (≤4)  | 35 | 29.17 |
| Medium (5-7)| 59 | 49.17 |
| Large (≥8)  | 26 | 21.67 |
| **Family type**                                      |
| Joint       | 39 | 32.50 |
| Nuclear     | 81 | 67.50 |

4. **Land holding**

| Marginal farmers (<2.5 acre) | 7  | 5.83 |
| Small farmers (2.5 to 5 acre) | 56 | 46.67 |
| Semi Medium farmers (5.01 to 10 acre) | 51 | 42.50 |
| Medium (10.01 to 25 acre) | 4  | 3.33 |
| Big (> 25)               | 2  | 1.67 |

5. **Annual income**

| Low (Mean –0.425SD) | 37 | 30.83 |
| Medium (Mean ± 0.425SD) | 54 | 45.00 |
| High (Mean + 0.425SD)  | 29 | 24.17 |
| **Mean** | 49.83 | **SD** | 22.77 |

**Scenario of the Rural Environment**

The ecosystem within which all rural activities are conducted encompasses the air, the water bodies, and the land. India supports approximately 16 per cent of the world population and 20 per cent of its livestock on 2.5 per cent of its geographical area, making its environment a highly stressed and vulnerable system. The pressure on land has led to soil erosion, water logging, salinity, nutrient depletion, lowering of the groundwater table, and soil pollution—largely a consequence of thoughtless human intervention. The extent of land degradation, the loss in capacity of our major water reservoirs and the decline in water level in wells in the past few years is alarming. Soil erosion from overgrazing, and intensive cultivation and soil degradation from excessive use of agricultural chemicals, have wide-ranging implications.

Agricultural activities that cause land degradation include shifting cultivation without adequate fallow periods, absence of soil conservation measures and cultivation of fragile lands, unbalanced fertilizer use, faulty planning or management of irrigation. Improper agricultural practices are usually observed under constraints of saturation of good lands and population
pressure leading to cultivation of ‘too shallow’ or ‘too deep’ soils and ploughing of fallow land before it has recovered its fertility. Overgrazing and over-extraction of green fodder lead to forest degradation through decreased vegetative regeneration, compaction of soil, and reduced infiltration and vulnerability to erosion.

**Impact on Human Health**

Globally, among the biggest dangers from farming is the continuous exposure to and the unsafe use of chemicals necessary for agriculture. In India, however, the danger to human health from such environment and pollution related causes are not given their due importance as accidents from farm machinery, with a fatality rate of 22 per 1,00,000 farmers. Fatality apart, chronic exposure to air and waterborne chemicals can have adverse health effects, which sometimes, can be difficult to measure because of problems in isolating individual chemical effects. (Table 2)

**TABLE 2: TOXIC HEAVY METALS WITH ESTABLISHED HEALTH EFFECTS n=120**

<table>
<thead>
<tr>
<th>Heavy Metal</th>
<th>Sources of Environmental exposure</th>
<th>Minimum Risk level</th>
<th>Chronic exposure toxicity effects</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lead</strong></td>
<td>Industrial, vehicular emissions, paints and burning of plastics, papers, etc.</td>
<td>Blood lead levels below 10 µg/dl of blood*</td>
<td>Impairment of neurological development, suppression of the haematological system and kidney failure</td>
</tr>
<tr>
<td><strong>Mercury</strong></td>
<td>Electronics, plastic waste, pesticides, pharmaceutical and dental waste Below 10 µg/dl of blood*</td>
<td>Oral exposure of 4mg/kg/day**</td>
<td>Gastro-intestinal disorders, respiratory tract irritation, renal failure and neurotoxicity</td>
</tr>
<tr>
<td><strong>Cadmium</strong></td>
<td>Electronics, plastics, batteries and contaminated water</td>
<td>Below 1 µg/dl of blood*</td>
<td>Irritation of the lungs and gastrointestinal tract, kidney damage, abnormalities of the skeletal system and cancer of the lungs and prostate</td>
</tr>
</tbody>
</table>

*µg/dl*: micrograms per decilitre of blood  
**mg/kg**: milligrams per kilogram

While certain cause and effect relationships are not easy to identify, cumulative effects are likely to be most critical. Cancer risk could be high from nitrate, metals, as well as pesticides; other problems like adverse hormonal functions, liver damage could also take place, as summarized (Figure 1). Moreover, toxic chemicals and pesticides in air, water, and earth enter body tissues and breast milk, through which they are passed on to infants.
Figure 1: Cancers linked to excessive pesticide and chemicals use in agriculture.

On one hand, as human productive capacity has gone up, whether due to the green revolution or rapid industrialization, so has its ability to generate waste. On the other, there is a growing demand on nature’s ability to provide life support as the population keeps growing and livelihood opportunities decline. We could look at this double squeeze on nature in the context of water resources. Water applied to the field in irrigation either seeps through to underground aquifers, or reappears as ‘return flow’ and finds its way back to the surface (regeneration); seepages from canals recharge groundwater aquifers; industrial use of water results in effluents; domestic and municipal uses become sewage; and whatever water evaporates comes back to earth as rain or snow. As seepages include pesticides, effluents include pollutants and untreated sewage; they find their way into water bodies, which in turn leads to declining biodiversity. Excessive pressure on the environment leads to drought-proneness in certain areas owing to declining water table levels and flood-proneness in others owing to silting of reservoirs and loss of forest cover.

Policy thrust and Government interventions

A much-generalized cause of environmental degradation is the failure of the governments to formulate appropriate policies to ensure sustainable land and water use. Such policy failures include price distortions through government-controlled prices, subsidies or taxes which give incorrect price signals, faulty delineation of property rights regimes and other legal structures, government projects which directly cause environmental damage, and weak public institutions. Furthermore, state appropriation of property rights has undermined traditional (often communal) property regimes, as in the case of our forest policy, and has in several cases led to de facto open access and resource degradation.

Micro planning approach and decentralisation

The answer to all the miseries does not lie in large, centralized, ‘top-down’, technology-driven projects but on the local, decentralized, community-based, people-centered alternatives availability and interactions. Problems of scarcity of water, depleted aquifers, declining groundwater tables, and drought proneness have been successfully tackled by water harvesting endeavors in Ralegan Siddhi village in Maharashtra, Sukhomajri in Haryana, and Alwar in Rajasthan. These are not ‘small’ instances to be dismissed as one-off phenomenon but examples
of significant and sustained success achieved in terms of increased water availability and rise in groundwater table.

Livelihoods encompassing capitals

Livelihood encompasses physical, natural, social, financial and human capitals. Natural resources play a dominant role in local livelihoods, it is true that people need to have an effective voice in decisions over the natural resources they depend on. The proponents of decentralization argue that the establishment of local (formal) institutions has the capability to improve people’s management and use of common property resources, thereby improving the resource base on which poor people are often disproportionately dependent. It is hoped that through these institutions, participation can better target benefits to the poor through the identification of key stakeholders who are most affected, and can imply an on-going information exchange and discussion through consciousness-raising by shared understanding of problems and a vision for the future that leads to commitment and ownership by the community.

Traditional water harvesting models

The governance structure is likely to change as a result of decentralization from centralized to localize, with the ‘people’ at the centre. Ideally, the higher authorities will not manage natural resources, but through a participatory process, the local people will manage them, thus resulting in a change in the pattern from a ‘command and control’, to a ‘responsive and accountable’ operative system. The new people-centered bottom-up paradigm in development thinking has created the overly optimistic view that decentralization will produce just and equitable outcomes for all, and that engaging the people will also act as a check on state power, thus helping to democratize local governance.

The new paradigm stresses the involvement of local people in contrast to the top-down paradigm, and tends to dominate management of natural resources at the local level. It has been argued that the emergent paradigm for humans living on and with the earth brings together decentralization, democracy, and diversity. The importance of traditional ways of combating with problems could be important too: here, informal institutions could be involved. For instance, whenever villagers in Karnataka’s Bijapur district sense a drought is imminent, they prepare for war with nature. Harbingers travel from place to place and try to bring rain through magic. Rainmaking may not work but the participants at least endeavour to do something in a situation.

CONCLUSIONS AND RECOMMENDATIONS
Strategic Review of Agricultural Extension

Farming systems vary with agro-ecological conditions and no single intervention will work as a magical cure for improving farm productivity. Agricultural extension has the potentiality and is equipped to develop and support the livelihood based on natural resources, especially water resources.

Properly planned and technically sound agriculture management: In some regions, solutions for increasing yields may involve a shortening of fallow periods and extension of cropping periods while in others where soil fertility and/ or access to purchased inputs is good, solutions such as annual cropping or multi-cropping without fallow would work. Again, farming systems based on tree crops, are suitable for some regions only and should be encouraged accordingly. Further, the degree of market integration, choice of crops and cropping systems, use of conservation technologies and use of purchased inputs and their effects on the farming system, are all important in determining the sustainability of particular farming systems.
Strengthening extension systems: Revival of agricultural dynamism calls for corrective steps to deal with the near collapse of the extension systems in most states and the decline in agricultural research universities.

Proper linkage between researcher to farmer field: Lab-to-land concept should be encouraged and put to practice by providing land-users multidisciplinary technical information and viable land-use options and alternatives identified for various agro-ecological and socio-economic units. Crop combinations and rotations suitable for different agro-ecological regions (as suggested by the Indian Council of Agricultural Research) need to be advocated for better land management.

RCTs and recommendations of premier research institutions: There is a need to stay abreast with evolving resource conservation technologies and practices and on analyzing the conditions and principles of sustainable land use. Efficient use of marginal lands needs to be encouraged and areas of untapped potential developed to ensure optimal utilization. For agricultural diversification to be a major element in the agricultural growth strategy, action on several fronts is necessary.

Ideally, there should be a shift of land from cereals to non-cereals (increasing both farm incomes and employment) combined with an increase in productivity in cereals to ensure that per capita availability of cereals does not decline. Improvement in fertilizer application efficiency, integrated with the use of bio fertilizers, to check the degradation of existing resources due to contamination with nitrates could be brought about through on-site farmer training programmes. Success in providing extension services so that the farmers can implement breakthroughs in research necessitates focus on water resource management.

REFERENCES


FROM ALGORITHMIC TEACHING TO-"KNOW" TO HOCS (HIGHER-ORDER-COGNITIVE-SKILLS) LEARNING TO-"THINK" ON SCIENCE AND TECHNOLOGY EDUCATION FOR SUSTAINABILITY; WHAT SHOULD IT TAKE? ... AND...HOW TO DO IT?

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Subject/Problem; Rationale, Conceptualization, Purpose and Objectives
There is an ever-increasing gap between the reality of the 21st century society, which is based on science, technology, economy, and advanced, sophisticated networked systems and capabilities and the response of the diverse, multi-sectorial educational systems, worldwide, to this reality. The later are perceived by students, teachers, parents, society, economical, political and … educational systems, as an instructional framework the objective of which is to advance pupils/students up the classes' ladder, based on their high scored passing of disciplinary, mainly algorithmic knowledge-centered exams and/or "standardized" tests. Pupils/students' learning are assessed and perceived, according to their “grade achievement” and/or scores on related standardized test/ examinations as the exclusive criteria.

Given the current striving for sustainability and the corresponding paradigms shift in science, technology, R&D, environment perception, economy and politics; e.g., from unlimited growth-to-sustainable development, correction-to-prevention and passive consumption of “goods”, culture and education-to-active participation, primarily in the science-technology-environment-society-economy-policy (S-T-E-S-E-P) context, the corresponding paradigms shift, at all levels of education is unavoidable. This requires a paradigm shift in conceptual-izat ion, thinking, and research in science education, particularly concerning the science-technology-environment-society (STES) interfaces.

Consequently, ‘STES literacy’ requires the development of students’ evaluative system thinking, decision making and transfer capabilities in this context, via the corresponding higher-order cognitive skills (HOCS)-promoting teaching, assessment and learning strategies (Zoller, 1993, 2000; Zoller & Levi Nahum, 2011; Zoller & Scholz, 2004). This means a shift, within different multicultural contexts and multi-sectorial educational systems from the currently dominating lower-order cognitive skills (LOCS) algorithmic teaching-to-know, to HOCS-promoting learning-to-think, typified by students’ capabilities of critical, evaluative, system, creative thinking and decision-making for problem solving and transfer. The HOCS approach to teaching and learning constitutes a comprehensive educational “world outlook” which has been and still continues to be research-based implemented in different settings and modifications, at all levels of education, world-wide. The HOCS conceptual model is presented in Figure 1. Clearly, moral and creative thinking are to be added [and, therefore, our research group is, currently working on it].
Figure 1: The guiding conceptual model of HOCS in the context of science education

Such a "LOCS-to-HOCS" paradigm shift in conceptualization, thinking, research and education, needs to be consonant with and enhanced by innovative, interdisciplinary generic, contextually bound, research-based teaching strategies assessment methodologies and, in accord, sustainable action – leading to ‘HOCS learning’.

There is an ever-increasing gap between the reality of modern society which is based on science, technology, economy, and advanced, sophisticated networked systems and capabilities and the response of the educational systems, worldwide, to this reality.

The current striving for sustainability and the corresponding paradigms shift in almost every aspect within the STESEP context, results in paradigms shifts, at all levels of education, as focused in Table 1 (Zoller, 2009; Zoller & Scholz, 2004).

In the contemporary educational contexts, it implies a paradigms shift in conceptualization, thinking, and research in the context of science education which includes, among others, novel teaching strategies, assessment methodologies and learning strategies, purposed at the development of students’ HOCS; among them the capabilities of Evaluative Thinking, system thinking, creative thinking and Decision Making (Zoller, 1993; Tsaparlis & Zoller, 2003; Zoller & Pushin, 2007; Zoller et al., 2010).

Table 1. Selected paradigms shifts in contemporary research and STESEP-oriented science education

<table>
<thead>
<tr>
<th>From:</th>
<th>To:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technological, economical, and social</td>
<td>Sustainable development</td>
</tr>
<tr>
<td>growth at all cost…</td>
<td></td>
</tr>
</tbody>
</table>
Reductionism; i.e., dealing with *in-vitro* isolated, highly controlled, components

Disciplinarity

Technological feasibility

Scientific inquiry (*per se*)

Algorithmic lower-order cognitive skills (LOCS) *teaching*

“Reductionist” thinking

Disciplinary teaching (physics, chemistry, biology, etc.)

Teacher-centered, authoritative, frontal instruction

Uncontrolled, *in-vivo complex systems*

Problem-solving oriented, systemic inter-/cross-/transdisciplinarity

Economical-societal feasibility

Socially accountable, responsible and environmentally sound R & D

“HOCS Learning”

System/lateral thinking

Interdisciplinary teaching

Student-centered, real world, project/research-oriented team learning

### Such a state of affairs mandates an *alternative educational practice*, in order to prepare students for a high level of personal and societal performance as motivated citizens inclined to learn and inquire; being active and involved, having the previously mentioned HOCS capabilities and, most important, taking responsibility for the consequent action and behavior (Zoller, 1993, 1994, 1999, 2000).

In parallel, the overwhelming agreement, worldwide, on the need for a fast transformation in all our life domains, from unlimited development and growth to sustainable development with all the implications involved requires, in accord, paradigms shifts (Table 1), not only in research and scientific, technological-engineering, economical, social, cultural and political practice, but even more so, in purposed education for sustainability and its attainment in all domains of life and human activity within a global web of complex systems, interrelationships and implications in the STES context (Zoller & Scholz, 2004; Zoller, 2011).

Such a shift from the traditional LOCS science teaching to 'HOCS learning', is to be encouraged by educators, national education policy makers, curriculum developers, teachers, Science, Technology, Engineering, Mathematics (STEM) educators and the public -at large, it reflects the worldwide ever-increasing social pressure towards more accountable socially, environmentally, economically and politically responsible sustainable development (Zoller, 1993, 2009; Zoller & Levi Nahum, 2011). Science/STEM/STES educators, researchers, economists, cognitive psychologists and sociologists consider HOCS capabilities for decision-making as the important domains for the assessment of students' learning for ensuring our future citizens' capability to exercise a responsible citizenry.

Science and technology are useful in establishing what we can do, and in providing us with the ability to generate new options. However, neither of them can tell us what we should do. Therefore, the development, promotion and nurturing of students' HOCS, is one of the tasks ahead for sound science education. This is of particular importance in the context of the contemporary "battle cry" for sustainability and, in accord, responsibility of the 21st science education in our diverse global community.

The essence of this research- and multi-dimensional educational experience-based paper constitutes an alternative to the existing “traditional” science education practice, aiming at
sustainability and excellence for all; namely, no more “preparing” students for effective performance, as citizens, in modern societies by imparting disciplinary knowledge via ‘test wishness’-oriented LOCS level algorithmic instruction, as the dominant component in the educational system. Rather, the fostering of transfer-oriented HOCS learning’ as the “king’s road” for empowering students toward rational, effective, excellence and responsible active participation in whatever role they might play in society. In short: the development of the students’ capability of purposed rational-reflective thinking, pre-decision making on what to accept or reject, do or not to do and in what way, and taking a responsible action accordingly; a socially creative and scientifically literate person, having the appetite, readiness and motivation to think, learn, inquire and grow – to compete with him/herself and having the capacity to collaborate with her/his peers (Zoller, 1990, 1993, 2000). Therefore, the nurturing of excellence for all in a broad spectrum of fields and contexts is envisioned as a vital overriding goal in the educational system.

Objectives, Goal and Related Research Questions

Guided by our ‘first approximation’ conceptual model (Figure 1) our educational objectives in science education are as follows:

1. To promote, in science education, the development of science/STEM students' evaluative critical system thinking, decision making (Levi Nahum et al., 2010; Zoller et al., 2010), problem solving (Ben-chaim et al., submitted) and transfer.

2. To teach science for acquiring new type of flexible contextually relevant, adaptive knowledge that facilitates one to cope with the complexity and fragility of multidimensional global socio-economic-technological-environmental-political systems via inter- and trans-disciplinarity in research and science education and in accord assessment methodologies for sustainable action. The Goal: The “STES Problem Solving – Decision Making Act” (Zoller, 1990; Zoller & Levy Nahum, 2011); namely,

1. Ability to look at the problem and its implications, and recognize it as a problem.
2. Understand the factual core of knowledge and concepts involved.
3. Appreciate the significance and meaning of various alternative possible solutions (resolutions)
4. Exercise the problem-solving act:
   Recognize/select the relevant data information;
   Analyze it for its reasonableness, reliability and validity;
   Devise/plan appropriate procedures/strategies for future dealing with the problem(s).
5. Apply value judgments (and be prepared to defend!)
6. Entertain the DM act:
   Make a rational choice between available alternatives, or generate new options;
   Make a decision (or take a position).
7. Act according to the decision made.
8. Take responsibility.

Our aims in our related longitudinal active research were: (a) contributing to the body of knowledge on these HOCS; and (b) fostering the shift from algorithmic teaching and assessment to a higher level of cognitive, deep learning. Accordingly, our research aimed at obtaining research-based answers to the following questions:

1. Does traditional science instruction lead to gains in students’ HOCS capabilities? (e.g., Evaluative thinking (ET), system thinking (ST), and decision making (DM)).
2. What are the science students’ views concerning their capability of resolving HOCS-requiring problems?
3. What can be learned from students’ responses to HOCS-requiring problems, to be used for
promoting their generic or disciplinary HOCS capabilities?

Selected Relevant Research Findings

Our longitudinal pre/post-based designed research program, within which specially designed questionnaires, relevant to the students’ HOCS capabilities studied – were developed, validated and applied. Students’ responses were, qualitatively ordinally categorized using a 3-level scale of 0, LOCS-1 and HOCS-2, followed by the relevant statistics. The essence of the results/findings of four such studies are given in tables 1-4 below.

1. Evaluative Thinking

<table>
<thead>
<tr>
<th>Cognitive Level</th>
<th>Scoring</th>
<th>Jewish sector (n=2625)</th>
<th>Arab sector (n=3285)</th>
<th>Χ²</th>
</tr>
</thead>
<tbody>
<tr>
<td>No response or irrelevant response</td>
<td>0</td>
<td>18.6%</td>
<td>12.36%</td>
<td>44.6*</td>
</tr>
<tr>
<td>LOCS-level response</td>
<td>1 point</td>
<td>30.1%</td>
<td>73.58%</td>
<td>1111.5*</td>
</tr>
<tr>
<td>HOCS-level response</td>
<td>2 points</td>
<td>51.3%</td>
<td>14.06%</td>
<td>951.5*</td>
</tr>
<tr>
<td>* p&lt; 0.0001</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. System Thinking

<table>
<thead>
<tr>
<th>Questionnaire</th>
<th>Trend</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>T value</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST(pre)</td>
<td>Environmental</td>
<td>43</td>
<td>12.35</td>
<td>2.77</td>
<td>-3.82</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>Study Science</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ST(post)</td>
<td>Environmental</td>
<td>50</td>
<td>14.86</td>
<td>3.57</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Study Science</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ST(post)</td>
<td>Environmental</td>
<td>46</td>
<td>16.74</td>
<td>3.12</td>
<td>-0.94</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>Study Science</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ST(post)</td>
<td>Environmental</td>
<td>49</td>
<td>17.75</td>
<td>3.19</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Study Science</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3. Problem Solving

Table 3. Students’ (N=47) views of HOCS-type problems
(Ben Chaim, et al., 2007)

<table>
<thead>
<tr>
<th>Statements</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Likert-type scale</td>
<td></td>
<td></td>
</tr>
<tr>
<td>In my opinion, solving this problem is within the capability of a beginning science major freshmen.</td>
<td>2.94</td>
<td>0.71</td>
</tr>
<tr>
<td>I have full confidence in my response.</td>
<td>2.38</td>
<td>0.67</td>
</tr>
</tbody>
</table>

HOCS capabilities are enhanced via (a) Tandem implementation of ‘HOCS promoting’ teaching strategies and assessment methodologies; (b) Such an enhancement requires time; it is not achievable via a single-shot short exercise; (c) The assessment needs not only to be consistent with the science teaching objectives, but also capable of their promotion. HOCS-promoting instruction and implementation of the corresponding HOCS-level assessment is attainable, and suggests that HOCS development is contextually- but not disciplinary content-bound. Thus, HOCS enhancement not only can be done; it should be done! The issue is –

How to Do It?

There exist quite many research and practice-evident ways to go ‘in line’ with the ‘teaching-to-know – to learning-to-think’ for SUSTAINABILITY. Most of them are HOCS-promoting teaching strategies and, in accord, examinations types and assessment methodologies (Zoller, 1994).

Selected HOCS-promoting teaching strategies follow:

1) Self-study of pre-class lecture material. Students have the course outline, scheduling, objectives, requirements and assignments in their hands, and they study the relevant material before it is ‘covered’ in the class, to which they bring their questions to be discussed.

2) No specific assigned course textbook(s). Students are provided, at the beginning of the course, with a list from which they can choose text- and reference books, to use for the study of any relevant topic as they find appropriate for their needs during the course.

3) Homework assignments—mainly problems (not exercises)—that require HOCS for their solution. These problems are to be worked out by the students (preferably in groups) and submitted, individually, for feedback and grading by teaching assistants, former “graduates” of these courses.

4) Students’ self-assessment. Students self-assess their home assignments, pre-guided by the course professor (Zoller et al., 1997).

Selected examples (many of them have already been published) of these strategies and methodologies, in the contexts of secondary and (undergraduate) tertiary levels, will be presented,

4. Decision Making

Table 4. Participants’ distribution (%) by LOCS/HOCS level of questions asked and the related scoring points (Item-1) (Zoller et al., 2010)

<table>
<thead>
<tr>
<th>Questions level</th>
<th>Group-T (N=105)</th>
<th>Group-4 (N=26)</th>
<th>Chi² test</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOCS</td>
<td>51.38</td>
<td>27.14</td>
<td>DF = 1</td>
</tr>
<tr>
<td>HOCS</td>
<td>48.62</td>
<td>72.86</td>
<td>Chi-square value = 12.96</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Scoring Points</th>
<th>1 or 2 points</th>
<th>3 or 4 points</th>
<th>5 or 6 points</th>
<th>Chi-square value = 15.87</th>
<th>P &lt; 0.0004</th>
</tr>
</thead>
</table>
critically discussed and a variety of options and variations of their application(s) in science teaching and assessment, in different multicultural multisectorial educational contexts and societies, will be proposed. Thus, the ‘translation’ of research results and successful science teaching and assessment for sustainability into action, in science education and education at large is not only doable, but it should be done purposely and persistently.

References


Abstract
Technology is taking over all aspects of life. Education, work and leisure are all becoming increasingly dependent on being able to interact with technology. But what of the academic and career prospects of those who do not want to interact with this technology. Technophobia is the fear or dislike of advanced technology or complex devices, especially computers. The present study examined the technophobia and gender disparity in attitude towards use of computers in a representative sample of 198 rural and urban school-going adolescents of Patiala district of Punjab. Technophobia in the present investigation was considered in terms of computer anxiety, computer self-efficacy and students’ attitude towards the use of computers. Three instruments namely computer anxiety scale, computer self-efficacy scale and Computer attitude scale were used to collect the data from school-going adolescents. Descriptive statistics, t-test, and ANOVA were used to analyse the data. The results of the study revealed significant gender differences in technophobia among adolescents. Further, the prevalence of technophobia was more in rural school students than their urban counterparts. Implications of the results are discussed.

Keywords: Technophobia, computer self-efficacy, computer anxiety, attitude towards computers, students

INTRODUCTION
Technophobia is described as the ‘abnormal fear or anxiety about the effects of advanced technology’, affecting one third of the population, causing health problems and the inability to work efficiently. People who dislike interacting with technology are often referred to as "technophobic". Technophobic people have negative thoughts and feelings about technology and they often have a desire to avoid interaction with technology. Technophobic students' negative feelings about technology have the potential to interfere with their learning when technology is utilized as a tool for instruction of school subjects. As computer use becomes prevalent and in many instances mandatory in education, the issue of technophobia increasingly needs to be understood and addressed.

Sam et al. (2005) observed that undergraduates had moderate computer anxiousness, medium attitudes toward the Internet, and high computer self-efficacy and used the Internet extensively for educational purposes such as doing research, downloading electronic resources and e-mail communications. This study challenges the long perceived male bias in the computer environment and supports recent studies that have identified greater gender equivalence in interest, use, and skills levels.

Miura (1987) suggested that self-efficacy may be an important factor related to the acquisition of computing skills. Computer self-efficacy is a specific type of self-efficacy. Specific self-efficacy is defined as belief in one’s ability to “mobilize the motivation, cognitive resources, and courses of action needed to meet given situational demands” (Wood and Bandura, 1989, p. 408). Thus, computer self-efficacy is a belief of one’s capability to use the computer (Compeau and Higgins, 1995). Brosnan (1998) argued that better computer self-efficacy could...
increase persistence in studying computing. Computer self-efficacy was also found to be associated with attitudes toward computer technologies (Zhang and Espinoza, 1998).

Computer anxiety has been defined as a fear of computers when using one, or fearing the possibility of using a computer (Chua et al., 1999). It is different from negative attitudes toward computers that entail beliefs and feelings about computers rather than one’s emotional reaction towards using computers (Heinssen et al., 1987). Computer anxiety is characterized as an affective response, an emotional fear of potential negative outcomes such as damaging the equipment. A high level of computer anxiety, on the other hand, has been negatively related to learning computer skills (Harrington et al., 1990), resistance to the use of computers (Torkzadeh and Angula, 1992; Weil and Rosen, 1995), and poorer task performance (Heinssen et al., 1987).

METHOD

The present study was conducted through survey research design to investigate school students’ computer anxiety, computer self-efficacy, and attitudes toward computers. The study also examined differences in computer anxiety, computer self-efficacy, attitudes toward computers with different demographic variables of school students. The subjects for this study were 198 school students studying in eleventh grade in different government and private schools of Patiala district of Punjab. The mean age of the subjects was 18.6 years old with standard deviation of 5.04. The sample was of students was selected following stratified random sampling technique giving due representation to gender, location and stream of study.

Research Tools

1. **Background Information Sheet**: This sheet was used to collect information about school students’ demographic characteristics such as age, gender, stream of study and residential background.

2. **Computer Anxiety Rating Scale**: Computer Anxiety Rating Scales (CARS) by Heinssen et al. (1987) was used to assess the subjects’ level of computer anxiety. This scale is a 19 items self-report inventory. The subjects responded on a five-point Likert type scale (1=strongly disagree, 2=disagree, 3=undecided, 4=agree, and 5=strongly agree). The total scores ranged from 19, indicating a low level of computer anxiety, to 95 indicating a high degree of computer anxiety.

3. **Computer Attitude Scale (CAS)**: Computer Attitude Scale developed and validated by Nickell and Pinto (1986) was used to measure the attitude of students towards use of computers. This scale is a 20-item self-report inventory, rated on a five point Likert type scale (1=strongly disagree, 2=disagree, 3=undecided, 4=agree, and 5=strongly agree). The total scores on CAS ranged from 20, indicating an extremely negative attitude toward the computer to a score of 100, which would imply an extremely positive attitude toward the computer.

4. **Computer Self-efficacy Scale (CSE)**: Computer self-efficacy Scale by Torkzadeh and Koufteros (1994) was used to assess the computer self-efficacy of school students. This scale has 29 items, each item preceded by the phrase “I feel confident”. The subjects responded to a five-point Likert type scale (1=strongly disagree, 2=disagree, 3=undecided, 4=agree, and 5=strongly agree). The total scores for CSE ranged from 29 to 145, with high scores indicating a high degree of confidence in a subject’s ability to use computer.
RESULTS DISCUSSION

Raubs (1981) early study reported that older people were more anxious than younger people. Other research indicates that the over fifties are less anxious than the under thirties, suggesting that far from reducing anxiety, computer experience can increase anxiety levels (Brosnan pg. 11). However, Anderson (1981), Elder et al. (1987) and Igbaria and Parasuraman (1989) have all found that age has a positive effect upon computer anxiety. As the diffusion of technology throughout many aspects of life has exposed virtually everyone to computerization, the relationship between anxiety, age and experience has become less clear. The only clear relationship between age and computer anxiety would therefore appear to be with respect to ones age when first interacting with a computer.

I found a very interesting study, which shows the difference of psychological impact between male and female. Just as technophobia has been reported as affecting more females than males, computer addiction has been found to be almost exclusively a male phenomenon (Shotton, 1989). Brosnan (1995) identified that in a student population, male students first interaction with computers occurred significantly earlier than female students first interaction with computers. This is significant as Todman and Monaghan (1994) report that early use of computers is associated with more favourable quality of initial experience, which leads to lower anxiety and greater readiness to use computers.

A large number of studies found that females report higher levels of computer anxiety than males (it is maybe not true because of my English teacher!). A smaller number of studies report no sex differences in computer anxiety. For example, Anderson (1981) found that males and females did not differ in their levels of anxiety, either before or after a computer literacy course. Temple and Lips (1989) found male students to have taken more computer science course and to be more likely to want to choose it as their major than female students. In conclusion, the findings regarding gender differences in technophobia have not been consistent.

REFERENCES


MARKETING OF REFRACTORY PRODUCTS: A STUDY IN THE REFRACTORY INDUSTRIES IN ORISSA (INDIA)

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Introduction

India’s diverse economy encompasses traditional village farming, modern agriculture, handicrafts, a wide range of modern industries, and a multitude of services. Table 1 illustrates India’s GDP growth rate from 2006-2008.

<table>
<thead>
<tr>
<th>Year</th>
<th>GDP Growth (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>8.5</td>
</tr>
<tr>
<td>2007</td>
<td>9.0</td>
</tr>
<tr>
<td>2008</td>
<td>7.3</td>
</tr>
</tbody>
</table>

Sources: 2009 CIA WORLD FACTBOOK

Three main sectors which contributed to the Indian economy in 2008 are agriculture, industrial and service account 18%, 29% and 54% of the GDP. Industrial sector has lot more contribution to the India’s Economic. Industrial goods are defined as companies which buy products and services to help them produce other goods and services. Industrial goods deal with: accessory equipments (eg. hand tools, lift trucks), business service (eg. banking and maintenance), installations (eg. furnaces, refractory) ,parts ,raw materials, semi manufactured goods and supplies (maintenance, repair and operating supplies). As such steel plants, cement rotary kilns or a glass melting furnaces used in producing finished goods cannot be produced without the application of Refractory products. So installations takes place with furnaces which are built with metallic and non metallic parts with the application of heat resisting non metallic materials which are called "Refractories".

Even though, the contribution of Refractory industry in India is 4% of the Global Market, the Refractory industries have been in good progress for exporting its products eg. export has increased from Rs. 314 Crores in 2006-2007 to about Rs. 452 Crores in 2007-2008. Table 2 illustrates the share of Refractory Industries of different regions in the world market.

<table>
<thead>
<tr>
<th>Region</th>
<th>Market Share(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asia/Pacific</td>
<td>40</td>
</tr>
<tr>
<td>Eastern Europe</td>
<td>23</td>
</tr>
<tr>
<td>Latin America</td>
<td>4</td>
</tr>
<tr>
<td>NAFTA(USA, Canada and Mexico)</td>
<td>14</td>
</tr>
<tr>
<td>Western Europe</td>
<td>15</td>
</tr>
<tr>
<td>Others (Africa and middle east)</td>
<td>4</td>
</tr>
</tbody>
</table>

Sources: Iron & steel review, 2009, Published by ISR Infomedia, monthly, pp-8-9.
Research Gap and Research Problem:
The study of the research work will be limited to the refractory industries located in Orissa only.
1. The scope of the research work will mainly be limited to the Marketing aspects of refractory industries in Orissa.
2. Because of the cost constraint the size of the sample has been limited to 64 nos from personnel category, 32 nos from customers category and 32 nos from agents through non-probability sampling method.

Objectives of the study:
I. What will be conceptual study of refractory market in the world, India as well as Orissa?
II. What are the picture of the Indian Refractory producers with respect to share of export and revenue earned?
III. What will be the problems faced by the Small Scale refractory producers in catering to the domestic as well as export demand?
IV. Comparison the position of refractory market in Orissa with that of India?
V. What type of customers, domestic as well as international purchasing the finished goods from the refractory Industries located in Orissa?
VI. What are the different products and marketing strategies adopted by the refractory industries of Orissa?
VII. What are the majors for the growth and development of refractory industries in India in general and Refractory Industries situated in Orissa in particular?

Research methodology:
The design of the present research work entitled “Marketing of Refractory in Orissa- A Study” has been a descriptive one. Data has been collected from both primary and secondary sources. Books, Journals, Magazines, Newspapers, Booklets and Websites etc have been referred for collecting data from secondary sources. Primary data will be collected through the help of structured questionnaires and personal interview. Through non random sampling method, primary data used to collected from the personnel working in different refractories in Orissa (India). Care has also be taken to take the feedback from the customers (domestic and export) and agents of the different refractory industries in Orissa (India).

Data analysis and results:
This section provides a discussion of the findings of the study. At first, the characteristics of the sample are described. It is followed by a reliability test. Then the underlying dimensions of standardization and its prevalence is discussed. The relationship between standardization and firm performance is elaborated at the end.

Sample Characteristics: A total of 64 respondents constituted the sample of the study. The respondents were mostly top executives of the Refractory Companies. About two-fifths of the sample held a vice president or above rank in the organization and one-third held a Director or similar position in the organization. A majority of the companies (53%) were marketing industrial products. Companies selling raw materials and services were 25% and 22% of the sample respectively. Only 28% of the companies had international sales accounting for 50% or above of the total sales. About 72% of the companies marketed in the developed region (mostly Europe). About 80% of the products/services were at the introduction-growth stage and nearly 77% of them were either market leaders or held above average market share.
Reliability:
In order to determine the reliability of the responses, the sample was divided into two equal
groups of 32. A split half t-test was conducted on eleven standardization variables and two
performance variables. None of the 13 variables were significant indicating that there is no bias
in item responses. (see Table 2.)

<table>
<thead>
<tr>
<th>Description</th>
<th>t-score</th>
<th>Probability of t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elements of standardization</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brand name</td>
<td>-0.66</td>
<td>0.51</td>
</tr>
<tr>
<td>Product Characteristics</td>
<td>-0.01</td>
<td>0.99</td>
</tr>
<tr>
<td>Packaging and design</td>
<td>0.24</td>
<td>0.81</td>
</tr>
<tr>
<td>Product positioning</td>
<td>-0.29</td>
<td>0.85</td>
</tr>
<tr>
<td>Pricing</td>
<td>-0.29</td>
<td>0.77</td>
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<tr>
<td>Advertising theme</td>
<td>0.73</td>
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</tr>
<tr>
<td>Advertising copy and layout</td>
<td>0.76</td>
<td>0.45</td>
</tr>
<tr>
<td>Media allocation</td>
<td>0.80</td>
<td>0.43</td>
</tr>
<tr>
<td>Sales promotion</td>
<td>-0.17</td>
<td>0.87</td>
</tr>
<tr>
<td>Distribution</td>
<td>-0.11</td>
<td>0.91</td>
</tr>
<tr>
<td>Public relations</td>
<td>0.06</td>
<td>0.95</td>
</tr>
<tr>
<td>Performance Criteria</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Return on sales</td>
<td>0.07</td>
<td>0.95</td>
</tr>
<tr>
<td>Sales growth</td>
<td>-0.83</td>
<td>0.41</td>
</tr>
</tbody>
</table>

Underlying Dimensions:
As mentioned, there were eleven elements of standardization that were used by respondents as
part of their marketing strategy. A factor analysis was conducted with the help of SAS to
determine if there were any underlying factors or dimensions of standardization. The factors so
obtained would be useful in understanding the relationship between marketing and performance
variables. Using eigenvalue greater than one criterion, three factors were retained. The graphical
screeplot also supported the retention of the three factors. These three factors accounted for 70% of the variability.

The factor pattern and loadings (see table 3) show that the promotion related variables mostly
loaded heavily on Factor 1. The variables that loaded heavily on Factor 1 were advertising
theme, advertising theme and layout, media allocation, sales promotion and public relations.
Product packaging and design also had a heavier weight on this factor, reflecting the influence of
packaging in promotion. This factor accounted for 37% of the variance. In Factor 2, the
variables/element that had heavier loadings were brand name, product characteristics and product
positioning. Since all these are product related variables this factor can be named 19% of the variance. In Factor 3, distribution was the lone variable that had heavy loading and its was
named Distribution Dimension of standardization. Distribution dimension explained 12% of the variance. Interestingly, factor analysis pointed out the conceptual elaboration (almost
paradigmatic) of the 4P’s in marketing. Pricing, through another “P” of marketing, did not show
any significant correlation with the factors. Through difficult to generalize, a similar finding with
factors analysis was observed in a study conducted by Akaah (1989)

<table>
<thead>
<tr>
<th>Elements of Factor 1-Promotion</th>
<th>Factor 2-Product</th>
<th>Factor 3-Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standardization</td>
<td>Mean</td>
<td>Standard Deviation</td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>-------</td>
<td>--------------------</td>
</tr>
<tr>
<td>Brand name</td>
<td>0.25904</td>
<td>0.66012</td>
</tr>
<tr>
<td>Product Characteristics</td>
<td>0.46196</td>
<td>0.67314</td>
</tr>
<tr>
<td>Packaging and Design</td>
<td>0.86014</td>
<td>0.13818</td>
</tr>
<tr>
<td>Product positioning</td>
<td>0.25945</td>
<td>0.72456</td>
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<tr>
<td>Pricing</td>
<td>0.58121</td>
<td>0.27140</td>
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<td>Advertising theme</td>
<td>0.83288</td>
<td>0.07713</td>
</tr>
<tr>
<td>Advertising copy and layout</td>
<td>0.86570</td>
<td>-0.27038</td>
</tr>
<tr>
<td>Media allocation</td>
<td>0.77457</td>
<td>-0.53412</td>
</tr>
<tr>
<td>Sales promotion</td>
<td>0.66342</td>
<td>-0.01653</td>
</tr>
<tr>
<td>Distribution</td>
<td>-0.12808</td>
<td>0.00564</td>
</tr>
<tr>
<td>Public relations</td>
<td>0.67555</td>
<td>-0.52002</td>
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<tr>
<td>Eigen value</td>
<td>0.3814</td>
<td>0.1417</td>
</tr>
<tr>
<td>Variance explained(%)</td>
<td>0.83</td>
<td>0.47</td>
</tr>
</tbody>
</table>

**Prevalence and Relationship**

The degree and prevalence of standardization varied across different elements. The means and standard deviations show that (see table 4) companies tended to opt more for product standardization. Brand name, product characteristics and product positioning rated very high on prevalence (see the means). The results are in line with the findings of previous studies in the area (e.g., Keegan 1969; Boddewyn et al. 1986; Delene et al. 1997; Hill and Still 1984; Sorenson and Wiechmann 1975; Quelch and Hoff 1986; and Quelch 1999). The next high ratings were received by the elements that represented distribution and pricing. Relatively speaking, promotion related elements received low mean scores in terms of standardization. The next high ratings were received by the elements that represented distribution and pricing. Relatively speaking, promotion related elements received low mean scores in terms of standardization. The high mean scores of product standardization and moderate mean score of distribution (as revealed later) had a bearing on the factor loadings and the relationship of the factors with marketing and performance variables. Perhaps the Refractory Companies rely more on product standardization than promotion in international marketing.

The relationship between the elements of standardization and the marketing variables revealed an interesting pattern. General linear models were used in SAS with both the factors and the elements of standardization. At the dimension /factor level, of the three models, the product and distribution models were valid at the global level (i.e., their F-Factors were significant). The R-squares show that the predictor variables explained 32% of variance in product model and 40% of variance in distribution model. Significant relationship between promotion and other marketing variables could not be observed. Among the predictor variables, regions, market share and type of product were significant in both product and distribution (two valid ones) models. Regional variation was discussed in Cavusgil et al. (1993), Jain (1989), Rau and Preble (1987), Onkvisit and Shaw (1987). The influence of the type of product was established in earlier studies (e.g., Boddewyn et al. 1986 and 1995; Douglas and Urban 1977; Hovell and Walters 1972; Jain 1989; Levitt 1988; Sandler and Shani 1992).
The model between each element of standardization and the marketing variables as given in Table 4, basically confirm the findings of the dimension/factor models of standardization. The regression models with the product related elements of standardization (i.e., brand name, product characteristics, product positioning) offered valid relationship (see the F-ratios). Among the elements of promotion, advertising theme and sales promotion model were significant. The model relationship between distribution and elements of marketing variables was also significant. Relatively speaking, the R-squares of all the models were quite low, indicating that marketing variables explain only a small portion of the variance in standardization. Although difficult to compare and generalize (because of the nature of studies and the characteristics of the samples), the findings of this study were broadly in line with previous empirical efforts in the area (e.g., Akaah 1991; Boddewyn et al. 1986 and 1995; Grosse and Zinn 1991; Samiee and Roth 1992; Sandler and Shani 1992; Sorenson and Wiechmann 1975).

**Relationship with Performance:**

In order to determine the effort of standardization on performance, the dimensions or factors derived previously were regressed with two measures of performance – after tax return on sales and sales growth. The five marketing variables were also used as predictors along with the factors (or dimensions) of standardization. The results of the GLM regression are given in Table 5. Both performance models were found to be valid (see the F-ratios). In the return on sales model, the predictors explained 53% of the variance. Standardization of product and distribution and region were found to be significant in explaining the sales growth of the companies. Evidently, both GLM regressions lead us to believe that, by and large, standardization positively contribute to firm performance. Firms thus can take advantage of standardization for competitive gains in International markets. Szymanski et al. (1993) made similar observations in their research.

<table>
<thead>
<tr>
<th>Criterion Variable</th>
<th>Mean</th>
<th>Std. Dev</th>
<th>Model F-ratio</th>
<th>R-square</th>
<th>Region</th>
<th>PLC</th>
<th>MKTSHARE</th>
<th>INTSAL</th>
<th>ES</th>
<th>Product Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factors</td>
<td>-</td>
<td>-</td>
<td>.31**</td>
<td>.12</td>
<td>.50</td>
<td>.27**</td>
<td>.02</td>
<td>.97</td>
<td>.70</td>
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<tr>
<td>Factor 1 (promotion)</td>
<td>-</td>
<td>-</td>
<td>.50**</td>
<td>.32</td>
<td>.56**</td>
<td>.18</td>
<td>.01</td>
<td>.93**</td>
<td>.31**</td>
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<tr>
<td>Factor 2 (Product)</td>
<td>-</td>
<td>-</td>
<td>.35**</td>
<td>.40</td>
<td>.58**</td>
<td>.87**</td>
<td>.71**</td>
<td>.76**</td>
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<tr>
<td>Factor 3 (Distribution)</td>
<td>-</td>
<td>-</td>
<td>.35**</td>
<td>.40</td>
<td>.58**</td>
<td>.87**</td>
<td>.71**</td>
<td>.76**</td>
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<tr>
<td>Element of standardization</td>
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<td>.03</td>
<td>.24**</td>
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<tr>
<td>Brand name</td>
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<td>.86</td>
<td>.29**</td>
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<td>.33**</td>
<td>.84</td>
<td>.28**</td>
<td>.00**</td>
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<td>Product characteristics</td>
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<td>.15</td>
<td>.59**</td>
<td>.21</td>
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<td>.72**</td>
<td>.75</td>
<td>.47**</td>
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<tr>
<td>Predictor Variables</td>
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<td>Sales growth</td>
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<td></td>
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<td>--------------------------------------------</td>
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<td>Model F-ratio</td>
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<td>.29**</td>
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<tr>
<td>R-square</td>
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<td>.55</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Factor 1(Promotion)</td>
<td>1.81</td>
<td>.36**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Factor 2(Product)</td>
<td>7.07**</td>
<td>.32**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Factor 3(Distribution)</td>
<td>8.35**</td>
<td>.16</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Regional Difference(Region)</td>
<td>10.18**</td>
<td>.47**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product life cycle(PLC)</td>
<td>0.37</td>
<td>.42</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Market share/leadership(MKTSHR)</td>
<td>0.09</td>
<td>.16**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internationalization(INTSALES)</td>
<td>0.37</td>
<td>.07</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product Category</td>
<td>1.79</td>
<td>.59*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: ** Significant at p=0.05 level . *-=significant at p=0.10 level

**Implications of the Study:**
The recent changing scenario has given a new Globally Competitive looked for the Refractory industries in India. The changes have affected the market by influencing all the industries (Steel, Ceramic, Copper, Zinc, Aluminum, Cement) which use refractories to move from traditional methods to modified materials and practices. In past 5 years we have number of India's Refractory makers in the global market. So to have a comprehensive view of the India's Refractory industries, it is imperative to know the present status against the Global trends. This
study would be directed at decision-makers in the Refractory Industries, as well as all other associated industries, which includes: Raw material suppliers, Refractory manufacturers, Refractory sales and marketing personnel, Refractory users, Furnace and heat containment designs, Equipment manufacturers for refractory making application and Merger, acquisition and investment executives.

References:

Books:
- Global marketing strategies by Jean-pierre jeannot and H.david Hennessey PP: 583
- International marketing and purchasing of industrial goods(1982 edition)

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- www.angeltrade.com : accessed 2009
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Journals:
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ON SOME REMARKABLE PRODUCT OF THETA-FUNCTION

M. S. Mahadeva Naika, M. C. Maheshkumar and K. Sushan Bairy
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Abstract
On pages 338 and 339 in his first notebook, Ramanujan records eighteen values for a certain product of theta-function. All these have been proved by B. C. Berndt, H. H. Chan and L-C. Zhang [4]. Recently M. S. Mahadeva Naika and B. N. Dharmendra [7], [8] and Mahadeva Naika and M. C. Maheshkumar [9] have obtained general theorems to establish explicit evaluations of Ramanujan's remarkable product of theta-function. Following Ramanujan we define a new function \( b_{M,N} \) as defined in (6). The main purpose of this paper is to establish some new general theorems for explicit evaluations of product of theta-function.

2 Introduction
In Chapter 16 of his second notebooks [1], [2], [10], Ramanujan develops the theory of theta-function and his theta-function is defined by

\[
\varphi(q) := f(q,q) = \sum_{n=-\infty}^{\infty} q^{n^2} = (-q;q^2)_\infty^2(q^2;q^2)_\infty,
\]

(2)

\[
\psi(q) := f(q,q^3) = \sum_{n=0}^{\infty} q^{n(n+1)/2} = (q^2;q^2)_{\infty}/(q;q^2)_{\infty},
\]

(3)

and

\[
f(-q) := f(-q,-q^2) = \sum_{n=-\infty}^{\infty} (-1)^n q^{n(n+1)/2} = (q;q)_{\infty},
\]

(4)

where

\[
(a;q)_{\infty} = \prod_{n=0}^{\infty} (1-aq^n).
\]

On page 338 in his first notebook [10, p.338], Ramanujan defines

\[
a_{M,N} = Ne^{-\frac{(N+1)\pi}{4}} \sqrt{\frac{M}{N}} \psi^2 \left( e^{-\pi \sqrt{MN}} \right) \varphi^2 \left( -e^{-2\pi \sqrt{MN}} \right).
\]

(5)

He then, on pages 338 and 339, offers a list of eighteen particular values. All these eighteen values have been established by Berndt, Chan and Zhang [4]. Following Ramanujan we define a new function by
Let \( K, K', L \) and \( L' \) denote the complete elliptic integrals of the first kind associated with the moduli \( k, k' := \sqrt{1-k^2}, l \) and \( l' := \sqrt{1-l'^2} \) respectively, where \( 0 < k, l < 1 \). For a fixed positive integer \( N \), suppose that

\[
N \frac{K'}{K} = \frac{L'}{L}. \tag{7}
\]

Then a modular equation of degree \( N \) is a relation between \( k \) and \( l \) induced by (7). Following Ramanujan, set \( \alpha = k^2 \) and \( \beta = l^2 \). Then we say \( \beta \) is of degree \( N \) over \( \alpha \).

Define

\[
g_n = 2^{-\frac{1}{4}} q^{-\frac{1}{24}} \chi(-q),
\]

where

\[
\chi(q) := (-q; q^2)_\infty.
\]

Moreover, if \( q = e^{-\frac{\pi}{\sqrt{N}}} \) and \( \beta \) has degree \( N \) over \( \alpha \), then

\[
g_{\frac{M}{N}} = \left(4\alpha(1-\alpha)^2\right)^{\frac{1}{24}} \text{ and } g_{MN} = \left(4\beta(1-\beta)^2\right)^{\frac{1}{24}}. \tag{8}
\]

The main purpose of this paper is to obtain some new general theorems for the explicit evaluations of remarkable product of theta-function (6) and also several new explicit evaluations there from.

### 3 Main Theorems

In this section, we establish several new general formulas for explicit evaluations of \( b_{M,N} \). In the following Theorem (3.1), the equivalent form of (6) is obtained.

**Theorem 3.1** We have

\[
b_{M,N} = N e^{\frac{N-1}{4}} \sqrt{\frac{M}{N}} \psi^2 \left( e^{-\frac{\pi}{\sqrt{MN}}} \right) \varphi^2 \left( -e^{-\frac{\pi}{\sqrt{MN}}} \right), \tag{9}\]

where \( M \) is any positive rational and \( N \) is a positive integer.

**Proof.** The identity (6) can be rewritten as

\[
b_{M,N} = N q^{\frac{N-1}{4}} \psi^2 \left( q^N \right) \varphi^2 \left( -q^{2N} \right), \quad q = e^{-\frac{\pi}{\sqrt{N}}}. \tag{10}\]

If \( \beta \) is of degree \( N \) over \( \alpha \), then using Entry 10 (iii) and Entry 11 (ii) of Chapter 17 of Ramanujan's notebooks [2, pp.122--123] in (10), we find that...
Using Entry 10 (ii) of Chapter 17 of Ramanujan's notebooks [2, p.122], we have

\[ \frac{\phi^2(-q^N)}{\phi^2(-q)} = \frac{1}{m^\frac{1}{2}} \left( 1 - \beta \right)^{\frac{1}{2}}. \]  \tag{12}

Using Entry 11 (i) of Chapter 17 of Ramanujan's notebooks [2, p.123], we have

\[ \frac{q^{-\frac{N-1}{4}} \psi^2(q^N)}{\psi^2(q)} = \frac{1}{m^\frac{1}{4}} \left( \frac{\beta}{\alpha} \right)^{\frac{1}{4}}. \]  \tag{13}

Using (12) and (13) in (11) with \( q = e^{-\frac{\pi}{\sqrt{MN}}} \), we obtain (9).

**Theorem 3.2** We have

\[ b_{2M,N} b_{\frac{2^2}{M},N} = 1. \]  \tag{14}

\[ b_{2M,1} b_{2M,N} = 1. \]  \tag{15}

\[ b_{M,2N} b_{1\frac{M}{N}} = 1. \]  \tag{16}

**Proof of (14).** Using equation (9), we find that

\[ b_{2M,N} b_{\frac{2^2}{M},N} = N^2 e^{-\frac{(N-1)\pi}{4} \left( \frac{2M}{N} \right) \sqrt{\frac{2}{MN}}} \]  \tag{17}

From Entry 27 (ii) of Chapter 16 of Ramanujan's notebooks [2, p.43], we have

\[ e^{-\frac{\mu}{2}} \psi^2(e^{2\mu}) \overline{\phi^2(-e^{-\nu})} = \frac{1}{4} \sqrt{\frac{\nu}{\mu}} \overline{\mu \nu} = \pi^2. \]  \tag{18}

Putting \( \mu = \pi \sqrt{\frac{M}{2N}} \) and \( \nu = \pi \sqrt{\frac{2N}{M}} \) in (18), we find that
Putting \( \mu = \pi \sqrt{N \over 2M} \) and \( \nu = \pi \sqrt{2M \over N} \) in (18), we deduce that

\[
e^{-\pi \sqrt{2N \over M}} e^{\pi \sqrt{2M \over N}} = 1 \quad {2N \over M}.
\]  

(19)

Putting \( \mu = \pi \sqrt{MN \over 2} \) and \( \nu = \pi \sqrt{2 \over MN} \) in (18), we find that

\[
e^{-\pi \sqrt{2 \over MN}} e^{\pi \sqrt{2MN \over 2}} = 1 \quad {2 \over MN}.
\]  

(20)

Putting \( \mu = \pi \sqrt{1 \over 2MN} \) and \( \nu = \pi \sqrt{2MN} \) in (18), we deduce that

\[
e^{-\pi \sqrt{2 \over MN}} e^{\pi \sqrt{2MN \over 2}} = 1 \quad {2 \over MN}.
\]  

(21)

Using (19), (20), (21) and (22) in (17), we obtain the required result (14).

Proofs of (15) and (16) are similar to the proof of (14). So we omit the proof.

**Corollary 3.1** We have

\[ b_{2,n} = 1. \]

(23)

**Proof.** Putting \( M = 1 \) in (14), we obtain the result (23).

**Theorem 3.3** We have

\[ b_{2M,N} = b_{2N,M} = b_2 = 1. \]

(24)

**Proof.** Replacing \( M \) by \( 2M \) in (9), we deduce that

\[
b_{2M,N} = Ne^{-\pi \sqrt{2MN \over 2N}} e^{\pi \sqrt{2MN \over 2N}} \phi^{2}\left(-e^{-\pi \sqrt{2MN \over 2N}}\right).
\]  

(25)
Putting $\mu = \pi \sqrt{\frac{M}{2N}}$ and $v = \pi \sqrt{\frac{2N}{M}}$ in (18), we find that
\[
\psi^2 \left( e^{-\pi \sqrt{\frac{2M}{N}}} \right) = \frac{1}{4} \sqrt{\frac{2N}{M}} e^{\frac{\pi}{2} \sqrt{\frac{M}{2N}}} \phi^2 \left( -e^{-\pi \sqrt{\frac{2N}{M}}} \right).
\] (26)

Putting $\mu = \pi \sqrt{\frac{N}{2M}}$ and $v = \pi \sqrt{\frac{2M}{N}}$ in (18), we deduce that
\[
\phi^2 \left( -e^{-\pi \sqrt{\frac{3M}{N}}} \right) = 4 \sqrt{\frac{N}{2M}} e^{\frac{\pi}{2} \sqrt{\frac{M}{2N}}} \psi^2 \left( e^{-\pi \sqrt{\frac{N}{2M}}} \right).
\] (27)

Using (26) and (27) in (25), we obtain the first equality of (24). The proofs of the other equalities are similar to the first equality. So we omit the details.

**Theorem 3.4** We have
\[
b_{M,2N} = b_{2N,M} b_{\frac{2N}{M}}.
\] (28)

**Proof.** Replacing $N$ by $2N$ in (9), we obtain
\[
b_{M,2N} = 2Ne^{-\frac{(2N-1)\pi}{4} \sqrt{\frac{M}{2N}}} \psi^2 \left( e^{-\pi \sqrt{\frac{2MN}{N}}} \right) \phi^2 \left( -e^{-\pi \sqrt{\frac{2MN}{N}}} \right).
\] (29)

Replacing $M$ by $2N$ and $N$ by $M$ in (9), we deduce that
\[
b_{2N,M} = Me^{-\frac{(M-1)\pi}{4} \sqrt{\frac{2N}{M}}} \psi^2 \left( e^{-\pi \sqrt{\frac{2MN}{N}}} \right) \phi^2 \left( -e^{-\pi \sqrt{\frac{2MN}{N}}} \right).
\] (30)

Using (29), (30) and (9), we obtain the required result.

**Theorem 3.5** We have
\[
\frac{1}{b_{M,3}} + b_{M,3} = \frac{1}{3} \left( \frac{g_{5M}^6}{g_{M}^6} + \frac{g_{M}^6}{g_{3M}^6} \right).
\] (31)

**Proof.** If $\beta$ is of degree 3 over $\alpha$, then using Entry 5 (vii) of Chapter 19 of Ramanujan's notebooks [2, p.230], we find that
\[
m^2 \left( \frac{\alpha(1-\alpha)^2}{\beta(1-\beta)} \right)^{\frac{1}{4}} + \frac{9}{m^2} \left( \frac{\alpha(1-\alpha)^2}{\beta(1-\beta)} \right)^{\frac{1}{4}} = \left( \frac{\beta(1-\alpha)^2}{\alpha(1-\beta)^2} \right)^{\frac{1}{4}} + \left( \frac{\beta(1-\alpha)^2}{\alpha(1-\beta)^2} \right)^{\frac{1}{4}}.
\] (32)

Using (8) and (11) with $N = 3$ in the above identity (32), we obtain (31).

**Corollary 3.2** We have
\[
b_{6,3} = \frac{1}{3}.
\] (33)
Proof. From the table in Chapter 34 of Ramanujan's notebooks [3, p.200], we have
\[ g_{18} = \left(\sqrt{3} + \sqrt{2}\right)^{\frac{1}{3}} \]  
(34)

and
\[ g_6 = g_2 = 1. \]  
(35)

Using (34) and (35) in (31) with \( M = 6 \), we obtain (33).

**Theorem 3.6** We have
\[ \frac{1}{\sqrt{b_{M,5}}} + \sqrt{b_{M,5}} = \frac{1}{\sqrt{5}} \left( \frac{g_{5M}^{3} g_{S_{5}}^{3}}{g_{S_{5}}^{3}} \right). \]  
(36)

Proof. If \( \beta \) is of degree 5 over \( \alpha \), then using Entry 13 (xii) of Chapter 19 of Ramanujan's notebooks [2, p.281], we find that
\[ m \left( \frac{(\alpha(1-\alpha^2)}{\beta(1-\beta^2)} \right)^{\frac{1}{8}} + \frac{5}{m} \left( \frac{(\alpha(1-\alpha^2)}{\beta(1-\beta^2)} \right)^{\frac{1}{8}} = \left( \frac{(\beta(1-\alpha^2)}{\alpha(1-\beta^2)} \right)^{\frac{1}{8}} \]  
(37)

Using (8) and (11) with \( N = 5 \) in the above identity (37), we obtain (36).

**Theorem 3.7** We have
\[ \frac{1}{\sqrt{b_{M,7}}} + \sqrt{b_{M,7}} = \frac{1}{7} \left( \frac{g_{7M}^{6}}{g_{M}^{6}} + \frac{g_{S_{7M}}^{6}}{g_{S_{7M}}^{6}} - 8 \left( \frac{g_{M}^{2}}{g_{S_{7M}}^{2}} + \frac{g_{M}^{2}}{g_{S_{7M}}^{2}} \right) \right). \]  
(38)

Proof. If \( \beta \) is of degree 7 over \( \alpha \), then using Entry 19 (v) of Chapter 19 of Ramanujan's notebooks [2, p.314], we find that
\[ m^2 \left( \frac{(\alpha(1-\alpha^2)}{\beta(1-\beta^2)} \right)^{\frac{1}{4}} + \frac{49}{m^2} \left( \frac{(\alpha(1-\alpha^2)}{\beta(1-\beta^2)} \right)^{\frac{1}{4}} = \left( \frac{(\beta(1-\alpha^2)}{\alpha(1-\beta^2)} \right)^{\frac{1}{4}} \]  
(39)

Using (8) and (11) with \( N = 7 \) in the above identity (39), we obtain (38).

**Theorem 3.8** We have
\[ \frac{1}{\sqrt{b_{M,9}}} + \sqrt{b_{M,9}} = \frac{1}{3} \left( \frac{g_{9M}^{3}}{g_{S_{9M}}^{3}} + \frac{g_{M}^{3}}{g_{S_{9M}}^{3}} - 4 \right). \]  
(40)

Proof. If \( \gamma \) is of degree 9 over \( \alpha \), then using Entries 3 (x), (xi) of Chapter 20 of Ramanujan's notebooks [2, p.352], we find that
\[
\sqrt{\frac{\alpha(1-\alpha)^2}{\gamma(1-\gamma)^2}} \left( \frac{1}{16} \right) + \frac{3}{\sqrt{\gamma \gamma \gamma \gamma}} \left( \frac{\alpha(1-\alpha)^2}{\gamma(1-\gamma)^2} \right) \left( \frac{1}{16} \right)
\]

\[
= \left( \frac{\gamma(1-\alpha)^2}{\alpha(1-\gamma)^2} \right) \left( \frac{1}{16} \right) + \left( \frac{\gamma(1-\alpha)^2}{\alpha(1-\gamma)^2} \right) \left( \frac{1}{16} \right).
\]

Using (8) and (11) with \( N = 9 \) in the above identity (41), we obtain (40).

**Theorem 3.9** We have

\[
\frac{1}{\sqrt{\mathbf{b}_{M,13}}} + \sqrt{\mathbf{b}_{M,13}} = \frac{1}{\sqrt{13}} \left( \frac{g_{13M}}{1} + \frac{g_{M}}{13} \right) - 14 \left( \frac{g_{13M}}{13} + \frac{g_{M}}{13} \right).
\]

**Proof.** If \( \beta \) is of degree 13 over \( \alpha \), then using Entries 8 (iii), (iv) of Chapter 20 of Ramanujan's Notebooks [2, p.376], we find that

\[
m \left( \frac{\alpha(1-\alpha)^2}{\beta(1-\beta)^2} \right) \left( \frac{1}{8} \right) + 13 \left( \frac{\alpha(1-\alpha)^2}{\beta(1-\beta)^2} \right) \left( \frac{1}{8} \right) = \left( \frac{\beta(1-\alpha)^2}{\alpha(1-\beta)^2} \right) \left( \frac{1}{8} \right) + \left( \frac{\beta(1-\alpha)^2}{\alpha(1-\beta)^2} \right) \left( \frac{1}{8} \right)
\]

\[
- 4 \left[ \left( \frac{\beta(1-\alpha)^2}{\alpha(1-\beta)^2} \right) \left( \frac{1}{23} \right) + \left( \frac{\beta(1-\alpha)^2}{\alpha(1-\beta)^2} \right) \left( \frac{1}{24} \right) \right].
\]

Using (8) and (11) with \( N = 13 \) in the above identity (43), we obtain (42).

**Theorem 3.10** We have

\[
\frac{1}{\sqrt{\mathbf{b}_{M,25}}} + \sqrt{\mathbf{b}_{M,25}}
\]

\[
= \frac{1}{5} \left[ \left( \frac{g_{25M}}{g_{M \cdot 25}} + \frac{g_{M}}{g_{25M}} \right)^{3} - 4 \left( \frac{g_{25M}}{g_{M \cdot 25}} + \frac{g_{M}}{g_{25M}} \right)^{2} - \left( \frac{g_{25M}}{g_{M \cdot 25}} + \frac{g_{M}}{g_{25M}} \right) + 8 \right].
\]

**Proof.** If \( \gamma \) is of degree 25 over \( \alpha \), then using Entries 15 (i), (ii) of Chapter 19 of Ramanujan's notebooks [2, p.291], we find that

\[
\sqrt{\gamma \gamma \gamma \gamma} \left( \frac{\alpha(1-\alpha)^2}{\gamma(1-\gamma)^2} \right) \left( \frac{1}{16} \right) + \frac{5}{\sqrt{\gamma \gamma \gamma \gamma}} \left( \frac{\alpha(1-\alpha)^2}{\gamma(1-\gamma)^2} \right) \left( \frac{1}{16} \right) = \left( \frac{\gamma(1-\alpha)^2}{\alpha(1-\gamma)^2} \right) \left( \frac{1}{16} \right)
\]

\[
+ \left( \frac{\gamma(1-\alpha)^2}{\alpha(1-\gamma)^2} \right) \left( \frac{1}{16} \right) - 2 \left[ \left( \frac{\gamma(1-\alpha)^2}{\alpha(1-\gamma)^2} \right) \left( \frac{1}{48} \right) + \left( \frac{\gamma(1-\alpha)^2}{\alpha(1-\gamma)^2} \right) \left( \frac{1}{48} \right) \right].
\]
Using (8) and (11) with $N = 25$ in the above identity (45), we obtain (44).

4 $b_{M,N}$ And Mixed Modular Equations

We shall employ certain type of mixed modular equations to establish several values of $b_{M,N}$.

**Theorem 4.1** We have

\[
\frac{1}{\sqrt{A_M}} + \sqrt{A_M} = \frac{1}{3}\left[\left(V_M + V_M^{-1}\right)^3 - 7\left(V_M + V_M^{-1}\right)\right],
\]

(46)

where

\[
A_M = b_{M,3}b_{25M,3} \text{ and } V_M = \frac{g_M g_{25M}}{3 g_{5M} g_{75M}}.
\]

**Proof.** If $\beta$, $\gamma$ and $\delta$ are of third, fifth and fifteenths degree over $\alpha$ respectively, then using Entries 11 (x) and (xi) of Chapter 20 of Ramanujan's notebooks [2, p.384], we find that

\[
\left(\frac{\alpha \gamma (1 - \alpha)^2 (1 - \gamma)^2}{\beta \delta (1 - \beta)^2 (1 - \delta)^2}\right)^{\frac{1}{8}} + 9 \left(\frac{\alpha \gamma (1 - \alpha)^2 (1 - \gamma)^2}{\beta \delta (1 - \beta)^2 (1 - \delta)^2}\right)^{\frac{1}{8}}
\]

\[
= \left(\frac{\beta \delta (1 - \alpha)^2 (1 - \gamma)^2}{\alpha \gamma (1 - \beta)^2 (1 - \delta)^2}\right)^{\frac{1}{8}} + \left(\frac{\beta \delta (1 - \alpha)^2 (1 - \gamma)^2}{\alpha \gamma (1 - \beta)^2 (1 - \delta)^2}\right)^{\frac{1}{8}}
\]

\[-4 \left(\frac{\beta \delta (1 - \alpha)^2 (1 - \gamma)^2}{\alpha \gamma (1 - \beta)^2 (1 - \delta)^2}\right)^{\frac{1}{24}} - 4 \left(\frac{\beta \delta (1 - \alpha)^2 (1 - \gamma)^2}{\alpha \gamma (1 - \beta)^2 (1 - \delta)^2}\right)^{\frac{1}{24}}.
\]

Using (8) and (11) with $N = 3$ in the above identity (47), we obtain (46).

**Theorem 4.2** We have

\[
\frac{1}{\sqrt{A_M}} + \sqrt{A_M} = V_M^3 + V_M^{-3} + 4,
\]

(48)

where

\[
A_M = b_{25M,3} b_{M,3} \text{ and } V_M = \frac{g_M g_{25M}}{3 g_{5M} g_{75M}}.
\]

**Proof.** If $\beta$, $\gamma$ and $\delta$ are of third, fifth and fifteenths degree over $\alpha$ respectively, then by using Entries 11 (viii) and (ix) of Chapter 20 of Ramanujan's notebooks [2, p.384], we find that

\[
\left(\frac{\beta \gamma (1 - \beta)^2 (1 - \gamma)^2}{\alpha \delta (1 - \alpha)^2 (1 - \delta)^2}\right)^{\frac{1}{16}} - \left(\frac{\beta \gamma (1 - \beta)^2 (1 - \gamma)^2}{\alpha \delta (1 - \alpha)^2 (1 - \delta)^2}\right)^{\frac{1}{16}}
\]

\[
= \left(\frac{\beta \gamma (1 - \beta)^2 (1 - \gamma)^2}{\alpha \delta (1 - \alpha)^2 (1 - \delta)^2}\right)^{\frac{1}{16}} - \left(\frac{\beta \gamma (1 - \beta)^2 (1 - \gamma)^2}{\alpha \delta (1 - \alpha)^2 (1 - \delta)^2}\right)^{\frac{1}{16}}.
\]

(49)
\[
\frac{1}{\sqrt{A_M}} + \sqrt{A_M} = V_M^3 + V_M^{-3} + 4,
\]

where
\[
A_M = \frac{b_{9M,5}}{b_{M,5}} \text{ and } V_M = \frac{g_M g_{45M}}{g_{5M} g_{9M}}.
\]

**Proof.** Using (8) and (11) with \( N = 3 \) in the above identity (49), we obtain (48).

**Theorem 4.3** We have
\[
\frac{1}{\sqrt{A_M}} + \sqrt{A_M} = V_M^3 + V_M^{-3} + 4,
\]

where
\[
A_M = \frac{b_{9M,5}}{b_{M,5}} \text{ and } V_M = \frac{g_M g_{45M}}{g_{5M} g_{9M}}.
\]

**Proof.** Using (8) and (11) with \( N = 5 \) in the above identity (49), we obtain (50).

**Theorem 4.4** We have
\[
\frac{1}{\sqrt{A_M}} + \sqrt{A_M} = \left( V_M + V_M^{-1} \right)^3 + \left( V_M + V_M^{-1} \right),
\]

where
\[
A_M = \frac{b_{49M,3}}{b_{M,3}} \text{ and } V_M = \frac{g_M g_{147M}}{g_{3M} g_{49M}}.
\]

**Proof.** If \( \beta, \gamma \) and \( \delta \) are of third, seventh and twenty-first degree over \( \alpha \) respectively, then by using Entries 13 (i) and (ii) of Chapter 20 of Ramanujan’s notebooks [2, p.401], we find that
\[
\frac{m'}{m} \left( \frac{\beta \gamma (1-\beta)^2 (1-\gamma)^2}{\alpha \delta (1-\alpha)^2 (1-\delta)^2} \right)^{1/8} + \frac{m'}{m} \left( \frac{\beta \gamma (1-\beta)^2 (1-\gamma)^2}{\alpha \delta (1-\alpha)^2 (1-\delta)^2} \right)^{1/8}
\]

\[
= \left( \frac{\alpha \delta (1-\beta)^2 (1-\gamma)^2}{\beta \gamma (1-\alpha)^2 (1-\delta)^2} \right)^{1/8} + \left( \frac{\alpha \delta (1-\beta)^2 (1-\gamma)^2}{\beta \gamma (1-\alpha)^2 (1-\delta)^2} \right)^{1/8}
\]

\[
+ 4 \left( \frac{\alpha \delta (1-\beta)^2 (1-\gamma)^2}{\beta \gamma (1-\alpha)^2 (1-\delta)^2} \right)^{1/24} + 4 \left( \frac{\alpha \delta (1-\beta)^2 (1-\gamma)^2}{\beta \gamma (1-\alpha)^2 (1-\delta)^2} \right)^{1/24}.
\]

Using (8) and (11) with \( N = 3 \) in the above identity (52), we obtain (51).

**Theorem 4.5** We have
\[
\frac{1}{\sqrt{A_M}} + \sqrt{A_M} = \left( V_M + V_M^{-1} \right)^3 + \left( V_M + V_M^{-1} \right),
\]

where
\[ A_M = \frac{b_{9M, 7}}{b_{M, 7}} \quad \text{and} \quad V_M = \frac{g_M g_{63M}}{7}. \]

**Proof.** Using (8) and (11) with \( N = 7 \) in the above identity (52), we obtain (53).

**Theorem 4.6** We have
\[ \frac{1}{\sqrt{A_M}} + \sqrt{A_M} = \left( V_M + V_M^{-1} \right)^3 + 4 \left( V_M + V_M^{-1} \right)^2 + 5 \left( V_M + V_M^{-1} \right), \tag{54} \]
where
\[ A_M = \frac{b_{169M, 3}}{b_{M, 3}} \quad \text{and} \quad V_M = \frac{g_M g_{507M}}{3}. \]

**Proof.** If \( \beta, \gamma \) and \( \delta \) are of third, thirteenth and thirty-ninth degree over \( \alpha \) respectively, then by using Entry 19 (iv) of Chapter 20 of Ramanujan's notebooks [2, p.426], we find that
\[ \sqrt{m} \left( \frac{\beta \gamma (1-\beta)^2 (1-\gamma)^2}{\alpha \delta (1-\alpha)^2 (1-\delta)^2} \right)^{\frac{1}{16}} + \sqrt{m} \left( \frac{\beta \gamma (1-\beta)^2 (1-\gamma)^2}{\alpha \delta (1-\alpha)^2 (1-\delta)^2} \right)^{\frac{1}{16}} \]
\[ = \left( \frac{\alpha \delta (1-\beta)^2 (1-\gamma)^2}{\beta \gamma (1-\alpha)^2 (1-\delta)^2} \right)^{\frac{1}{16}} + \left( \frac{\alpha \delta (1-\beta)^2 (1-\gamma)^2}{\beta \gamma (1-\alpha)^2 (1-\delta)^2} \right)^{\frac{1}{16}} \]
\[ + 2 \left( \frac{\alpha \delta (1-\beta)^2 (1-\gamma)^2}{\beta \gamma (1-\alpha)^2 (1-\delta)^2} \right)^{\frac{1}{48}} + 2 \left( \frac{\alpha \delta (1-\beta)^2 (1-\gamma)^2}{\beta \gamma (1-\alpha)^2 (1-\delta)^2} \right)^{\frac{1}{48}}. \]

Using (8) and (11) with \( N = 3 \) in the above identity (55), we obtain (54).

**Theorem 4.7** We have
\[ \frac{1}{\sqrt{A_M}} + \sqrt{A_M} = \left( V_M + V_M^{-1} \right)^3 + 4 \left( V_M + V_M^{-1} \right)^2 + 5 \left( V_M + V_M^{-1} \right), \tag{56} \]
where
\[ A_M = \frac{b_{9M, 13}}{b_{M, 13}} \quad \text{and} \quad V_M = \frac{g_M g_{117M}}{13}. \]

**Proof.** Using (8) and (11) with \( N = 13 \) in the above identity (55), we obtain (56).

**Theorem 4.8** We have
\[ \frac{1}{\sqrt{A_M}} + \sqrt{A_M} = \left( V_M + V_M^{-1} \right)^3 + 4 \left( V_M + V_M^{-1} \right)^2 + 5 \left( V_M + V_M^{-1} \right) + 4, \tag{57} \]
where
Proof. If $\beta$, $\gamma$ and $\delta$ are of fifth, seventh and thirty-fifth degree over $\alpha$ respectively, then by using Entries 18 (vi), (vii) of Chapter 20 of Ramanujan's notebooks [2, p.426], we find that

$$\sqrt{m'} \left( \frac{\beta \gamma (1-\beta)^2 (1-\gamma)^2}{\alpha \delta (1-\alpha)^2 (1-\delta)^2} \right)^{\frac{1}{16}} - \sqrt{m'} \left( \frac{\beta \gamma (1-\beta)^2 (1-\gamma)^2}{\alpha \delta (1-\alpha)^2 (1-\delta)^2} \right)^{\frac{1}{16}}$$

$$= \left( \frac{\alpha \delta (1-\beta)^2 (1-\gamma)^2}{\beta \gamma (1-\alpha)^2 (1-\delta)^2} \right)^{\frac{1}{16}} + \left( \frac{\alpha \delta (1-\beta)^2 (1-\gamma)^2}{\beta \gamma (1-\alpha)^2 (1-\delta)^2} \right)^{\frac{1}{16}}$$

$$+ \left( \alpha \delta (1-\beta)^2 (1-\gamma)^2 \right)^{\frac{1}{48}} + \left( \alpha \delta (1-\beta)^2 (1-\gamma)^2 \right)^{\frac{1}{48}} .$$

Using (8) and (11) with $N = 5$ in the above identity (58), we obtain (57).

Theorem 4.9 We have

$$\frac{1}{\sqrt{A_M}} + \sqrt{A_M} = \left( V_M + V_M^{-1} \right)^3 + 4 \left( V_M + V_M^{-1} \right)^2 + 5 \left( V_M + V_M^{-1} \right) + 4 ,$$

where

$$A_M = \frac{b_{29M,5}}{b_{M,5}} \text{ and } V_M = \frac{g_M g_{245M}}{g_{5M} g_{49M}^5} .$$

Proof. Using (8) and (11) with $N = 7$ in the above identity (58), we obtain (59).

Theorem 4.10 We have

$$\frac{1}{\sqrt{A_M}} + \sqrt{A_M} = \frac{1}{3} \left[ \left( V_M + V_M^{-1} \right)^3 - 4 \left( V_M + V_M^{-1} \right)^2 - 3 \left( V_M + V_M^{-1} \right) + 12 \right] ,$$

where

$$A_M = \frac{b_{25M,7}}{b_{M,7}} \text{ and } V_M = \frac{g_M g_{127M}}{g_{7M} g_{25M}^7} .$$

Proof. If $\beta$, $\gamma$ and $\delta$ are third, eleventh and thirty-third degree over $\alpha$ respectively, then using Entries 14 (i) and (ii) of Chapter 20 of Ramanujan's notebooks [2, p.408], we find that

$$\sqrt{m} \left( \frac{\alpha \gamma (1-\alpha)^2 (1-\gamma)^2}{\beta \delta (1-\beta)^2 (1-\delta)^2} \right)^{\frac{1}{16}} + \frac{3}{\sqrt{m}} \left( \frac{\alpha \gamma (1-\alpha)^2 (1-\gamma)^2}{\beta \delta (1-\beta)^2 (1-\delta)^2} \right)^{\frac{1}{16}} .$$

(61)
\[
\begin{align*}
\beta \gamma (1-\beta \gamma )^2 (1-\gamma )^2 \frac{16}{\alpha \gamma (1-\beta \gamma )^2 (1-\delta )^2} \left( \beta \gamma (1-\beta \gamma )^2 (1-\gamma )^2 \right) \frac{16}{\alpha \gamma (1-\beta \gamma )^2 (1-\delta )^2} \\
-2 \frac{\beta \gamma (1-\beta \gamma )^2 (1-\gamma )^2}{\alpha \gamma (1-\beta \gamma )^2 (1-\delta )^2} \left( \frac{\beta \gamma (1-\beta \gamma )^2 (1-\gamma )^2}{\alpha \gamma (1-\beta \gamma )^2 (1-\delta )^2} \right) \frac{1}{48}.
\end{align*}
\]

Using (8) and (11) with \( N = 3 \) in the above identity (61), we obtain (60).

**Theorem 4.11** We have
\[
\frac{1}{\sqrt{A_M}} + \sqrt{A_M} = V_M^3 + V_M^{-3},
\]
where
\[
A_M = \frac{b_{81M,3}}{b_{M,3}} \text{ and } V_M = \frac{g_M g_{243M}}{3 g_{3M} g_{27M}}.
\]

**Proof.** If \( \beta, \gamma, \) and \( \delta \) are of third, ninth and twenty-seventh degree over \( \alpha \) respectively, then by using Entry 5 (i) of Chapter 20 of Ramanujan's notebooks [2, p.360] and its reciprocal equation, we find that
\[
\begin{align*}
\sqrt{m''} \left( \frac{\beta \gamma (1-\beta \gamma )^2 (1-\gamma )^2}{\alpha \delta (1-\alpha \delta )^2 (1-\delta )^2} \right) \frac{16}{\alpha \delta (1-\alpha \delta )^2 (1-\delta )^2} \\
- \sqrt{m''} \left( \frac{\beta \gamma (1-\beta \gamma )^2 (1-\gamma )^2}{\alpha \delta (1-\alpha \delta )^2 (1-\delta )^2} \right) \frac{16}{\alpha \delta (1-\alpha \delta )^2 (1-\delta )^2}
\end{align*}
\]

Using (8) and (11) with \( N = 3 \) in the above identity (63), we obtain (62).

**Theorem 4.12** We have
\[
\frac{1}{\sqrt{A_M}} + \sqrt{A_M} = V_M^3 + V_M^{-3},
\]
where
\[
A_M = \frac{b_{9M,3}}{b_{M,3}} \text{ and } V_M = \frac{g_M g_M}{g_{3M} g_{81M}}.
\]

**Proof.** Using (8) and (11) with \( N = 9 \) in the above identity (63), we obtain (64).

5 Explicit Evaluations of \( b_{M,N} \)

In this section, we establish several explicit evaluations of \( b_{M,N} \).

**Theorem 5.1** We have
\[ b_{5,3} = \frac{\sqrt{190-105\sqrt{3}} - \sqrt{186-105\sqrt{3}}}{2}, \quad (65) \]

\[ b_{8,3} = \left(\sqrt{43+24\sqrt{3}} - \sqrt{42+24\sqrt{3}}\right)^{\frac{1}{2}}, \quad (66) \]

\[ b_{20,3} = \left(2 - \frac{\sqrt{15}}{2}\right)^{\frac{1}{2}} \left(47 - 21\sqrt{5}\right)^{\frac{1}{2}}, \quad (67) \]

\[ b_{22,3} = 6 + \sqrt{33} - 2\sqrt{17} + 3\sqrt{33}, \quad (68) \]

\[ b_{34,3} = 33 - 8\sqrt{17}, \quad (69) \]

\[ b_{38,3} = 22 + 3\sqrt{57} - 2\sqrt{249} + 33\sqrt{57}, \quad (70) \]

\[ b_{42,3} = \frac{2 + \sqrt{2}}{3} - \sqrt{\frac{1+2\sqrt{2}}{3}}, \quad (71) \]

\[ b_{46,3} = \sqrt{3057+1248\sqrt{6}} - \sqrt{3056+1248\sqrt{6}}, \quad (72) \]

\[ b_{66,3} = \frac{\sqrt{33}}{3} + \sqrt{42+10\sqrt{33}} \left(\frac{1}{24} \sqrt{66 - \frac{3}{8}\sqrt{2}}\right), \quad (73) \]

\[ b_{70,3} = \sqrt{54105+5280\sqrt{105}} - \sqrt{54104+5280\sqrt{105}}, \quad (74) \]

\[ b_{110,3} = \sqrt{2537329+540960\sqrt{22}} - \sqrt{2537328+540960\sqrt{22}} \quad (75) \]

and

\[ b_{174,3} = \frac{11\sqrt{6}}{3} + \left(8\sqrt{6} - 23\right)\sqrt{\frac{99+42\sqrt{6}}{29}}. \quad (76) \]

**Proof of (65).** From the table in Chapter 34 of Ramanujan's notebooks [3, pp.190, 341], we find that

\[ G_5 G_5 = \sqrt{2}. \quad (77) \]

Using Entries 12 (vi) and (vii) of Chapter 17 of Ramanujan's notebooks [2, p.124] in Entry 5(ii) of Chapter 19 of Ramanujan's notebooks [2, p.230], we find that
Using (77) in (78) with \( n = \frac{5}{3} \), we find that

\[ g_{\frac{5}{3}}g_{15} = \frac{\sqrt{3} + 1}{2}. \]  

(79)

From Theorem 4.1(i) in [6], we have

\[ 2\sqrt{2} \left[ g_{\frac{5}{3}}g_{9n}^3 + g_{g_{9n}}^{-3} \right] = \frac{g_{9n}^6}{g_{n}} - \frac{g_{n}^6}{g_{9n}}. \]  

(80)

Using (79) in (80) with \( n = \frac{5}{3} \), we deduce that

\[ \frac{g_{15}}{g_{\frac{5}{3}}} = \sqrt{\frac{1710 - 945\sqrt{3}}{4}} + \sqrt{\frac{1706 - 945\sqrt{3}}{4}}. \]  

(81)

Using (81) in (31) with \( M = 5 \), we obtain the required result (65).

**Proof of (66).** From Theorem 4.5(i) in [6], we have

\[ g_8g_{24} = \sqrt{3} + 1. \]  

(82)

Using (82) in (80) with \( n = \frac{8}{3} \), we find that

\[ \frac{g_{24}}{g_{\frac{8}{3}}} = \left( \frac{44 + 27\sqrt{3}}{8} \right) + \left( \frac{33 + 18\sqrt{3}}{8} \right)\sqrt{2}. \]  

(83)

Using (83) in (31) with \( M = 8 \), we obtain the required result (66).

**Proof of (68).** From the table in Chapter 34 of Ramanujan's notebooks [3, p.201], we have

\[ g_{66} = \left( \sqrt{3} + \sqrt{2} \right)^{\frac{1}{3}} \left( 7\sqrt{2} + 3\sqrt{11} \right)^{\frac{1}{12}} \left( \sqrt{\frac{7 + \sqrt{33}}{8}} + \sqrt{\frac{\sqrt{33} - 1}{8}} \right)^{\frac{1}{2}}. \]  

(84)

Using (84) in (80) with \( n = \frac{22}{3} \), we find that

\[ g_{\frac{22}{3}}g_{22} = \left( \sqrt{3} + \sqrt{2} \right)^{\frac{1}{3}} \left( 7\sqrt{2} + 3\sqrt{11} \right)^{\frac{1}{12}} \left( \sqrt{\frac{7 + \sqrt{33}}{8}} - \sqrt{\frac{\sqrt{33} - 1}{8}} \right)^{\frac{1}{2}}. \]  

(85)

Using (84) and (85) in (31) with \( M = 22 \), we obtain the required result (68).

Proof of the identity (67) is similar to the proof of the identity (65) and proofs of the identities (69)-(76) being similar to the proof of the identity (68). So we omit the details.

**Theorem 5.2** We have

\[ b_{\frac{5}{3}} = \left( \sqrt{2} - 1 \right)^{2}. \]  

(86)
b_{38,5} = \left(17 - 12\sqrt{2}\right)^2 \quad (87)

and

b_{62,5} = \left(28 + 9\sqrt{10} - 3\sqrt{177} + 56\sqrt{10}\right)^2. \quad (88)

**Proof of (86).** From the table in Chapter 34 of Ramanujan's notebooks [3, p.200], we have

\[ g_{30} = \left(2 + \sqrt{5}\right)^{\frac{1}{2}} \left(3 + \sqrt{10}\right)^{\frac{1}{6}}. \quad (89) \]

From Theorem 4.1(ii) in [6], we have

\[ 2\left[g_n^2 g_{25n}^2 + g_n^{-2} g_{25n}^{-2}\right] = \frac{g_{25n}^3}{g_n^3} - \frac{g_n^3}{g_{25n}^3}. \quad (90) \]

Using (89) in (90) with \( n = \frac{6}{5} \), we find that

\[ g_6^6 = \left(2 + \sqrt{5}\right)\left(-3 + \sqrt{10}\right). \quad (91) \]

Using (89) and (91) in (36) with \( M = 6 \), we obtain the required result (86).

As the proofs of the identities (87)-(88) being similar to the proof of the identity (86). So we omit the details.

**Theorem 5.3** We have

\[ b_{6,7} = 5 - 2\sqrt{6}, \quad (92) \]

\[ b_{10,7} = \left(\sqrt{10} - 3\right)^2, \quad (93) \]

\[ b_{14,7} = -\frac{2}{9} + \sqrt{\frac{7 + 2\sqrt{14}}{49}} \quad (94) \]

and

\[ b_{18,7} = \left(\sqrt{34 + 24\sqrt{2}} - \sqrt{33 + 24\sqrt{2}}\right)^2. \quad (95) \]

**Proof of (92).** From the table in Chapter 34 of Ramanujan's notebooks [3, p.201], we have

\[ g_{42} = \left(2\sqrt{2} + \sqrt{7}\right)^{\frac{1}{2}} \left(\frac{\sqrt{3} + \sqrt{7}}{2}\right)^{\frac{1}{2}}. \quad (96) \]

From Theorem 4.1(iii) in [6], we have

\[ 16\sqrt{2}\left[g_n^0 g_{49n}^0 + g_n^{-9} g_{49n}^{-9}\right] + 168\left[g_n^6 g_{49n}^6 + g_n^{-6} g_{49n}^{-6}\right]. \quad (97) \]
Using (96) in (97) with \( n = \frac{6}{7} \), we find that

\[
g_6 = \left(2\sqrt{2} + \sqrt{7}\right)\left(-\frac{3 + \sqrt{7}}{2}\right)^{1/2}.
\]

Using (96) and (98) in (38) with \( M = 6 \), we obtain the required result (92).

As the proofs of the identities (93)-(95) being similar to the proof of the identity (92). So we omit the details.

**Theorem 5.4** We have

\[
b_{10,9} = \left(\sqrt{10} + 4\sqrt{6} - \sqrt{9} + 4\sqrt{6}\right)^2,
\]

(99)

\[
b_{22,9} = \left(\sqrt{253} + 44\sqrt{33} - \sqrt{252} + 44\sqrt{33}\right)^2
\]

and

\[
b_{58,9} = \left(\sqrt{117370} + 47916\sqrt{6} - \sqrt{117369} + 47916\sqrt{6}\right)^2.
\]

(101)

**Proof of (99).** From the table in Chapter 34 of Ramanujan's notebooks [3, p.202], we have

\[
g_{90} = \left(2 + \sqrt{5}\right)\left(\sqrt{5} + \sqrt{6}\right)^{1/6}\left(\sqrt{\frac{3 + \sqrt{6}}{4}} + \sqrt{\frac{\sqrt{6} - 1}{4}}\right).
\]

(102)

Using (102) in an identity from a page 145 of Chapter 4 in [5, eq(4.7.12), p.145] with changing \( q \) to \(-q\), we obtain

\[
g_{10} = \left(2 + \sqrt{5}\right)\left(\sqrt{5} + \sqrt{6}\right)^{1/6}\left(\sqrt{\frac{3 + \sqrt{6}}{4}} - \sqrt{\frac{\sqrt{6} - 1}{4}}\right).
\]

(103)

Using (102) and (103) in (40) with \( M = 10 \), we obtain the required result (99).

As the proofs of the identities (100)-(101) being similar to the proof of the identity (99). So we omit the details.

**Theorem 5.5** We have

\[
b_{6,13} = \left(3 - 2\sqrt{2}\right)^2
\]

(104)

and

\[
b_{10,13} = \left(\sqrt{65} - 8\right)^2.
\]

(105)

**Proof of (104).** From the table in Chapter 34 of Ramanujan's notebooks [3, p.202], we have
Using (106) in Entry 41 of Chapter 38 of Ramanujan's notebooks [3, p.378], we find that

\[
g_{78} = \left( \frac{3 + \sqrt{13}}{2} \right)^{\frac{1}{2}} \left( 5 + \sqrt{26} \right)^{\frac{1}{6}}. \tag{106}
\]

Using (106) and (107) in (42) with \( M = 6 \), we obtain the required result (104).

As the proof of the identity (105) being similar to the proof of the identity (104). So we omit the details.

**Remark:** \( b_{M,N} \) are units in some quadratic field. We retain the details for our future paper.

**Acknowledgement**

Authors wish to thank the referee for their valuable suggestions.

**References**


ACHIEVEMENT VARIATIONS OF BASIC SCIENCE STUDENTS TAUGHT WITH TEACHER-CENTRED, TEACHER/STUDENT-CENTERED AND STUDENT-CENTERED INSTRUCTIONS IN KADUNA STATE, NIGERIA.

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Abstract
This study investigated the effects of teacher-centered, teacher/student-centered and student-centered instruction on the academic achievement of basic science students at the Junior secondary school level, in relation to class-size and gender. A quasi-experimental pretest-posttest research design was used for the study which featured nine comparable groups of basic science students. Four hundred and eighty JSS II students randomly selected from nine schools in Giwa Zone, of Kaduna state formed the study sample. They were taught basic science concepts using the three types of instruction. Performances of the nine groups were compared using their posttest mean scores. Four null hypotheses were tested using one way Analysis of Variance and t-test at a significance level of $P<0.05$. Integrated Science Achievement Test (ISAT) with reliability coefficients of and 0.85 was used to collect data for the study. The following findings were established from the study: (i) Students in three different class-sizes taught with student-centered instruction achieved significantly higher than those taught with teacher/student-centered and teacher-centered. (ii) There was no significant difference in performance of male and female students when taught with teacher-centered and teacher/student-centered instruction. (iii) A significant difference was found in the performance of male and female students taught with student-centered instruction with the males performing better than the females. Based on the above findings, recommendations were made among which are the need to train teachers on the use of student-centered instruction in science classrooms.

Keywords: teacher, student, instruction, achievement

Introduction
Science and technology interplay with the society to bring about sustainable development. Nations all over the world, strive to have its citizens educated in Science, Technology, Engineering and Mathematics (STEM) disciplines. Nigeria, as a developing nation has made quite commendable efforts to enhance scientific literacy of its citizens.

Despite the relative importance of science and technology to the country’s quest for technological advancement, there is a continuous trend of poor performance in the science subjects and there is also a decline in students’ achievement in Integrated Science (13). Many studies such as Agbi (1) have advanced numerous reasons for the decline in students’ achievement in Basic science in Nigerian schools. Some of these reasons include poor professional training, poor academic background of the teachers, lack of practical work, lack of students’ involvement and inappropriate pedagogies.

Interactions between students and teachers are fundamental to the learning process and the effectiveness of teaching could be influenced by the intellectual quality of classroom
interactions, that is, on the cognitive demands placed on the pupils in the classroom. For students to achieve high in science, the teacher has to use a strategy which will enable the students to understand science concepts and create conducive environment that enhance effective teacher-student interaction.

Students do not learn much just by sitting in class and listening to teachers. Lessons especially Science lessons need to be student centered since science is best learned by inquiry. According to Lara (12), Instructor-centered teaching focuses on the teacher as both authority and model. The instructor determines the content and organization of the course to a great extent. The students are recipients of the instructor’s knowledge. Student-centered teaching focuses on the student. Decision-making, organization, and content are largely determined by the student’s needs and perceptions. The instructor acts as coach and facilitator. In many respects, the goal of this type of teaching is the development of the student’s cognitive abilities.

Interaction whether verbal or non-verbal could be between male and female teachers and students. Patterns of interaction of male and female students have also been reported which reveal significant differences in interaction between boys and girls. Some other research findings exist that suggest that boys are more likely to be provided public response opportunities than are girls (5). They suggested that boys being active, salient and perceived by teachers as potentially disruptive are provided response opportunities as a method of maintaining appropriate classroom discipline. Brophy and Good reviewed many studies and concluded that boys tend to have more interactions of all kinds with their teachers than girls do and initiated more contact with the teacher and were more forceful and assertive at gaining teachers’ attention. This they considered as a major factor that contributes to high achievement in boys.

A number of researchers, for example Bassey (3); Iroegbu (11) and Shaibu (17), have attributed students’ poor academic achievement in science in the secondary schools to large class-size. The National Policy on Education (7) defines class-size as the population of a given class in terms of number of students and recommends an average class-size of 40 learners to a teacher. In the present study, a large class is defined as one having a student population ratio of 75 – 90 students to one teacher, medium class-size is considered to be one with student population of 50 – 65 students while a small class-size is considered to be one with 25 – 35 students.

The National Policy of Education (7) recommendation of an average class-size of 40 learners to a teacher is hardly tenable in Nigerian Schools. Duyilemi (6) for example observed that class-size ranging from fifty (50) to an unbelievable figure of one hundred and twenty (120) students are found in some secondary schools. He further explained that in some cases one or two students within a group may tend to dominate whereas the others may exhibit passive behaviours, such as observing or copying, even though the general goal is to involve all the students equally in class activities.

With the introduction of Universal Basic Education in 1999, there has been a great influx of children into schools in Nigeria. There has not been commensurate expansion of facilities including human resources. The Nigerian science teacher is thus faced with a herculean task of handling large classes and yet keeps students focused and interested. This study therefore set out to investigate the effect of teacher-centered instruction (i.e. a situation where student listen while the teacher talks), teacher/student-centered instruction ( a situation where teacher dominates the lesson half way and the remaining part of the lesson allows student to dominate class discussions), student–centered instruction (where students are allowed to dominate class
discussions with teacher serving only as a guide) on the academic achievement of male and female basic science students in different class-sizes and in different ability groups.

Specifically, the study sought answers to the following Research Questions:

1. What is the effect of teacher-centered instruction, teacher/student-centered and student-centered instruction on the academic achievement of male and female basic science students?
2. What is the effect of teacher-centered, teacher/student-centered and student-centered instruction on the academic achievement of basic science students in large, medium and small class-sizes?

Hypotheses

Based on the research questions, the following null hypotheses were formulated for testing:

\( H_{O1a} \): There is no significant difference in the academic achievement of male and female Basic science students exposed to teacher-centered instruction.

\( H_{O1b} \): There is no significant difference in the academic achievement of male and female Basic science students exposed to teacher/student-centered instruction.

\( H_{O1c} \): There is no significant difference in the academic achievement of male and female Basic science students exposed to student-centered instruction.

\( H_{O2} \): There is no significant difference in the academic achievement of Basic science students in large class-size, exposed to teacher-centered instruction, teacher/student-centered instruction and student-centered instruction.

\( H_{O3} \): There is no significant difference in the academic achievement of Basic science students in medium class-size, exposed to teacher-centered instruction, teacher/student-centered instruction and student-centered instruction.

\( H_{O4} \): There is no significant difference in the academic achievement of Basic science students in small class-size, exposed to teacher-centered instruction, teacher/student-centered instruction and student-centered instruction.

Method of Data Collection

A quasi-experimental design involving pretest and posttest (16) was adopted for this study. In the study, 480 students divided into nine comparable groups of students, selected by random sampling from 20 schools in Kaduna state, were used for the study. Three groups of 35 students (20 males and 15 females) each (representing small class-size), three groups of 50 students (25 males and 25 females) and three groups of 75 students (40 males and 35 females) each (representing large class-size).

The instruments used for this study were Integrated Science Achievement Test (ISAT) with a reliability coefficient of 0.85, adopted from Inyang (10) (and used by Usman, 19). The Integrated Science Achievement Test consists of a set of forty multiple choice test items designed to reveal the extent to which students have understood the topics selected in Integrated Science (Basic science).

A pretest was conducted on the sample subjects in the nine schools using the Integrated Science Achievement Test (ISAT). This is to ensure comparability in ability level of the subjects for the study. The pretest scores were subjected to a one-way Analysis of Variance (ANOVA) and tested at \( P<0.05 \) level of significance. No significant difference was obtained in the pretest scores of all subjects indicating comparability and equivalence of all the nine groups at the start of the study.
The nine groups (Ltc, Lts, Lsc, Mtc, Mtsc, Msc, Ssc, Stsc, Scsc) were then taught for six weeks on Basic Science concepts (Ecology, Energy and Method of Separating Mixtures) utilizing teacher-centered instruction, teacher/student-centered instruction and student-centered instruction for each of the three class-sizes respectively (for instance Group Ltc was a group of students in large class-size taught, using Teacher-centered instruction). A posttest was administered after teaching the groups, marked and data collated for analysis.

Results
Data were subjected to statistical analysis based on formulated hypotheses.

HO1a: There is no significant difference in the academic achievement of male and female students exposed to teacher-centered instruction.

This hypothesis was analysed using t-test statistic. The result is shown on Table 1a.

Table 1a: t-test Analysis of Posttest Mean Scores of Male and Female Subjects Exposed to Teacher-centered Instruction.

<table>
<thead>
<tr>
<th>Groups</th>
<th>N</th>
<th>Mean</th>
<th>df</th>
<th>SD</th>
<th>t</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>88</td>
<td>12.500</td>
<td>147</td>
<td>3.74</td>
<td>1.848</td>
<td>NS 0.067</td>
</tr>
<tr>
<td>Female</td>
<td>61</td>
<td>11.328</td>
<td></td>
<td>3.89</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>149</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NS Not significant at \(P<0.05\)

From Table 1a, the calculated t-value is 1.848, and p-value is 0.067 obtained at \(\alpha = 0.05\), df 147. Since the p-value 0.067 is greater than 0.05, it means that there is no significant difference between the posttest mean scores of the male and female subjects exposed to teacher-centered instruction.

The null hypothesis \(HO_{1a}\) was therefore retained and this implies that Teacher-centered instruction is gender friendly since male and female subjects achieved equally.

\(HO_{1b}\): There is no significant difference in the academic achievement of male and female students exposed to teacher/student-centered instruction.

This hypothesis was analysed using t-test statistic. The result is shown on Table 1b.

Table 1b: t-test Analysis of Posttest Mean Scores of Male and Female Subjects Exposed to Teacher/Student-Centered Instruction.

<table>
<thead>
<tr>
<th>Groups</th>
<th>N</th>
<th>Mean</th>
<th>df</th>
<th>SD</th>
<th>t</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>89</td>
<td>18.348</td>
<td>147</td>
<td>4.46</td>
<td>-0.333</td>
<td>NS 0.740</td>
</tr>
<tr>
<td>Female</td>
<td>60</td>
<td>18.600</td>
<td></td>
<td>4.63</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>149</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NS Not significant at \(P<0.05\)

Result of the analysis in Table 1b shows t-calculated as -0.333 and p-value is 0.740 obtained at \(\alpha = 0.05\), df 147. Since the p-value 0.740 is greater than 0.05 it means there is no significant difference between the posttest means of the male and female subjects exposed to Teacher/Student-centered instruction.

The null hypothesis \(HO_{1b}\) was therefore retained and in this respect Teacher/Student-centered instruction is gender friendly.
HO\textsubscript{1c}: There is no significant difference in the academic achievement of male and female students exposed to student-centered instruction.

This hypothesis was analysed using t-test statistic. The result is shown on Table 1c.

**Table 1c: t-test Analysis of Posttest Mean Scores of Male and Female Subjects Exposed to Student-Centered Instruction.**

<table>
<thead>
<tr>
<th>Groups</th>
<th>N</th>
<th>Mean</th>
<th>df</th>
<th>SD</th>
<th>t</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>89</td>
<td>22.169</td>
<td>148</td>
<td>6.9122</td>
<td>3.082</td>
<td>.002</td>
</tr>
<tr>
<td>Female</td>
<td>61</td>
<td>18.803</td>
<td></td>
<td>6.0327</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>150</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Significant at P < 0.05

The results of analysis presented in table 1c shows the calculated t-value to be 3.082 at \( \alpha = 0.05 \) df 148. The p-value 0.002 being less than 0.05 shows that there is a significant difference between the posttest mean scores of the male and female subjects exposed to student-centered instruction. From the means of the two groups indicated in Table 1c, the males performed better than the females.

The null hypothesis HO\textsubscript{1c} was thus rejected showing that there is a significant difference in the scores of male and female students taught with teacher-centered instruction, teacher/student-centered instruction and student-centered instruction.

HO\textsubscript{2}: There is no significant difference in the academic achievement of Basic science students in large class-size, exposed to teacher-centered instruction, teacher/student-centered and student-centered instruction.

To test this hypothesis, the posttest achievement scores were subjected to one way Analysis of Variance to show which group achieved highest among the three large class sizes. The results are presented in Tables 2a and 2b.

**Table 2a: Summary of Students Posttest Scores among the Three Groups \((L_{tc}, L_{tsc}, L_{sc}).\)**

<table>
<thead>
<tr>
<th>Groups</th>
<th>Count</th>
<th>Sum</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>L\textsubscript{tc}</td>
<td>75</td>
<td>885.0</td>
<td>11.800</td>
</tr>
<tr>
<td>L\textsubscript{tsc}</td>
<td>75</td>
<td>1349.0</td>
<td>17.987</td>
</tr>
<tr>
<td>L\textsubscript{sc}</td>
<td>75</td>
<td>1381.0</td>
<td>18.413</td>
</tr>
</tbody>
</table>

Key

- \( L_{tc} = \) Large class-size exposed to teacher-centered instruction
- \( L_{tsc} = \) Large class-size exposed to teacher/student-centered instruction
- \( L_{sc} = \) Large class-size exposed to student-centered instruction

Table 2a shows that subjects in group \( L_{sc} \) achieved highest with mean score of 18.413, followed by \( L_{tsc} \) (17.987) and \( L_{tc} \) (11.800) achieved the least. This therefore implies that student-centered instruction is the best to apply in a large class-size.

**Table 2b: One Way Analysis of Variance of Students Posttest Scores among the Three Groups.**

<table>
<thead>
<tr>
<th>Source of variance</th>
<th>Sum of squares</th>
<th>df</th>
<th>Mean squares</th>
<th>F-ratio</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>2054.827</td>
<td>2</td>
<td>1027.413</td>
<td>39.631*</td>
<td>0.001</td>
</tr>
<tr>
<td>Within groups</td>
<td>5755.173</td>
<td>222</td>
<td>25.924</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>7810.000</td>
<td>224</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Significant at P≤0.05
Table 2b reveals the calculated F-value to be 39.631 with degree of freedom = 224 at $\alpha = 0.05$ level of significance. The p-value (0.001) obtained being less than 0.05 shows that there is significant difference in the performance of subjects in their posttest scores at $P<0.05$ level of significance. Table 2a shows the direction of the difference.

The null hypothesis $H_0_2$ was thus rejected showing that there is a significant difference in the scores of students in large class-size, taught with teacher-centered instruction, teacher/student-centered instruction and student-centered instruction.

$H_0_3$: There is no significant difference in the academic achievement of Basic science students in medium class-size, exposed to teacher-centered instruction, teacher/student-centered instruction and student-centered instruction.

To test this hypothesis, the posttest achievement scores were subjected to one way Analysis of Variance to show which group achieved highest among the three medium class sizes. The results are presented in Tables 3a and 3b.

### Table 3a: Summary of Students Posttest Scores among Groups in Medium Class-Sizes

<table>
<thead>
<tr>
<th>Group</th>
<th>Count</th>
<th>Sum</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>$M_{ts}$</td>
<td>50</td>
<td>522</td>
<td>10.440</td>
</tr>
<tr>
<td>$M_{tsc}$</td>
<td>50</td>
<td>911</td>
<td>18.220</td>
</tr>
<tr>
<td>$M_{sc}$</td>
<td>50</td>
<td>1051</td>
<td>21.020</td>
</tr>
</tbody>
</table>

key $M_{ts}$ = Medium class-size exposed to teacher-centered instruction.

$M_{tsc}$ = Medium class-size exposed to teacher/student-centered instruction.

$M_{sc}$ = Medium class-size exposed to student-centered instruction.

Table 3a shows that subjects in group $M_{sc}$ achieved highest with mean score of 21.020, followed by $M_{tsc}$ (18.220) and the least $M_{ts}$ (10.440).

### Table 3b: One Way Analysis of Variance of Students Posttest Scores among the Three Group, in Medium Class-Sizes

<table>
<thead>
<tr>
<th>Source of variance</th>
<th>Sum squares</th>
<th>df</th>
<th>Mean squares</th>
<th>F -ratio</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>3005.080</td>
<td>2</td>
<td>1502.540</td>
<td>83.039*</td>
<td>0.001</td>
</tr>
<tr>
<td>Within groups</td>
<td>2659.880</td>
<td>147</td>
<td>18.094</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>5664.960</td>
<td>149</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Significant at $P < 0.05$

The result in Table 3b shows that the calculated $F$ value is 83.039 at $\alpha = 0.05$, df 149. The p-value 0.001 being less than 0.05 implies a significant difference in the posttest scores of students.

The null hypothesis $H_0_3$ was therefore rejected showing that there is a significant difference in the scores of students in medium class-size, taught with teacher-centered instruction, teacher/student-centered instruction and student-centered instruction.
HO4: There is no significant difference in the academic achievement of Basic science students in small class-size, exposed to teacher-centered instruction, teacher/student-centered instruction and student-centered instruction.

One-way ANOVA was used to test this hypothesis. The results are shown in Tables 4a and 4b.

**Table 4a: Summary of Students Posttest Scores among Groups in Small Class-Sizes**

<table>
<thead>
<tr>
<th>Groups</th>
<th>Count</th>
<th>Sum</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>S\text{tc}</td>
<td>25</td>
<td>391</td>
<td>15.640</td>
</tr>
<tr>
<td>S\text{tsc}</td>
<td>25</td>
<td>508</td>
<td>20.320</td>
</tr>
<tr>
<td>S\text{sc}</td>
<td>25</td>
<td>686</td>
<td>27.440</td>
</tr>
</tbody>
</table>

Key: S\text{tc} = Small class-size exposed to teacher-centered instruction
S\text{tsc} = Small class-size exposed to teacher/student-centered instruction
S\text{sc} = Small class-size exposed to student-centered instruction

Table 4a shows that subjects in group S\text{sc} achieved highest with a mean score of 27.440, followed by S\text{tsc} (20.320) and S\text{tc} (15.640) which achieved the

**Table 4b: One Way Analysis of Variance of Students Posttest Scores among the Three Groups in Small class-Sizes**

<table>
<thead>
<tr>
<th>Source of variance</th>
<th>Sum of squares</th>
<th>df</th>
<th>Mean squares</th>
<th>F-ratio</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>1765.307</td>
<td>2</td>
<td>882.653</td>
<td>40.755*</td>
<td>0.001</td>
</tr>
<tr>
<td>Within groups</td>
<td>1559.360</td>
<td>72</td>
<td>21.658</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>3324.667</td>
<td>74</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Significant at ≤ 0.05 level

The result from table 4b indicate the F-calculated as 40.755 at α = 0.05, df 74. The p-value 0.001, being less than 0.05, shows that there is a significant difference in the posttest scores among the groups.

The null hypothesis HO4 was thus rejected showing that there is a significant difference in the scores of students in small class-size, taught with teacher-centered instruction, teacher/student-centered instruction and student-

**Discussion**

Null hypotheses 1a and 1b focused on effect of teacher-centered instruction on achievement of male and female basic science students. Result of the analysis testing these hypotheses show no significant differences in the mean scores of male and female students exposed to teacher-centered and teacher/student-centered instruction. [Tables 1a and 1b]. This implies that boys and girls exposed to these types of instructions not differ significantly in their academic achievement. This could be explained by the fact that since the teacher dominated the classroom talk in the first instance and students were given opportunity to initiate and dominate classroom discussions (in the case of teacher/student-centered instruction), each gender had equal opportunities available to them. No gender group had opportunity to be interactive at the detriment of the other group which could have resulted to a higher performance on their part.

The equivalent performance of both boys and girls reported in this study in line with the studies of Ogunboyede (14). This report however is in disagreement with Harding and Whiteleg (8), Usman (19), Aigboman (2), who reported in their various studies that boys performed significantly better than girls in science. The result of this study implies that teacher-centered and
teacher/student–centered instruction are gender friendly and should be encouraged in science classrooms that mixed-gender.

Hypothesis 1c focused on effect of student-centered instruction on academic performance of male and female students. Analysis of results testing this hypothesis indicate a significant difference in the posttest mean scores of male and female students exposed to student-centered instruction [Table 1c]. From the analysis, males performed significantly better than the females.

This result agrees with the findings of Tambaya (18) who reported a significant difference in the achievement of boys and girls exposed to high level teacher-student verbal interaction. However results of this study disagree with that of Bichi (4), Ogunboyede (14) who independently reported that boys are not better than girls in their academic achievement.

The findings of this study reveal that gender differences in science achievement levels could be influenced by the type of instruction adopted by the science teacher especially in whether it is teacher-centered, student-centered or both. The higher performance by boys taught with student-centered instruction could be as a result of the fact that most girls in the Northern part of the country naturally shy away from class verbal interaction in mixed classrooms and did not get enough opportunity to participate in class discussions and demonstrations like the boys.

However this study has clearly revealed the efficacy of student-centered instruction in both male and female students. Looking at the means of the male and students exposed to the three different types of instruction namely; male (teacher-centered), mean = 12.5000, male (teacher/student- centered), mean = 18.348, male (student centered), mean = 22.169. For the fact that males taught with student-centered instruction had the highest means shows a positive effect of this type of instruction even within the same gender. This is further asserted by the results reported by this study on females viz; female (teacher-centered) 11.328, female (teacher/student-centered) mean = 18.600 and female (student centered) mean = 18.803. Student-centered instruction should thus be encouraged for science classes especially in single sex classrooms.

Hypotheses 2, 3 and 4 focused on effects of type of instruction in relation to class-size. Results of the analyses in Tables 2, 3 and 4 indicate significant differences in the posttest scores of subjects in large, medium and small class-sizes, exposed to the three types of instruction under discussion. The results reveal that subjects exposed to student-centered instruction in large, medium and small class-sizes performed significantly better than the other groups. This could be as a result of increase in interest and enthusiasm of students in classrooms where student-centered instruction is utilised thus leading to higher performance among this group. This indicates that student-centered instruction is important for effective learning of basic science concepts.

This report is in agreement with earlier findings by Olajide (15), Tambaya (18) who reported positive educational outcomes through allowing students to actually participate in verbal communication in classrooms. The report also agrees with Inamullah, Hussain and Din (9) who reported that teacher verbal domination of the classroom conditions students to become passive and dependent on the teacher. Their findings further suggest that this dependency has adverse effects on students’ attitudes towards learning and consequently students’ performance in school.

Conclusion and Recommendations
The nature of science demands active participation by learners during lessons. This study has confirmed this fact with students taught with student-centered instruction performing better than others. However the study has also revealed an important issue to consider. Student–centered instruction does not favour females in mixed gender science classrooms and should not be used
in such classes. However if the science teacher has a way of controlling students’ participation to ensure that girls are given equal opportunities with boys, then student –centered instruction can be used in all science classrooms, otherwise science classes should be single sex. Science teachers need to be trained on the art of using this type of instruction in teaching science.

This study concludes with these questions; will student-centered instruction always enhance academic performance in other scientific concepts apart from the ones used in this study? Will it always enhance academic achievement in science irrespective of tribe, race or culture of students? This calls for further research.

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DEVELOPING AND ASSESSING SCIENCE AND TECHNOLOGY PROCESS SKILLS (STPSs) IN NIGERIAN UNIVERSAL BASIC EDUCATION ENVIRONMENT

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Abstract
The paper examines the centrality of Science and Technology Process Skills (STPSs) in Universal Basic Education (UBE) learning environment in Nigeria. UBE programme was implemented in Nigeria to ascertain the Millennium Development Goals (MDGs) in order to make education free and compulsory to all school age children up to junior secondary school level. It also looked at the position of the STPS, structure for measuring STPS at the UBE school levels. Since Science and Technology (ST) teachers could only transfer the skills in them to students, basic STPS that are necessary for complete teacher education were also outlined. Therefore, the teaching and learning of science, technology and mathematics at both the primary and junior secondary schools should not end at seeing the cognitive final outcome but also developing and assessing the process skills that have been acquired by the students. Science and technology curricula need to be modified to engender opportunities for students to demonstrate their science and technology process skills during teaching, learning and assessment processes.

Introduction
Education is the wheel on which all nations developmental programme ride. Educational dynamism causes changes and brings daily rethinking of how to make it more relevant in positively building a self reliance nation. If education is given the right focus, it will not only be a source of growth for all sectors of economy but also would foster current waves of global technological development to be achieved in a country. All nations of the world realise this fact by coming together to fashion out means and how education would be at reach of every child by organising conferences and submits that would usher in positive changes in governance, economy and technology. Examples of such conferences were World Conference on Education for All (Jomitien, 1990), The E-9 Submit (New Dehli, 1993), Second World Congress on Education and Information (Moscow, 1996), Second International Congress on Technical and Vocational Education (Seoul, 1999), World Science Conference (Budapes, 1999), Education for All (EFA) Forum (Dakar, 2000) among others.

African countries including Nigeria actively participated in these conferences. Obanya (2000) summarised the lessons most African countries learnt from these conferences as awareness raising, capacity building, enlarged partnership and inter-learning. This development therefore, brought a lot of challenges in form of how to integrate education into the overall national development; develop holistic education, prioritize, carry everyone along, sustain capacities, manage resources and develop innovations to proffer solutions to educational problems.
In taking drastic step to implement the Millennium Development Goals (MDGs), Nigerian government launched the Universal Basic Education (UBE) programme in 1999. Its implementation took off in 2005 when government disbursed UBE funds to Universal Basic Education Commission (UBEC) and to each state. The concept of Basic education is not a new move to the Nigerian society for the vision is meant to universalise access to education, enhance equity while focusing on teaching and learning environment (Yoloye, 2004). The goals of UBE include:

- Developing in the entire citizenry a strong consciousness for education and strong commitment to its vigorous promotion;
- Provision of free UBE for every Nigerian child of school age;
- Reducing drastically the occurrence of drop-out from formal school system;
- Catering for young persons, their schools as well as other out of school children through appropriate form of complementary approaches to the provision of UBE;
- Ensuring the acquisition of appropriate levels of literacy, manipulative communicative and life skills as well as the ethical, moral and civic values needed for laying a solid foundation for life long living (Federal Government of Nigeria, 2000).

In order attain life skills as stated in UBE goals, the learning of science and technology play important roles especially when appropriate science skills are developed in the learners.

**Implementation Guidelines and Challenges of UBE**

Based on the white paper on UBE implementation, the following guidelines were giving for its effective take off:

- Public enlightenment and social mobilization for community development
- Data collection and analysis
- Planning, monitoring and evaluation
- Teachers’ recruitment, education, retraining, and motivation
- Infrastructural facilities
- Enriched curricula
- Textbooks and instructional materials
- Improved funding
- Management of the entire process (FGN, 2000).

Eight key areas could be identified from these guidelines as shown in figure 1 below:
In spite of these guidelines, UBE was faced with a lot of challenges in the form of funding misuse, inadequate provision and maintenance of infrastructural materials, supervision and monitoring at the UBE centres, daily home-school distance covered by children, inadequate planning, unhealthy rivalry between private and public schools and ineffective science, technology and mathematics teaching/learning in schools. Dike (2000) observed that since UBE is intended to provide free and compulsory education to every Nigerian child of school age, its implementation should not be left in the hands of greedy and corrupt politicians but educators should be allowed to organise, manage, and supervise the programme. UBE also upholds the ideals of National Policy on Education which emphasised that universal basic education, in a variety of forms, depending on needs and possibilities, shall be provided for all citizens; lifelong education shall be the nation’s educational policy, educational activities shall be centred on the learner for maximum self-development and self-fulfilment; and efforts should be made to relate education to overall community needs.

**STPS Position in UBE Programme**

In implementing UBE, education is made free and compulsory from primary to junior secondary school levels in Nigeria. Therefore, the introduction of basic education which spans through nine (9) years of lower basic (Primaries 1 to 3), middle basic (Primaries 4 to 6) and upper basic (JSS1 – 3). Nigerian science and technology curriculum at junior secondary were reformed to reflect the UBE ideas. For instance the previous integrated science becomes Basic science, Introductory Technology is now Basic Technology and Mathematics also. Basic science has four themes: You and your Environment, Living and Non-living things, Science and Development and You and Energy. All the STM themes were geared towards skills acquisition in Nigerian learners. UBE Curriculum contains Arts and Languages, Social Studies and Civic Education, Vocational subjects, Mathematics, Science and Technology. Figure 2 shows that ST and mathematics directly linked to technological development through skill acquisitions when process skills are emphasised in learning and teaching.
Figure 2: Relationship of UBE Curriculum, STPS and Technological Development

STM Process Skills at Basic Education Levels

There are questions science asks in terms of what, which, why, how... When teaching science and technology and mathematics in order to achieve UBE goals, teachers laying more emphasis on questions of “what” and “which” should be minimised because they encourage rote learning in learners and do not measure high level attainment. Process skills involve answering “how” questions which enable learners to explain deeper understanding of scientific processes. ST teaching involves integrating process skills acquisition and not just knowledge attainment. ST and teaching about STM are more than just acquiring scientific and technological knowledge but also ability to do science (Ivowi, 2006). There are three dimensions of science that are important viz (i) content of science, the basic concepts and scientific knowledge (ii) process of doing and (iii) scientific attitudes. The processes of doing science are the science process skills that scientists use in the process of doing science. When we teach science students to use these skills in science, we are also teaching them skills that they would use in the nearest future. Process skills develop favourable scientific attitudes and disposition in learners. These include being curious and imaginative including enthusiasm about asking questions. Therefore, these skills affect the personal, social, and global lives of individuals. The STMPS are fundamental tools to produce and use scientific information, to perform scientific research, and to solve problems. These skills can be attained through certain science education (Harlen, 1999; Hupert, Lomask & Lazarorcitz, 2002). STPS summarily is how a scientist works, thinks and solve problems and proffer solutions.

At basic education level, the ST process skills include
(i) Defining problem (ii) Estimating (iii) Collecting data (iv) Observing (v) Classifying 
(vi) Measuring (vii) Presenting data (viii) Table drawing (ix) Graph drawing (x) Predicting 
(xi) Communicating (explaining results)

At the primary school (lower and middle basic) levels, the STMPS are organizational in nature. These involves Observing: By using five senses to identify the characteristics of objects and their interactions

Communicating: Object are identified and events are described so that information can be processed

Comparing: Objects and events are viewed in relations to similarities and differences. When comparing known to unknown learners can gain knowledge about the unknown.

Organizing: By systematically compiling, classifying and ordering data learners gain knowledge of principles and laws.

At Junior secondary (upper basic) level, the STMSP are relational in nature and such include experimenting the process by which concrete and abstract ideas are brought together to test or explain a phenomenon. Relational skills are inductive, deductive and hypothetical reasoning.

Relational scientific methods consist of five steps:
Identifying the problem: Stating what the investigator wants to find out.
Hypothesis: Proposing a solution
Experiment: Testing one variable at a time to determine its relative effect on another in order to solve a problem or answer the question.
Results: When data are appropriately presented one can easily see the relative effects on one or more variables.

Conclusion: Finding out if there is sufficient evidence from the results to answer the original question. What was discovered by doing the experiment. These active learning processes are achieved in doing, experimentation, use of hands, thinking, response to enquiry, creative challenges, enquiring, analysing, design exercises initiating innovations and all then are turned to acquisition of skills. The usefulness of these skills would result in ability of learners to assess performance, obtain and interpret results, re-design alternatives and motivation for continued learning.

Tasks for Assessing STPS

ST teachers need to draw questions or tasks which might be used to assess science process skills in students based on scientific skills enumerated above.

Observation: Assessment questions could find out how students are able to
- Use senses to notice specific features
- Identify qualitative and quantitative changes in conditions
- Identify similarities and differences in features
- Classify objects, specimens, organisms using observable properties

Predictions
- Predicting the results for a proposed laboratory test or set up
- Selecting predictions based on previously observed patterns
- Providing rationale for the predictions

Calculations
- Using measurement to determine area, volumes, percentages, ratios etc.
- Determining volume of acids that would neutralise a particular quantity of base.
- Performing statistical analysis of raw data as mean, median, mode, range, standard deviation

Data Presentation
- Preparing an appropriate tables, charts, diagrams, illustrations etc.
- Assessing the presentation of data

Graphing
- Selecting appropriate graph for set of data as line, bar, and pie chart etc
- Identifying the title source dependent and independent variables
- Labelling of axes
- Scaling each axis for a graph
- Preparing a line, bar or pie chart to represent a set of a data
- Spotting the coordinate points and marking them
- Making a best line fit
- Interpreting a graph and making predictions or inferences based on the data on a graph.

Inferences
- Formulating assumptions based on observations
- Differentiate between observations and inferences
Involving Process Skills in ST Teacher Education Development

In order to ensure that ST is well structured in the UBE, the issues of ST teacher development in various institutions need to be looked into by inculcating relevant process skills in them. Such skills could include:

- Construction of a unit plan utilising the discovery method of instruction for a set of content, skills and/or attitudes for a selected elementary, primary and junior secondary schools.
- Environmental maintenance to be conducive to the teaching and learning of ST through appropriate classroom and laboratory management techniques. This would be evaluated during micro-teaching using appropriate use of an evaluation form.
- Demonstration of increased competency in applying and skills in defined strategies and techniques of classroom methodology as revealed through a series of micro-teaching experiences.
- Demonstration of increased STPS in planning, organising and teaching individual of students through participation in a series of planned in-school experiences.
- Presentation of a lesson on an assigned topic using a student prepared lesson plan and unit plan.
- Construction of ST instructional modules by utilising the discovery methods of instruction for a given set of content skills or attitudes for appropriate UBE educational levels.
- Planning and using lessons involving technological approaches to meet the diverse needs of the learners in a variety of educational settings after having made a series of observation in ST classrooms.
- Listing the careers relating to STPS to be acquired.
- Preparation of a variety of assessment modes consistent with the goals of ST courses to assess students’ outcomes, i.e. quizzes, tests, examination.
- The would-be ST teachers should be trained on how to make valid observation, classify objects, measure, make inferences, form prediction, recognise space-time relation and recognise number relations.
- Matching primary process skills with an appropriate description or activity.
- Preparation of a list of safety precautions for primary and junior secondary schools.
- Identification and analysis of specified science, technology and mathematics curriculum improvement projects.

The ST teachers need to undergo a training that will inculcate these skills in them. When they possess them, they would pass on to the ST students who would apply them in the nearest future to proffer solution to life problems.

Instruments for Measuring STPS in Students

When assessing students’ overall performance on ST-based subjects, teachers should not based such assessment on the product alone by emphasising the cognitive attainment. The end results might not justify the means, process skills of arriving at the product as shown by each student could be ascertained using appropriate rating system. Teachers could evaluate students’ abilities to make and communicate observation, determine whether they demonstrate these skills. Examples of such process skills’ ratings tools are...
Process Skills in Evaporation: Changing from Liquid to Gas

<table>
<thead>
<tr>
<th>S/N</th>
<th>DESIRED SKILLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Identification and using relevant instruments e.g. measuring cylinder</td>
</tr>
<tr>
<td>2</td>
<td>Measuring appropriate volume of water</td>
</tr>
<tr>
<td>3</td>
<td>Transferring water to container</td>
</tr>
<tr>
<td>4</td>
<td>Drawing the container being used to hold water</td>
</tr>
<tr>
<td>5</td>
<td>Recording how much water evaporate</td>
</tr>
<tr>
<td>6</td>
<td>Recognising that water escapes</td>
</tr>
<tr>
<td>7</td>
<td>Predicting the conditions for evaporation to take place</td>
</tr>
<tr>
<td>8</td>
<td>Making relevant inference</td>
</tr>
</tbody>
</table>

Process skills in graphing operations

<table>
<thead>
<tr>
<th>S/N</th>
<th>DESIRED SKILLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Identification of graph sheet.</td>
</tr>
<tr>
<td>2</td>
<td>Compilation of table</td>
</tr>
<tr>
<td>3</td>
<td>Choosing appropriate scale</td>
</tr>
<tr>
<td>4</td>
<td>Drawing of the axes</td>
</tr>
<tr>
<td>5</td>
<td>Calibration of graph axes based on choice of scales</td>
</tr>
<tr>
<td>6</td>
<td>Fixing of points</td>
</tr>
<tr>
<td>7</td>
<td>Joining of points to draw appropriate graph shapes</td>
</tr>
<tr>
<td>8</td>
<td>Putting title of the graph</td>
</tr>
<tr>
<td>9</td>
<td>Using graph to answer questions</td>
</tr>
</tbody>
</table>

Process skills in drawing of isometric cube block

<table>
<thead>
<tr>
<th>S/N</th>
<th>DESIRED SKILLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Familiarity with isometric drawing tools e.g. drawing paper, Tee-square, set square etc.</td>
</tr>
<tr>
<td>2</td>
<td>Drawing a horizontal line</td>
</tr>
<tr>
<td>3</td>
<td>Drawing a vertical line at a particular point on the horizontal line</td>
</tr>
<tr>
<td>4</td>
<td>Measuring required angle using relevant tool</td>
</tr>
<tr>
<td>5</td>
<td>Marking out required points based on specified measurement</td>
</tr>
<tr>
<td>6</td>
<td>Completing the block by joining the marked points</td>
</tr>
</tbody>
</table>

The aforementioned skills were just samples of areas of focus in basic science, basic technology and mathematics. Teachers set students on process skills activities, observe students carrying them out and rate each of them on level of attainment of those skills from a minimum of 1 and maximum of 5. Other science-based teachers could develop skill rating tools relevant to their subject areas.

Conclusion and recommendations

Achievement of Universal Basic Education goals is hinged on the abilities of STM teachers to develop and assess basic process skills acquired by their students. Therefore,
teachers need to re-orientate themselves to lay more emphasis on skills acquisition among students instead of much emphasis on knowledge attainment during classroom and laboratory lessons. Teachers are supposed to facilitate the development and acquisition of appropriate manipulative skills, laboratory management techniques and workshop practices where applicable in students. Since doing science leads to skills acquisition, teachers evaluation of students performance should not be limited to the cognitive domain alone but involve psychomotor where a lot could be achieved through observation and completion of appropriate checklists and rating scales.

The following recommendations are necessary to enhance the level of science and technology process skills in schools’ science learning and teaching especially the UBE enabling environment:

1. Learners should be initiated to inculcate the sense of skill acquisition in learning science and technology.
2. Students should be guided to make research activities intended to enhance the level of their STPSs.
3. Science and technology based subjects’ curricula should be developed with the mind of improving STPSs of the students.
4. Teachers should derive teaching methods that would assist in developing STPSs in students.
5. Assessment of students in ST subjects should not be based on the knowledge alone but also skills acquire by the students during teaching and learning.
6. Each ST teacher should develop relevant assessment tools (instruments) for assessing skills developed in the students.

References


ON SOME NEW MODULAR RELATIONS FOR RAMANUJAN'S \( \kappa(q) \) – FUNCTION and \( \nu(q) \) – FUNCTION

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ABSTRACT

In his second and 'lost' notebooks, S. Ramanujan introduced parameters \( \kappa(q) \) and \( \nu(q) \) related to the Rogers-Ramanujan continued fraction. In this paper, we establish several new \( P-Q \) modular equations for the ratios of Ramanujan's theta function. We establish several general formulas for explicit evaluations of the ratios of Ramanujan's theta function \( \psi(q) \). We establish several new modular relations connecting \( \kappa(q) \) with \( \kappa(q') \) and \( \nu(q) \) with \( \nu(q') \) for different positive integer \( n > 1 \). We also establish relations between \( \kappa(q) \), \( \nu(q) \) and \( \mu(q) \).

Key words and Phrases: Continued fraction, Modular equation

Introduction

The Rogers-Ramanujan continued fraction is defined by

\[
R(q) := q^{1/5} \frac{q}{1 + q^{1/5}} \frac{q^2}{1 + q^{2/5}} \frac{q^3}{1 + q^{3/5}} \cdots, \quad |q| < 1,
\]

was first studied by L. J Rogers [14]. Later, this continued fraction was rediscovered by S. Ramanujan and recorded may interesting results involving \( R(q) \). For more details on \( R(q) \) one can see [2], [3], [6], [15], [16] and [17].

In his 'lost' notebook Ramanujan [13], introduced the parameters \( \mu(q) := R(q)R(q^4) \) and \( \kappa(q) := R(q)R^2(q^2) \) which are related to Rogers-Ramanujan continued fraction. Ramanujan stated several interesting identities involving the parameters \( \mu(q) \) and \( \kappa(q) \). These results were studied in detail by S. -Y. Kang [9]. S. -Y. Kang also introduced a new parameter \( \nu(q) := R^2(q^2)R(q)/R(q^2) \) which is analogous to \( \mu(q) \) and \( \kappa(q) \) and established some identities. Recently, C. Gugg [8] established certain identities of Ramanujan using the parameter \( \kappa(q) \). S. Cooper [7], also systematically studied several results involving the parameter \( \kappa(q) \).

The Ramanujan's theta function is defined by

\[
f(a,b) := \sum_{n=-\infty}^{\infty} a^{n(n+1)/2} b^{n(n-1)/2}, \quad |ab| < 1,
\]

Three special cases of \( f(a,b) \) are as follows:
\[
\varphi(q) := f(q, q) = \sum_{n=-\infty}^{\infty} q^{n^2} = \frac{(-q; q)_{\infty}}{(q; q)_{\infty}},
\]

\[
\psi(q) := f(q, q^3) = \sum_{n=0}^{\infty} q^{n(n+1)/2} = \frac{(q^2; q^2)_{\infty}}{(q; q)_{\infty}},
\]

\[
f(-q) := \sum_{n=-\infty}^{\infty} q^{n(3n-1)/2} = (q; q)_{\infty},
\]

where

\[
(a; q)_{\infty} := \prod_{n=0}^{\infty} (1 - a q^n), \quad |q| < 1.
\]

Now we define a modular equation in brief. The ordinary hypergeometric series \( \genfrac{[}{]}{0pt}{}{2}{1} \) is defined by

\[
\genfrac{[}{]}{0pt}{}{2}{1}(a, b; c; x) := \sum_{n=0}^{\infty} \frac{(a)_n (b)_n}{(c)_n n!} x^n,
\]

where \((a)_0 = 1, (a)_n = a(a + 1)(a + 2) \cdots (a + n - 1)\) for any positive integer \(n\), and \(|x| < 1\).

Let

\[
z := z(x) := \genfrac{[}{]}{0pt}{}{2}{1}\left(\frac{1}{2}, \frac{1}{2}; 1; x\right)
\]

and

\[
q := q(x) := \exp\left\{-\pi \frac{\genfrac{[}{]}{0pt}{}{2}{1}\left(\frac{1}{2}, \frac{1}{2}; 1; 1-x\right)}{\genfrac{[}{]}{0pt}{}{2}{1}\left(\frac{1}{2}, \frac{1}{2}; 1; x\right)}\right\},
\]

where \(0 < x < 1\).

Let \(r\) denote a fixed natural number and assume that the following relation holds:

\[
\frac{\genfrac{[}{]}{0pt}{}{2}{1}\left(\frac{1}{2}, \frac{1}{2}; 1; 1-\alpha\right)}{\genfrac{[}{]}{0pt}{}{2}{1}\left(\frac{1}{2}, \frac{1}{2}; 1; \alpha\right)} = \frac{\genfrac{[}{]}{0pt}{}{2}{1}\left(\frac{1}{2}, \frac{1}{2}; 1; 1-\beta\right)}{\genfrac{[}{]}{0pt}{}{2}{1}\left(\frac{1}{2}, \frac{1}{2}; 1; \beta\right)}.
\]

Then a modular equation of degree \(r\) in the classical theory is a relation between \(\alpha\) and \(\beta\) induced by (9). We often say that \(\beta\) is of degree \(r\) over \(\alpha\) and \(m := \frac{z(\alpha)}{z(\beta)}\) is called the multiplier. We also use the notations \(z_1 := z(\alpha)\) and \(z_r := z(\beta)\) to indicate that \(\beta\) has degree \(r\) over \(\alpha\).

In [4] and [18], the authors have defined two parameters \(l_{k,n}\) and \(l'_{k,n}\) as follows:

\[
l_{k,n} := \frac{\psi(-e^{-\pi \sqrt{n/k}})}{k^{1/4} e^{\frac{(k-1)\pi}{8 \sqrt{n/k}}} \psi(-e^{-\pi \sqrt{n/k}})},
\]

and
They have established several properties and some explicit evaluations of $l_{k,n}$ and $l'_{k,n}$ for different positive rational values of $n$ and $k$. Recently, M. S. Mahadeva Naika, S. Chandankumar, K. Sushan Bairy [10, 11] have established several new modular equations and also established general formulas for explicit evaluations of the ratios of Ramanujan's theta function $\psi$.

In Section 3, we collect several results which are useful to prove our main theorems. In Section 4, we prove several new $P-Q$ modular equations for the ratios of Ramanujan's theta function. In Section 5, we establish some general formulas for explicit evaluations of $l_{5,n}$ and $l'_{5,n}$. In Section 6, we establish several new modular relations connecting $\kappa(q)$ with $\kappa(q^n)$. In Section 7, we establish several new modular relations connecting $\nu(q)$ with $\nu(q^n)$. In Section 8, we establish some new modular relations connecting $\kappa(q)$, $\nu(q)$ and $\mu(q)$.

Preliminary results

In this section, we collect several identities which are useful in proving our main results.

**Lemma 3.1** [13, p. 56] [9] We have

$$
\frac{f^3(-q)}{f^3(-q^5)} = \frac{\psi(q)}{\psi(q^5)} \left( \frac{\psi(q) - 5\psi(q^5)}{\psi(q) - q\psi(q^5)} \right),
$$

(12)

$$
\frac{f^6(-q^2)}{f^6(-q^{10})} = \frac{\psi^2(q)}{\psi^2(q^5)} \left( \frac{\psi^2(q) - 5\psi^2(q^5)}{\psi^2(q) - q\psi^2(q^5)} \right),
$$

(13)

$$
\frac{f^s(-q^2)}{qf^s(-q^{10})} = \frac{\varphi(q)}{\varphi(q^5)} \left( \frac{5\varphi^2(q^5) - \varphi^2(q)}{\varphi^2(q) - \varphi^2(q^5)} \right),
$$

(14)

$$
\frac{f^4(-q)}{qf^4(-q^5)} = \frac{\varphi^4(-q)}{\varphi^4(-q^5)} \left( \frac{5\varphi^2(-q^5) - \varphi^2(-q)}{\varphi^2(-q) - \varphi^2(-q^5)} \right).
$$

(15)

**Lemma 3.2** [13, p. 56] [9] We have

$$
\frac{\psi^2(q)}{q\psi^2(q^5)} = \frac{1 + \kappa(q) - \kappa^2(q)}{\kappa(q)}.
$$

(16)

**Lemma 3.3** [3, Entry 1.8.1, p. 33] [9] We have

$$
\frac{\psi(q)}{q^2\psi(q^5)} = \frac{1 + \nu(q)}{1 - \nu(q)}.
$$

(17)

**Lemma 3.4** [13, p.26] [9] We have
Lemma 3.5 [13, Entry 1.6.2(i), p.50] We have
\[
16qf^2(-q^5)f^2(-q^{10}) = (\varphi^2(q) - \varphi^2(q^5))(5\varphi^2(q^5) - \varphi^2(q)).
\]
\[
(18)
\]
Lemma 3.6 [5, Ch. 16, Entry 24 (i), p.39] We have
\[
\psi(q^5)\psi(q^{11}) - q^5\psi(q)\psi(q^{55}) = \psi(-q^5)\psi(-q^{11}) + q^5\psi(q)\psi(q^{55}).
\]
\[
(19)
\]
Lemma 3.7 [5, Ch. 16, Corollary (ii), p.74] We have
\[
\psi(q^5)\psi(q^{11}) - q^5\psi(q)\psi(q^{55}) = \psi(-q^5)\psi(-q^{11}) + q^5\psi(q)\psi(q^{55}).
\]
\[
(20)
\]
Lemma 3.8 [13, p. 55]
If \(x = \frac{f(-q)}{q^5 f(-q^5)}\) and \(y = \frac{f(-q^2)}{q^7 f(-q^{10})}\), then
\[
xy + \frac{5}{xy} = \left(\frac{x}{y}\right)^3 + \left(\frac{y}{x}\right)^3.
\]
\[
(22)
\]
Lemma 3.9 [13, p. 55]
If \(x = \frac{f(-q)}{q^5 f(-q^5)}\) and \(y = \frac{f(-q^4)}{q^7 f(-q^{20})}\), then
\[
(xy)^3 + \left(\frac{5}{xy}\right)^3 = \left(\frac{x}{y}\right)^5 + \left(\frac{y}{x}\right)^5 - 8\left\{\left(\frac{x}{y}\right)^3 + \left(\frac{y}{x}\right)^3\right\}
\]
\[
+4\left(\frac{x}{y} + \frac{y}{x}\right) + 4 \left(\frac{x}{y} + \frac{y}{x}\right).
\]
\[
(23)
\]
Lemma 3.10 [13, p. 55]
If \(x = \frac{f(-q)}{q^5 f(-q^5)}\) and \(y = \frac{f(-q^5)}{q^6 f(-q^{25})}\), then
\[
(xy)^2 + \left(\frac{5}{xy}\right)^2 + 5\left(xy + \frac{5}{xy}\right) + 15 = \left(\frac{y}{x}\right)^3.
\]
\[
(24)
\]
Lemma 3.11 [5, Ch 20, Entry 18 (vi) and (vii), p.423]
If \( \beta \), \( \gamma \) and \( \delta \) are of degrees 5, 7 and 35 respectively over \( \alpha \), then
\[
\left( \frac{\alpha \delta}{\beta \gamma} \right)^{1/8} + \left( \frac{(1-\alpha)(1-\delta)}{(1-\beta)(1-\gamma)} \right)^{1/8} - \left( \frac{\alpha \delta(1-\alpha)(1-\delta)}{\beta \gamma(1-\beta)(1-\gamma)} \right)^{1/8} + 2 \left( \frac{\alpha \delta(1-\alpha)(1-\delta)}{\beta \gamma(1-\beta)(1-\gamma)} \right)^{1/12} = \frac{m}{\sqrt{m}},
\]
\[
\left( \frac{\beta \gamma}{\alpha \delta} \right)^{1/8} + \left( \frac{(1-\beta)(1-\gamma)}{(1-\alpha)(1-\delta)} \right)^{1/8} - \left( \frac{\beta \gamma(1-\beta)(1-\gamma)}{\alpha \delta(1-\alpha)(1-\delta)} \right)^{1/8} + 2 \left( \frac{\beta \gamma(1-\beta)(1-\gamma)}{\alpha \delta(1-\alpha)(1-\delta)} \right)^{1/12} = -\frac{m}{\sqrt{m}}.
\]

Lemma 3.12 [5, Ch. 17, Entry 10(i) and Entry 11(ii), pp. 122--123] We have
\[
\varphi(q) = \sqrt{z},
\]
\[
\sqrt{2} q^{1/8} \psi(-q) = \sqrt{z} \{ \alpha(1-\alpha) \}^{1/8}.
\]

Lemma 3.13 [1, Theorem 5.1]
If \( P = \frac{\psi(-q)}{q^{1/2} \psi(-q^5)} \) and \( Q = \frac{\varphi(q)}{\varphi(q^5)} \), then
\[
Q^2 + P^2 Q^2 = 5 + P^2.
\]

Lemma 3.14 [3, Ch. 25, Entry 66, p. 233]
If \( P = \frac{\psi(q)}{q^{1/2} \psi(q^5)} \) and \( Q = \frac{\psi(q^3)}{q^{3/2} \psi(q^{15})} \), then
\[
PQ + \frac{5}{PQ} = -\left( \frac{P}{Q} \right)^2 + \left( \frac{Q}{P} \right)^2 + 3 \left( \frac{P}{Q} + \frac{Q}{P} \right).
\]

Lemma 3.15 [4]
If \( P = \frac{\psi(q)}{q^{1/2} \psi(q^5)} \) and \( Q = \frac{\psi(q^2)}{q^{2/2} \psi(q^{10})} \), then
\[
\left( \frac{P}{Q} \right)^2 + \left( \frac{Q}{P} \right)^2 + 4 = P^2 + \frac{5}{P^2}.
\]
Lemma 3.16 [4]

If \( P := \frac{\psi(q)}{q^{1/2} \psi(q^5)} \) and \( Q := \frac{\psi(-q)}{q^{1/2} \psi(-q^5)} \), then

\[
\frac{P^2}{Q^2} + \frac{Q^2}{P^2} + \left( P^2 + \frac{5}{P^2} \right) = \left( Q^2 + \frac{5}{Q^2} \right) + 6. \tag{32}
\]

Modular equations for ratios of Ramanujan's theta function

In this section, we establish some new modular equations for ratios of Ramanujan's theta function.

**Theorem 4.1** If \( P := \frac{\psi(q)}{q^{1/2} \psi(q^5)} \) and \( Q := \frac{\varphi(q)}{\varphi(q^5)} \), then

\[
\left( \frac{P}{Q} \right)^2 + \left( \frac{Q}{P} \right)^2 + 4 = P^2 + \frac{5}{P^2}. \tag{33}
\]

**Proof.** Cubing the equation (22) and using the equations (12) and (14), we find that

\[
(P^4 - 5P^2 + 4P^2Q^2 - P^2Q^4 + Q^4)(P^4Q^2 - P^4 - 4P^2Q^2 + 5Q^2 - Q^4) \nonumber
\]

\[
(P^2Q^2 - P^2 + 5 - Q^2)(25 - 10P^2 - 10Q^2 + P^4 - 2P^4Q^2 + P^4Q^4 - 4P^2Q^2) \nonumber
\]

\[
-16P^2Q + 16Q^5P - 2P^2Q^4 + Q^4)(25 - 10P^2 - 10Q^2 + P^4 - 2P^4Q^2 + P^4Q^4 - 4P^2Q^2) \nonumber
\]

\[
+P^4Q^4 - 4P^2Q^2 + 16P^2Q - 16Q^5P - 2P^2Q^4 + Q^4) = 0. \tag{34}
\]

By examining the behavior of the above factors near \( q = 0 \), we can find a neighborhood about the origin, where the second factor is zero; whereas other factors are not zero in this neighborhood. By the Identity Theorem second factor vanishes identically. This completes the proof.

**Theorem 4.2** If \( P := \frac{\psi(-q)\psi(-q^2)}{q^2\psi(-q^5)\psi(-q^{10})} \) and \( Q := \frac{\psi(-q)\psi(-q^{10})}{q^{2/3} \psi(-q^5)\psi(-q^{25})} \), then

\[
Q^4 + \frac{1}{Q^4} + \left( Q^2 + \frac{1}{Q^2} \right) = P^2 + \frac{25}{P^2} + \left( P + \frac{5}{P} \right) \left[ 5 \left( Q + \frac{1}{Q} \right) - \left( Q^2 + \frac{1}{Q^2} \right) \right] + 30. \tag{35}
\]

**Proof.** Cubing the equation (23), we deduce that
\[
a^{16} - 22500a^6b^{24} - 1020a^{24}b^{18} - 7420b^{24}a^{12} - 22500a^{24}b^6 - a^{30}b^{24} - 7420a^{24}b^{12} - 1953125a^{12}b^6 - 127500a^{12}b^{18} - 1953125b^{12}a^6 \\
- 391b^6 - 391a^6b^{30} - a^{24}b^{30} - 937500a^{12}b^{12} - 375000a^6b^{18} \\
- 16380a^{18}b^{18} - 60a^{24}b^{24} - 24a^{18}b^{30} - 24a^{30}b^{18} - 180a^{30}b^{12} \\
- 180a^{12}b^{30} - 127500b^{12}a^6 - 375000b^6a^{18} - 1020a^{18}b^{24} + b^{36} = 0.
\]

where

\[
a = \frac{f(-q)}{q^6f(-q^5)} \quad \text{and} \quad b = \frac{f(-q^4)}{q^2f(-q^{10})}.
\]

Using the equations (12) and (13) in the above equation (36), we find that

\[
(N^2M^4 + M^4 - 4N^2M^2 + 5N^2 + N^4)(M^2N^8 - 5N^6 + 5M^6 - M^8 - N^8 + 4N^6M^8 \\
- 25N^2M^4 - 25N^4M^2 + 30N^4M^4 + M^2N^6 + 5M^4N^6 + N^2M^6 + N^8 \\
- N^2M^8 - 5N^4 + N^6M^8)(625 + 500N^2 + 150N^4 + 150M^4 + 20N^6 - 4N^8M^6 \\
- 20M^6 + M^8 - 4M^2N^8 + 40N^2M^4 - 40N^4M^2 + 660N^4M^4 + 6M^4N^8 + N^8M^8 \\
+ 224M^2N^6 + 8M^4 + 224M^2 + 4N^2M^8 - 500M^2 + 8N^6M^8 + 6N^4M^8) \\
(-N^6 - 109375M^4 + 65625M^6 - 21875M^8 + 4375M^{10} - 525M^{12} - 7M^{12}N^{16} \\
+ 804N^8M^{14} + 304M^2N^{14} + 7M^2N^{16} - 21M^4N^{16} - 1024M^4N^{14} + 35M^6N^{16} \\
- 896M^8N^{14} + 400M^{10}N^{14} - 128M^{12}N^{14} + 16M^{14}N^{14} - 35M^8N^{16} + 21M^{10}N^{16} \\
+ 27600N^{10}M^2 + 100500M^2N^8 + 250000N^2M^2 + 78125M^2 - 400000N^2M^4 \\
- 87680N^{10}M^4 + 4280N^{12}M^2 - 14336N^{12}M^4 + 250000N^2M^6 - 112000N^2M^8 \\
+ 110672N^4M^{10} - 17536N^2M^{12} + 1104N^6M^{14} + 110672N^4M^{10} - 67968N^{10}M^8 \\
+ 21104N^{10}M^{10} - 4096N^{10}M^{12} + 368N^{10}M^{14} + 17976N^{12}M^6 - 10816N^{12}M^8 \\
+ 33200N^2M^{10} - 5120N^2M^{12} + 304N^2M^{14} + 469000N^4M^6 - 270400N^4M^8 \\
- 600000N^4M^8 + 230000M^2N^8 - 277000M^4N^8 - 512000M^4N^8 + M^{14}N^{16} \\
+ 3752N^{12}M^{10} - 960N^{12}M^{12} + 104N^{12}M^{14} + 337020N^8M^6 - 217648N^8M^8 \\
+ 89880N^4M^{10} - 14336N^4M^{12} + 856N^4M^{14} + 527600N^6M^6 - 339840N^6M^8 \\
+ 67404N^8M^{10} - 11080N^8M^{12} + 325000N^4M^2 - M^{16} + 1328M^8N^{14} = 0.
\]

where

\[
M := \frac{\psi(q)}{q \psi(q^5)} \quad \text{and} \quad N := \frac{\psi(-q^2)}{q^4 \psi(-q^{10})}.
\]

By examining the behavior of the above factors near \( q = 0 \), we can find a neighborhood about the origin, where the second factor is zero; whereas other factors are not zero in this neighborhood. By the Identity Theorem second factor vanishes identically. Changing \( q \) to \( -q \) in the second factor, we arrive at the equation (35).
Theorem 4.3 If \( P := \frac{\psi(q)}{q^2 \psi(q^5)} \) and \( Q := \frac{\psi(q^4)}{q^2 \psi(q^{20})} \), then
\[
\frac{P^4}{Q^4} + \frac{Q^8}{P^4} + 24 \left( \frac{P^2}{Q^2} + \frac{Q^2}{P^2} \right) + 8 \left( P^2 Q^2 + \frac{25}{P^2 Q^2} \right) - 20 \left( Q^2 + \frac{5}{Q^2} \right) + 120
\]
\[
+ 3 \left( P^4 + \frac{25}{P^4} \right) - 32 \left( P^2 + \frac{5}{P^2} \right) = P^4 \left( Q^2 + \frac{3}{Q^2} \right) + \frac{5}{P^4} \left( 3Q^2 + \frac{25}{Q^2} \right).
\]

Proof. Using the equations (12) and (23), we arrive at (38).

Theorem 4.4 If \( P := \frac{\psi(-q)}{q^2 \psi(-q^5)} \) and \( Q := \frac{\psi(-q^4)}{q^2 \psi(-q^{20})} \), then
\[
Q^8 + \frac{1}{Q^8} - 19 \left( Q^6 + \frac{1}{Q^6} \right) - 419 \left( Q^4 + \frac{1}{Q^4} \right) - 1327 \left( Q^2 + \frac{1}{Q^2} \right) - 2332
\]
\[
+ \left( P + \frac{5}{P} \right) \left[ Q^7 + \frac{1}{Q^7} - 44 \left( Q^5 + \frac{1}{Q^5} \right) - 295 \left( Q^3 + \frac{1}{Q^3} \right) - 672 \left( Q + \frac{1}{Q} \right) \right]
\]
\[
- \left( P^2 + \frac{5^2}{P^2} \right) \left[ 28 \left( Q^4 + \frac{1}{Q^4} \right) + 109 \left( Q^2 + \frac{1}{Q^2} \right) + 132 \right] \left( P^3 + \frac{5^3}{P^3} \right)
\]
\[
\times \left[ 13 \left( Q + \frac{1}{Q} \right) + 9 \left( Q^2 + \frac{1}{Q^2} \right) \right] - \left( P^4 + \frac{5^4}{P^4} \right) \left[ Q^2 + \frac{1}{Q^2} \right] = 0.
\]

Proof. Using the equations (32) and (38), we arrive at the equation (39).

Theorem 4.5 If \( P := \frac{\psi(-q)}{q^{1/2} \psi(-q^5)} \) and \( Q := \frac{\psi(-q^5)}{q^{1/2} \psi(-q^{25})} \), then
\[
\frac{Q^3}{P^3} - \frac{5Q^2}{P^2} - \frac{15Q}{P} - 5 \left( PQ + \frac{5}{PQ} \right) - 5 \left( Q^2 + \frac{5}{Q^2} \right)
\]
\[
- P^2 Q^2 + \frac{5^2}{P^2 Q^2} - 15 = 0.
\]

Proof. Using the equation (12) in the equation (24), we deduce that
\[
(-90P^3Q^2 + 75PQ^2 + 2Q^3P^2 - 10QP^2 - 75P + 15P^5Q^2 + 90P^3 + 5Q \left( Q^3 - 15P^3 - P^3Q^3 + 5P^4Q \right)x^2y^2 + (25Q^3P^2 - 125QP^2 + 50P^4Q)
\]
\[
+ 25P^5Q^2 + P^5Q^3 + 125PQ^2 + 150P^3 - 125P - 150P^3Q^2 - 25P^3 - 5P^5Q
\]
\[
- 10P^5Q^3)xy - 150P^3Q^2 + 250P^4Q + 25P^4Q^2 + 5P^6Q^3 - 125P - 25P^5
\]
\[
- 625QP^2 + 125Q^3P^2 + 150P^3 - 50P^4Q^3 + 125PQ^2 - 25P^6Q = 0,
\]
where  
\[ x = \frac{f(-q)}{q^{1/6} f(-q^5)} \quad \text{and} \quad y = \frac{f(-q^5)}{q^{1/6} f(-q^{25})}. \]

Solving the above quadratic equation for \( xy \) and then cubing both sides, we find that
\[
\begin{align*}
-Q^6 + 5PQ^4 - 25PQ^2 - 5QP^3 + 25PQ^3 - 5Q^4P^3 + 15Q^2P^3 \\
-5P^4Q + 3125P^4Q - 105600P^4Q^3 - 948000Q^5P^5 + 9Q^6P^{10} \\
-13125P^2 + 45625Q^2P^2 - 16250P^6 + 21250P^4 + 1250Q^4 + 625P^{10} \\
+40000P^3Q - 12500QP - 250Q^6 + 28900P^6Q^6 \\
-45000P^2Q - 95250Q^2P^4 + 144500P^8Q^3 + 37650P^2Q^5 - 55250P^2Q^5 \\
+67250P^6Q^2 - 77700P^6Q^4 + 20000(Q^3P + PQ^7) - 15625Q^2P^6 - Q^{10} \\
+13450Q^4P^8 - 3810Q^6P^8 + 24000Q^8P^7 + 5625P^{10} + 120000P^5Q^5 \quad (42) \\
-650Q^4P^5 + 170P^9Q^5 + 211200Q^7P^3 - 41600Q^7P^3 - 32320Q^7P^3 \\
-2210Q^6P^6 + 3650Q^8P^8 - 21Q^8P^{10} + 3270Q^7P^9 + 4800Q^7P^9 + 25Q^8 \\
-5Q^{10}P^8 - 10Q^{10}P^4 + 160Q^9P^7 - 296Q^9P^7 - 20Q^9P^9 - 7400PQ^5 \\
+960P^3Q^9 + 220PQ^9 - 104000P^3Q^8 - 72900P^3Q^8 + 1125Q^7P^{10} \\
-2500PQ^9 - 46650Q^9P^2 + 5P^2Q^{10} - 1800Q^5P^9 + 10Q^{10}P^6 + 7530Q^8P^8 \) \\
(-Q^3P^2 - 75PQ^2 - 15P^3 + 15Q^2P^3 + Q^7 + 5P^2Q^2 + 75P - 5Q)^3 = 0
\end{align*}
\]

By examining the behavior of the above factors near \( q = 0 \), we can find a neighborhood about the origin, where the first factor is zero; whereas other factors are not zero in this neighborhood. By the Identity Theorem first factor vanishes identically. Replacing \( q \) to \( -q \) in the first factor, we arrive at the equation (40).

**Theorem 4.6** If  
\[ P := \frac{\psi(-q)\psi(-q^7)}{q^3\psi(-q^5)\psi(-q^{35})} \quad \text{and} \quad Q := \frac{\psi(-q)\psi(-q^{35})}{q^3\psi(-q^5)\psi(-q^{7})}, \]
then
\[
\begin{align*}
Q^4 - \frac{1}{Q^6} + 14\left[ Q^3 + \frac{1}{Q^3} \right] + \left( Q^2 - \frac{1}{Q} \right) + 10 \left( Q + \frac{1}{Q} \right) + P^3 + \frac{5}{P^3} \\
+ 7 \left[ P^2 + \frac{5}{P^2} \right] \left( P + \frac{1}{P} \right) + \left( P + \frac{5}{P} \right) \left( 2 \left( Q^2 + \frac{1}{Q^2} \right) + 9 \right) \right] = 0. \quad (43)
\end{align*}
\]

**Proof.** Using the equations (25), (26), (27) and (28), we deduce that
\[ 1 + r - 2Ar + sr - s + 2A^2r = 0, \quad (44) \]
where
\[
r := \frac{q^3\psi(-q)\psi(-q^{35})}{\psi(-q^5)\psi(-q^7)}, \quad s := \frac{\varphi(q)\varphi(q^{35})}{\varphi(q^5)\varphi(q^7)} \quad \text{and} \quad A := (s / r)^{1/3}.
\]

On simplification of the equation (44), we find that
\[ 2A = 1 + M, \quad (45) \]
where
Cubing both sides of the equation (45) and eliminating $M$, we deduce that

$$14d^3c^2 + d^5c^2 - 2d^3s - 8c^4d^2 - c^3d^4 + 6c^4d^3 + 3c^4d^3 + 4sc^5 + 5c^2ds$$

$$+ c^5d^2 + 2c^5 - 5sd^3 - 5cd^2 + 15e^2d + 4d^3 + 5c^3 + 5c^3s + 5d^3 - 6d^3e^2s$$

$$- d^5c^2s + 6cd^4s + 14c^3d^3s + 3c^4d^3s + 8e^4ds + c^4d^3s + c^5d^2s + 15cd^2s = 0,$$

(46)

where

$$c := \frac{\psi(-q)}{q^{1/2}q(q)} \quad \text{and} \quad d := \frac{\psi(-q)}{q^{7/2}q(q)}.$$

Collecting the terms containing $s$ on one side of the above equation (46) and squaring both sides and then using the equation (29), we arrive at the equation (43).

**Theorem 4.7** If $P := \frac{\psi(-q)\psi(-q^{11})}{q^6\psi(q)(q)}$ and $Q := \frac{\psi(-q)\psi(-q^{55})}{q^5\psi(q)(q)}$, then

$$Q^6 + \frac{1}{Q^6} - 33\left(Q^2 + \frac{1}{Q^2}\right) - 99\left(Q^4 + \frac{1}{Q^4}\right) - 1529\left(Q^3 + \frac{1}{Q^3}\right)$$

$$- 1683\left(Q^2 + \frac{1}{Q^2}\right) - 8800\left(Q + \frac{1}{Q}\right) - 6534\left(P^2 + \frac{5^3}{P^3}\right)$$

$$- 11\left(P^4 + \frac{5^2}{P^2}\right)\left(Q + \frac{1}{Q}\right) + \left(P^3 + \frac{5^3}{P^3}\right)\left[11 + 4\left(Q^2 + \frac{1}{Q^2}\right)\right]$$

$$+ \left(P^2 + \frac{5^2}{P^2}\right)\left[18 + 56\left(Q + \frac{1}{Q}\right) + 3\left(Q^2 + \frac{1}{Q^2}\right) + 8\left(Q^3 + \frac{1}{Q^3}\right)\right]$$

$$+ \left(P + \frac{5}{P}\right)\left[324 + 126\left(Q + \frac{1}{Q}\right) + 160\left(Q^2 + \frac{1}{Q^2}\right) + 18\left(Q^3 + \frac{1}{Q^3}\right)\right]$$

$$+ 9\left(Q^4 + \frac{1}{Q^4}\right) + \left(P^3 + \frac{5^3}{P^3}\right)\left[11 + 4\left(Q^2 + \frac{1}{Q^2}\right)\right] = 0.$$

(47)

**Proof.** Replacing $q$ by $-q$ in the equation (19), we deduce that

$$-16qf^2(-q^2)f^2(-q^{10}) = \varphi^4(-q^5)\left[\frac{\varphi^2(-q)}{\varphi^2(-q^5)} - 1\right]\left[5 - \varphi^2(-q)\right].$$

(48)

Using the equations (48) and (19), we find that

$$\frac{\varphi^4(q^5)}{\varphi^4(-q^5)} = \left[\frac{\varphi^2(-q)}{\varphi^2(-q^5)} - 1\right]\left[\frac{\varphi^2(-q)}{\varphi^2(-q^5)} - 5\right].$$

(49)
Replacing $q$ by $q^{11}$ in the above equation (49), we deduce that

$$\frac{\varphi^4(q^{55})}{\varphi^4(-q^{55})} = \frac{\varphi^2(-q^{11})}{\varphi^2(-q^{55})} - 1 \frac{\varphi^2(-q^{11})}{\varphi^2(-q^{55})} - 5 \frac{\varphi^2(-q^{11})}{\varphi^2(-q^{55})} - 5. \quad (50)$$

Employing the equation (20) along with the equations (49) and (50), we deduce that

$$\frac{\psi(q^3)\psi(q^{55})}{\psi(-q^5)\psi(-q^{55})} = \frac{\varphi^2(-q)}{\varphi^2(-q^5)} - 1 \frac{\varphi^2(-q)}{\varphi^2(-q^5)} - 5 \frac{\varphi^2(q)}{\varphi^2(q^5)} - 1 \frac{\varphi^2(q)}{\varphi^2(q^5)} - 5 \frac{\varphi^2(q)}{\varphi^2(q^5)} - 5. \quad (51)$$

The equation (21) can be re arranged as,

$$\left[ \frac{\psi(q^3)\psi(q^{55})}{\psi(-q^5)\psi(-q^{55})} \right] = \left[ \frac{\psi(-q^{11})}{q^{11} \psi(-q^{55})} - \frac{\psi(q)}{q^{11} \psi(q^5)} \right]^{11}. \quad (52)$$

Using the equations (51) and (52), we deduce that

$$\left[ \frac{\varphi^2(-q)}{\varphi^2(-q^5)} - 1 \frac{\varphi^2(-q)}{\varphi^2(-q^5)} - 5 \frac{\varphi^2(q)}{\varphi^2(q^5)} - 1 \frac{\varphi^2(q)}{\varphi^2(q^5)} - 5 \frac{\varphi^2(q)}{\varphi^2(q^5)} - 5 \right]$$

$$= \left[ \frac{\psi(-q^{11})}{q^{11} \psi(-q^{55})} - \frac{\psi(q)}{q^{11} \psi(q^5)} \right]^{11}. \quad (53)$$

Using the equations (29), (32) and (33) in the above equation (53), we arrive at the equation (47). This completes the proof.

**General formulas for explicit evaluations for ratios of Ramanujan's theta-functions**
In this section, we establish some general formulas for the explicit evaluations of the ratios of Ramanujan's theta function \( \psi(q) \).

**Theorem 5.1** If \( X := \frac{l_{5, n} l_{5, 4n}}{l_{5, 4n}} \) and \( Y := \frac{l_{5, n}}{l_{5, 4n}} \), then

\[
Y^4 + \frac{1}{Y^4} + \left( Y^2 + \frac{1}{Y^2} \right) = 5\left( X^2 + \frac{1}{X^2} \right)
+ \sqrt{5}\left( X + \frac{1}{X} \right)\left[ 5\left( Y + \frac{1}{Y} \right) - \left( Y^3 + \frac{1}{Y^3} \right) \right] + 30. \tag{54}
\]

**Proof.** Using the equation (35) along with the equation (10), we arrive at the equation (54).

**Corollary 5.1** We have

\[
l_{5, 2} = \sqrt{2} + 1, \tag{55}
\]
\[
l_{5, 1/2} = \sqrt{2} - 1, \tag{56}
\]

\[
l_{5, 4} = \left( 1 + \frac{\sqrt{11 + 5\sqrt{5}}}{2} + \frac{\sqrt{4\sqrt{11 + 5\sqrt{5}} + 11 + 5\sqrt{5}}}{2} \right)^{1/2}, \tag{57}
\]

\[
l_{5, 1/4} = \left( 1 + \frac{\sqrt{11 + 5\sqrt{5}}}{2} - \frac{\sqrt{4\sqrt{11 + 5\sqrt{5}} + 11 + 5\sqrt{5}}}{2} \right)^{1/2}, \tag{58}
\]

\[
l_{5, 8} = \left( \sqrt{32 + 14\sqrt{5} + 10\sqrt{10} + 22\sqrt{2} + \sqrt{34 + 15\sqrt{5} + 11\sqrt{10} + 24\sqrt{2}}} \right)^{1/2}, \tag{59}
\]

\[
l_{5, 1/8} = \left( \sqrt{34 + 15\sqrt{5} + 11\sqrt{10} + 24\sqrt{2} - \sqrt{32 + 14\sqrt{5} + 10\sqrt{10} + 22\sqrt{2}}} \right)^{1/2}, \tag{60}
\]

**Proofs of (55) and (56).** Putting \( n = 1/2 \) in the equation (54) and using the fact that \( l_{5, 2} l_{5, 1/2} = 1 \), we deduce that

\[
(l_{5, 2}^4 - 2l_{5, 2}^2 - 1)(l_{5, 2}^4 + 2l_{5, 2}^2 - 1)(2l_{5, 2}^2 - 1 + \sqrt{5})^2(2l_{5, 2}^2 + 1 + \sqrt{5})^2 = 0. \tag{61}
\]

We observe that the first factor of the equation (61) vanishes for the specific value of \( q = e^{-\pi \sqrt{5}} \), but the other two factors does not vanish. Hence, we deduce that

\[
l_{5, 2}^4 - 2l_{5, 2}^2 - 1 = 0. \tag{62}
\]
Solving the above equation (62), we arrive at the equations (55) and (56).

Proofs of (57) and (58). Putting \( n = 1 \) in the equation (54) and by using the fact that \( l_{5,1} = 1 \), we deduce that
\[
l_{5,1}^2 - 4l_{5,1}^6 - l_{5,1}^4(5\sqrt{5} + 5) - 4l_{5,1}^2 + 1 = 0.
\]
(63)
The above equation (63) can be rewritten as
\[
x^2 - 4x - 5\sqrt{5} - 7 = 0, \text{ where } x := l_{5,4}^2 + \frac{1}{l_{5,4}^2}.
\]
(64)
Solving the above equation for \( x \) and \( x > 1 \), we deduce that
\[
l_{5,4}^2 + \frac{1}{l_{5,4}^2} = 2 + (11 + 5\sqrt{5})^{1/2}.
\]
(65)
On solving the above equation (65), we arrive at the equations (57) and (58).

Proofs of (59) and (60). Using the equation (55) in the equation (54), we obtain the equations (59) and (60).

Theorem 5.2 If \( X := l_{5,n} \) and \( Y := l_{5,25n} \), then
\[
\frac{Y^3}{X^3} - \frac{5Y^2}{X^2} - \frac{15Y}{X} - 5\sqrt{5} \left( XY + \frac{1}{XY} \right) - 5\sqrt{5} \left( Y^2 + \frac{5}{X^2} \right) - 5 \left( X^2Y^2 + \frac{1}{X^2Y^2} \right) - 15 = 0.
\]
(66)

Proof. Using the equation (40) along with the equation (10), we arrive at the equation (66).

Corollary 5.2 We have
\[
l_{5,5} = \sqrt{5 + 2\sqrt{5}},
\]
(67)
\[
l_{5,1/5} = \frac{\sqrt{5 - 2\sqrt{5}}}{\sqrt{5}}.
\]
(68)

Proofs of (67) and (68). Putting \( n = 1/5 \) in the equation (66) and using the fact that \( l_{5,5}l_{5,1/5} = 1 \), we deduce that
\[
(l_{5,5}^2 - 5 - 2\sqrt{5})(l_{5,5}^2 + \sqrt{5})^2 = 0.
\]
(69)
Since \( l_{5,5} > 0 \), hence by solving the equation \( l_{5,5}^2 - 5 - 2\sqrt{5} = 0 \), we arrive at the equations (67) and (68).
Theorem 5.3 If \( X := l_{s,n}l_{s,12n} \) and \( Y := \frac{l_{s,n}}{l_{s,12n}} \), then

\[
Y^6 + \frac{1}{Y^6} - 33 \left( Y^5 + \frac{1}{Y^5} \right) - 99 \left( Y^4 + \frac{1}{Y^4} \right) - 1529 \left( Y^3 + \frac{1}{Y^3} \right) \\
-1683 \left( Y^2 + \frac{1}{Y^2} \right) - 8800 \left( Y + \frac{1}{Y} \right) - 6534 - 25\sqrt{5} \left( X^5 + \frac{1}{X^5} \right) \\
-11\sqrt{5} \left[ 5\sqrt{5} \left( X^4 + \frac{1}{X^4} \right) \left( Y + \frac{1}{Y} \right) + 5 \left( X^3 + \frac{1}{X^3} \right) \left[ 11 + 4 \left( Y^2 + \frac{1}{Y^2} \right) \right] \\
+\sqrt{5} \left( X^2 + \frac{1}{X^2} \right) \left[ 18 + 56 \left( Y + \frac{1}{Y} \right) + 3 \left( Y^2 + \frac{1}{Y^2} \right) + 8 \left( Y^3 + \frac{1}{Y^3} \right) \right] \\
+ \left( X + \frac{1}{X} \right) \left[ 324 + 126 \left( Y + \frac{1}{Y} \right) + 160 \left( Y^2 + \frac{1}{Y^2} \right) + 18 \left( Y^3 + \frac{1}{Y^3} \right) \right] \\
+9 \left( Y^4 + \frac{1}{Y^4} \right) \right] = 0.
\]

(70)

Proof. Using the equation (47) along with the equation (10), we arrive at the equation (70).

Corollary 5.3 We have

\[
l_{5,11} = \sqrt{12 + 5\sqrt{5} + 2\sqrt{67} + 30\sqrt{5}},
\]

(71)

\[
l_{5,1/11} = \sqrt{12 + 5\sqrt{5} - 2\sqrt{67} + 30\sqrt{5}}.
\]

(72)

Proofs of (71) and (72). Putting \( n = 1/11 \) in the equation (70) and using the fact that \( l_{s,11}l_{s,1/11}^{-1} = 1 \), we deduce that

\[
(2l_{s,11}^4 + (3 + \sqrt{5})l_{s,11}^2 + 2)\left(-l_{s,11}^4 + (24 + 10\sqrt{5})l_{s,11}^2 - 1\right) \\
(2l_{s,11}^8 + (3 + 3\sqrt{5})l_{s,11}^6 + (30 - 6\sqrt{5})l_{s,11}^4 + (3 + 3\sqrt{5})l_{s,11}^2 + 2) \\
(l_{s,11}^4 - (6 - 4\sqrt{5})l_{s,11}^2 + 1)^2 = 0.
\]

(73)

We observe that the second factor of the equation (73) vanishes for the specific value of \( q = e^{-\pi\sqrt{5}} \), but the other factors does not vanish. Hence , we deduce that

\[
l_{s,11}^4 - 24l_{s,11}^2 - 10l_{s,11}^2\sqrt{5} + 1 = 0.
\]

(74)

Solving the above equation (74), we arrive at the equations (71) and (72).
Modular Relations Between $\kappa(q)$ and $\kappa(q^n)$

In this section, we establish several new modular relations connecting $\kappa(q)$ with $\kappa(q^n)$ using the $P-Q$ modular equations obtained in the Section 4.

**Theorem 6.1** If $u := \kappa(q)$ and $v := \kappa(q^5)$, then

\[
v^4u + (-u^4 + 3u + 3u^2 - 3u^3)v^3 + (-3u + 3u^2)v^2 + (-3u - 3u^2 + 3u^3 + 1)v - u^3 = 0.
\] (75)

**Proof.** Using the equation (16) and (30), we arrive at the equation (75).

**Theorem 6.2** If $u := \kappa(q)$ and $v := \kappa(q^4)$, then

\[
(v^3 - v^2 - v + 1)u^4 + (4v^3 - 4v^2 - 8v)u^3 + (2v - 2v^3 + 8v^2)u^2 + (-8v^3 + 4v^2 + 4v)u + v^3 + v^4 - v^2 - v = 0.
\] (76)

**Proof.** Using the equation (16) and (38), we arrive at the equation (76).

**Theorem 6.3** If $u := \kappa(q)$ and $v := \kappa(q^5)$, then

\[
(-2v + v^2 - 1-v^4 + 2v^3)u^5 -(v^4 - v^2 - v^3)5u^4 -(3v^3 + 2v^2 - 3v)5u^3
\]
\[
+(3v^4 - 3v^3 + 2v^2)5u^2 +(v^3 - v^2 - v)5u + 2v^2 + v - 2v^4 + v^5 - v^3 = 0.
\] (77)

**Proof.** Using the equation (16) and (40), we arrive at the equation (77).

**Theorem 6.4** If $u := \kappa(q)$ and $v := \kappa(q^7)$, then

\[
7\left((v^7 + 2v^6 - 4v^5 - 4v^4 + 4v^3 + v^2 - v)u^7 + (v^7 + 6v^6 - 11v^5 - 12v^4
\]
\[
+14v^3 + 6v^2 - 2v)u^6 -(4v^7 + 14v^6 - 31v^5 - 23v^4 + 31v^3 + 11v^2 - 4v)u^5
\]
\[
+(4v - 12v^2 - 23v^3 - 12v^2 - 4v^7 + 23v^4 + 24v^5)u^4 + (14v^2 + 31v^3 + 4v^7
\]
\[
-23v^4 - 31v^3 - 4v + 11v^6)u^3 +(2v^7 + 6v^6 - 14v^5 + 11v^4 - 12v^3 + 6v^2 - v)u^2
\]
\[
+(-4v^3 + 4v^2 - 2v^3 + v - v^6 + 4v^4 - v^7)u\right) + v'u^7 + u^7 - v'u^v - v = 0.
\] (78)

**Proof.** Using the equation (16) and (43), we arrive at the equation (78).

**Theorem 6.5** If $u := \kappa(q)$ and $v := \kappa(q^{11})$, then

\[
u^2 - uv + 11\left((8v^2 + 2v^8 - v^{10} - 3v^9 - 16v^4 + 7v^6 + 24v^3 - 37v^5 - 4v + 19v^7)u^11
\]
\[
-(v^{11} + 7v^{10} + 5v^9 - 26v^8 - v^7 - 49v^6 + 19v^5 + 100v^4 - 38v^3 - 32v^2 + 8v)u^{10}
\]
\[
+(88v^8 - 2v^4 - 5v^{10} - 51v^7 + 79v^9 - 354v^3 + 745v^5 - 49v^6 + 24v - 3v^{11}
\]
\[
-32v^7u^9 +(152v^5 + 26v^7 + 61v^8 + 2v^3 + 16v - 260v^7 + 88v^9 + 26v^{10} - 100v^2
\]
\[
-518v^6 + 2v^{11})u^8 + (-260v^8 + 2252v^7 - 511v^9 - 2540v^5 - 152v^4 + 745v^3 + v^{10}
\]
Proof. Using the equation (16) and (47), we arrive at the equation (79).

Modular Relations Between $v(q)$ and $v(q^n)$

In this section, we establish modular relations for $v(q)$ using the $P - Q$ modular equations obtained in the Section 4.

**Theorem 7.1** If $u := v(q)$ and $v := v(-q)$, then

$$(1 + 4u^3 + 4u + u^4 - 18u^2)(1 + v^2) + (6u^4 - 8u - 12u^2 - 8u^3 + 6)v^2 + (8u - 4 + 8u^3 + 8u^2 - 4u^4)(v + v^3) = 0.$$  

**Proof.** Using the equation (17) and (32), we arrive at the equation (80).

$$(80)$$

**Theorem 7.2** If $u := v(q)$ and $v := v(q^2)$, then

$$v^2(u^4 + 1) + (1 - 2v - 2v^2 - 2v^3 + v^4)(u^3 + u) + (-2v^4 + 10v^2 - 2)u^2 = 0.$$  

**Proof.** Using the equations (17) and (31), we arrive at the equation (81).

$$(81)$$

**Theorem 7.3** If $u := v(q)$ and $v := v(q^3)$, then

$$(3u + 3u^2 - 3u^3 + u^4) v^3 - 3v^2(u + u^3) + (3u^3 - 3u + 3u^2 + 1)v = u^3 + v^4u.$$  

**Proof.** Using the equation (17) and (30), we arrive at the equation (82).

$$(82)$$

**Theorem 7.4** If $u := v(q)$ and $v := v(q^4)$, then

$$(v^8 + 6v^6 + 6v^4 - 4v^2 - 4v - 14v^4)(u^7 + u) + (32[v^7 - v^5 + v - v^3] - 6v^6 - 6 - 48v^6 + 48v^2 + 136v^4)(u^6 + u^2) + (15v^8 - 108v^7 - 108v + 202v^6 + 15 + 80v^5 - 434v^4 + 202v^2 + 80v^3)(u^3 + u^5) + (160v^7 - 20 + 160v - 20v^8 - 160v^5 - 320v^6 - 320v^2 + 750v^4)u^4 + v^4 + u^8v^4 + u^7 + u = 0.$$  

**Proof.** Using the equation (17) and (38), we arrive at the equation (83).

$$(83)$$

**Theorem 7.5** If $u := v(q)$ and $v := v(q^5)$, then
\begin{equation}
(u^5 + 10u^3 + 6 - 5u^2 - 5u^4 - 10u) v^4 - (6u^5 - 35u + 25u^3 - 25u^4 + 20u^2) v^3
+ (11u^5 + 25u^2 - 35u^4 - 25u + 20u^3) v^2 - (6u^5 - 5u - 10u^4 - 5u^3 + 10u^2) v
+ v + u^5 - v^5 - 11v^3 + 6v^2 = 0.
\end{equation}

\textbf{Proof.} Using the equation (17) and (40), we arrive at the equation (84).

\textbf{Theorem 7.6} If \( u := \nu(q) \) and \( v := \nu(q^7) \), then
\begin{align*}
v + u^8 v^7 - v^8 u - u^7 + 7 \{(u - 2u^2 - u^7 + 4u^3 + 3u^6 - 4u^5) v^7 + (2u^7 - 3u + 26u^5
- 29u^3 - 14u^6 + 14u^2) v^6 + (29u^6 - 26u^2 + 5u^4 + 55u^3 - 55u^5 + 4u - 4u^7) v^5
- 5(u^3 + u^5) v^4 + (4u^2 - 55u + 29u^2 + 55u^5 - 4u - 26u^6 + 5u^4) v^3 + (-29u^5
- 14u^2 + 26u^3 + 14u^6 - 3u^7 + 2u) v^2 + (3u^2 + u^7 + 4u^5 - 2u^6 - u - 4u^3)v\}\} = 0.
\end{align*}

\textbf{Proof.} Using the equation (17) and (43), we arrive at the equation (85).

\textbf{Theorem 8.1} If \( k := \kappa(q) \) and \( u := \nu(q) \), then
\begin{align*}
&k^2 - 1) u^2 + 2(1 + 2k - k^2) u + k^2 = 1.
\end{align*}

\textbf{Proof.} Using the equations (16) and (17), we arrive at the equation (87).
Theorem 8.2 If \( u := \nu(q) \) and \( \nu := \mu(q) \), then
\[
\begin{align*}
    u^4v^2 + v^2 + (1 - 2v + v^4 - 2v^2 - 2v^3)(u^3 + u) &= 2(1 - 5v^2 + v^4)u^2.
\end{align*}
\] (88)

Proof. Using the equations (17), (18) and (33), we arrive at the equation (88).

Theorem 8.3 If \( k := \kappa(q) \) and \( \nu := \mu(q) \), then
\[
(-1 + v)k^2 + (v^2 + 1)k + v^2 = v.
\] (89)

Proof. Using the equations (16), (18) and (33), we find that
\[
(k^2v^3 - kv^2 + v - 1 - k - k^2v)(kv^2 + v^2 - v + k - k^2 + k^2v) = 0.
\] (90)
By examining the behaviour of the factors of the equation (90) near \( q = 0 \), it can be seen that there is a neighbourhood about the origin, where the second factor is zero, whereas the other factors are not zero in this neighbourhood. By the Identity Theorem second factor vanishes identically. This completes the proof.

Theorem 8.4 If \( k := \kappa(q) \) and \( u := \nu(q^2) \), then
\[
(u - 1)k^2 + (u^2 + 1)k + u^2 = u.
\] (91)

Proof. Using the equations (12), (13), (16) and (17), we find that
\[
\begin{align*}
    (-u^2k - u + 2ku - k + k^2u)(u^2k^2 - u^2k + u - 1 - k - k^2u) \\
    (u^2k + u^2 - u + k - k^2 + k^2u) &= 0.
\end{align*}
\] (92)
By examining the behaviour of the factors of the equation (92) near \( q = 0 \), it can be seen that there is a neighbourhood about the origin, where the third factor is zero, whereas the other factors are not zero in this neighbourhood. By the Identity Theorem third factor vanishes identically. This completes the proof.

Theorem 8.5 If \( u := \nu(q) \) and \( k := \kappa(q^2) \), then
\[
\begin{align*}
    (k^2 - 1)^2(1 + u^4) + 2(3 + 16k^3 - 22k^2 - 16k + 3k^4)u^2 \\
    = 4(k^4 - 2k + 2k^3 + 1 - 6k^2)(u + u^3).
\end{align*}
\] (93)

Proof. Using the equations (12), (13), (16) and (17), we find that
\[
\begin{align*}
    (-ku^2 - u + 2ku - k + k^2u)(k^4 - 4k^4u + 6k^6u^2 - 4k^4u^3 + k^4u^4 - 8k^3u^3) \\
    + 32k^3u^2 - 8k^3u - 2k^2u^4 + 24k^2u^3 - 44k^2u^2 + 24k^2u - 2k^2 + 8ku^3 + 1 \\
    - 32ku^2 + 8ku - 4u + 6u^2 - 4u^3 + u^4) &= 0.
\end{align*}
\] (94)
By examining the behaviour of the factors of the equation (94) near \( q = 0 \), it can be seen that there is a neighbourhood about the origin, where the second factor is zero, whereas the first factor is not zero in this neighbourhood. By the Identity Theorem second factor vanishes identically. This completes the proof.

Theorem 8.6 If \( k := \kappa(q) \) and \( u := \nu(q^3) \), then
\[8(8k^5 - 8k^3 - 1 - 2k^6 + 6k^4 - 2k^2 - k^8)(u + u^7) + 4(12(k + k^3 - k^7 - k^5)\]
\[-78k^4 + 7 + 32k^6 + 32k^2 + 7k^8)(u^2 + u^6) + 8(42k^4 - 14k^2 + 32k^7 - 14k^6\]
\[-7 - 7k^8 + 72k^3 - 32k - 72k^5)(u^3 + u^5) + 2(35k^8 + 4k^2 + 560(k^5 - k^3)\]
\[+50k^4 + 35 + 208(k - k^7 + 4k^6)u^4 = (4k^6 - 1 - 6k^4 + 4k^2 - k^8)(u^8 + 1).\]  

**Proof.** Using the equations (16), (17) and (30), we arrive at the equation (95).

**Theorem 8.7** If \(k := \kappa(q)\) and \(u := \nu(q^4)\), then

\[(k - 1)u^4 - (k^3 + k^2 - k - 1)u^3 - 3(1 - k^2)ku^2 + (k^3 - k^2 - k + 1)ku = k^3 + k^4.\]  

**Proof.** Using the equations (16), (17) and (30), we arrive at the equation (96).

**Theorem 8.8** If \(u := \nu(q)\) and \(k := \kappa(q^4)\), then

\[8(8k^6 - 2k^7 - 1 - k^8 + 2k - 26k^5 + 8k^2 + 26k^3 + 18k^4)(u + u^7) + 4(68k^6 + 7\]
\[+32k^7 + 160k^5 - 160k^3 + 7k^8 - 32k - 534k^4 + 68k^2)(u^2 + u^6) + 8(-264k^6\]
\[-7 - 264k^2 + 1022k^4 + 78k + 138k^5 - 138k^3 - 7k^8 - 78k^7)(u^3 + u^5)\]
\[+2(1780(k^2 + k^6) - 6190k^4 + 1920(k^3 - k^5) + 640(k^7 - k) + 35(k^8 + 1))u^4\]
\[+(1 - 4k^6 + 4k^2 - 64k^4)(1 + u^8) = 0.\]  

**Proof.** Using the equations (16), (17) and (38), we arrive at the equation (97).

**Acknowledgement**

This Research work is supported by the UGC, Govt. of India under major research project No.F.No.34--140 \ 2008 (SR).

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ON TEENAGE DEPRESSION AND GENDER DISPARITY OF HIGH SCHOOL STUDENTS IN RURAL INDIA

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ABSTRACT

Depression is a serious mental health concern that will touch most people's lives at some point in their life time either directly or through someone close they know. Improved recognition, treatment, and prevention of depression are critical public health priorities. The present study was undertaken on 80 ie.40 males and 40 females of 7th grade students, randomly selected from schools of two villages of Hisar District, Haryana, India. The age range was 12 to 15 years. Children Depression Inventory (Kovac2003) was used to assess the depression level of children. Personal and socio-economic profile was collected using pretested self structured interview schedule. Results of the study highlighted that depression symptoms were prevalent among one fourth of the total sample. The results evidenced statistically that girls were more depressed than the boys. More number of children was depressed in nuclear and high income group family.

Keywords: Negative Mood, Inter Personal Problem, Ineffectiveness, Anhedonia, Negative Self Esteem

INTRODUCTION

Depression is one of the most common psychological problems, affecting nearly everyone through either personal experience or through depression in a family member. Depression can interfere with normal functioning, and frequently causes problems with work, social and family adjustment. It causes pain and suffering not only to those who have a disorder, but also to those who care about them. Serious depression can destroy family life as well as the life of the depressed person. Depression is a psychological condition that changes how you think and feel, and also affects your social behavior and sense of physical well-being. We have all felt sad at one time or other, but that is not depression. Sometimes we feel tired from working hard, or discouraged when faced with serious problems. The present scenario of adolescents clearly shows that the condition of our youth has significantly deteriorated. Recent studies show that there is significant rise in the problems faced by the adolescents for example, serious emotional disturbances has increased (WHO, 2001). Increased sexual activity in schools, rise in AIDS cases in India and greater use of alcohol consumption has been found. Apart from the above, use of heavy drugs and youth school drop outs has also increased in the recent years (UNICEF, 2001). Depression is a common mental disorder that presents with depressed mood, loss of interest or pleasure, feelings of guilt or low self-worth, disturbed sleep or appetite, low energy, and poor concentration. These problems can become chronic or recurrent and lead to substantial impairments in an individual's ability to take care of his or her everyday responsibilities. At its worst, depression can leads to suicide, a tragic fatality associated with the loss of about 850 000 lives every year. This gives us the clear image of the struggles that adolescents go through, the
problems they face. So providing an experience that would strengthen adolescent’s coping abilities to counter environmental stress and disadvantages with which they sometimes have to cope with while experiencing is an essential need.

According to Soresi Nota and Ferrari (2005), childhood and adolescent depression must not be underestimated, as it is associated with dysthymic and anxiety disorders, severe behavioral disorders, and substance abuse. Research has also shown that teenage depression often persists into adulthood, especially if it goes untreated (Kovac 1996). Depression can affect anyone. Unfortunately, depression is not always diagnosed, because many of the symptoms mimic physical illness, such as sleep and appetite disturbances. Recognizing depression is the first step in treating it. Once identified, most people diagnosed with depression are successfully treated. Looking at the severity of the problem the study was carried out with objective-- To find out the prevalence of depression among boys and girls of rural Haryana.

METHODOLOGY

Sample:
The sample of the study comprised of 80, 7th grade randomly selected students (40 males and 40 females). The age range was 12 to 15 years. The sample was drawn from Govt. and Private schools of village Rawalwas, Khurd and Kalan, randomly selected from Hisar District of Haryana, India. The total number of schools sampled for the current study amounted to four schools (Two Government and two private). Data for the study was collected using the individual approach.

Instrument

Respondents were interviewed by the researcher to get information of their age, gender, household income, family size, type and ordinal position. Academic achievement in terms of percentage of marks secured in last exam was collected from the school records.

Depression was measured with the help of Children Depression Inventory (Kovac, 2003). The scale consists of 27 items, scored on a 3 point scale ranging from 0 = once in a while, 1 = many times and 2 = all the times. Items were summed and ‘T’ score given in test against raw score for different age group and sex were calculated. Categories were formed using ‘T’ score as given in the inventory.

Data Analyses:

SPSS programme was run to analyze the data. Descriptive statistics was used to describe the background information and main variables to the study. Pearson correlation was computerized to examine the relationship between depression and selected variables. Independent sample t-test was used to examine gender differences in depression.

RESULTS:

Profile of respondents

The respondents of the study ranged from11-15 years equally representing both males and females. The maximum percentage (95%) of respondents were, ≤13 years of age. Majority of them having 1st or 2nd ordinal position in family. Sixty five per cent respondents had moderate performance in the academics. A large percentage of respondents were from middle and high cast and nuclear family system (56.2%). A large percentage of fathers had formal education from middle to senior secondary (76.2%), while about 48.8 percent mothers compared to fathers had education up to senior secondary. Comparatively higher percentage of mothers was illiterate.
against fathers. About 75 percent mothers were housewife against almost 50 percent fathers who were involved in farming, business or service. Nearing fifty percent children were from moderate income family earning up to 10,000 per month. One forth of total families had monthly income above Rs. 10,000.

**Level of depression**

Table 1 indicated that 76.3 per cent children were average in depression which means not depressed followed by 21.2 percent having above average depression, whereas, about 2.5 percent respondents had severe depression. On different aspects of depression i.e. negative mood, interpersonal problems, ineffectiveness, anhedonia and negative self esteem, 65.0, 63.8, 78.8, 67.5, 83.8 per cent were in normal level and 30.0, 26.2, 21.2, 31.3. 16.2 percent had above average depression respectively. Only 5.0 percent had severer negative mood, 10.0 percent faced sever interpersonal problems and one child had sever anhedonia problem. Gender comparison highlighted that comparatively more females had above average (27.5%) and severe depression (5%) against male respondents (15.0 & 0.00 respectively). The results are consistent with the study conducted by Uba et al (2010) which reported that 12.8 per cent respondents were depressed against 87.2 per cent non depressed respondents. Saluja et al. (2004) also found that eighteen percent of youths reported symptoms of depression. A higher proportion of females (25%) reported depressive symptoms than males (10%). Prevalence of depressive symptoms increased by age for both males and females. Results also got support from another study reported by Saima and Sharma (2011) who reported that 8.33 and 10 per cent respondents had poor and very poor mental health conditions.

**Gender wise mean differences**

The study further discovered significant differences (t=2.246 P<.05) in depression scores of males and females respondents. Significant gender differences were also seen on depression sub aspects i.e. ineffectiveness (t=2.432) anhedonia (t=3.867) at 5 percent level of significance. (Table2)

The findings of the study illustrated that female were more depressed than male counterparts. The present findings were consistent with the study conducted by Uba et al (2010) in Malaysia and with other studies by Nolen – Hoeksema (1994) and William et al (2003).

In addition table 3 indicated that about 52.63 percent depressed children were from nuclear family, coming from high caste. Further 42.10 per cent depressed respondents were from low income group families. Findings of present study are in line with the result reported by Uba et al (2010), Saime and Sharma (2011), and Srividhya (2007).

**Conclusion:**

Conclusion reveals that majority of the respondents were non-depressed and a small percentage was depressed. Girls were found to be more depressed than boys and the differences were statistically significant. The respondents from nuclear family with poor income were comparatively more depressed. The results mark the need for diagnosis and psychological treatment of children at early age when the symptoms of depression are still emerging, so that the situation does not get worse by the time they reach high level and face the pressure of academic achievement, which further leads to danger of suicide, drug addiction etc. and other psychological problem. There is also a need for educating and training the teachers in preliminary diagnosis of depression symptoms and providing referral services.
References

Kovacs M, “Children’s Depression Inventory” published by MHS in North Tonawanda NY. 2003


Table 1: Distribution of respondents for depression by gender

<table>
<thead>
<tr>
<th>CDI categories</th>
<th>Male(40)</th>
<th>Female(40)</th>
<th>Total(80)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average</td>
<td>Above Average</td>
<td>Severe</td>
</tr>
<tr>
<td>Negative Mood</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>11</td>
<td>25</td>
<td>52</td>
</tr>
<tr>
<td>(67.5)</td>
<td>(27.5)</td>
<td>(62.5)</td>
<td>(65.0)</td>
</tr>
<tr>
<td>Inter Personal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>15</td>
<td>27</td>
<td>51</td>
</tr>
<tr>
<td>(60.0)</td>
<td>(37.5)</td>
<td>(67.5)</td>
<td>(63.8)</td>
</tr>
<tr>
<td>Problem</td>
<td>Sex 40(Male) &amp; 40(Female)</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>---------------------</td>
<td>---------------------------</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>52.375</td>
<td>10.769</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>54.825</td>
<td>11.235</td>
</tr>
<tr>
<td>Negative Mood</td>
<td>Male</td>
<td>51.650</td>
<td>7.757</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>55.925</td>
<td>15.168</td>
</tr>
<tr>
<td>Interpersonal Problem</td>
<td>Male</td>
<td>50.325</td>
<td>6.442</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>53.600</td>
<td>5.569</td>
</tr>
<tr>
<td>Ineffectiveness</td>
<td>Male</td>
<td>49.725</td>
<td>5.242</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>54.925</td>
<td>6.696</td>
</tr>
<tr>
<td>Anhedonia</td>
<td>Male</td>
<td>47.050</td>
<td>6.872</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>47.375</td>
<td>8.598</td>
</tr>
<tr>
<td>Negative Self esteem</td>
<td>Male</td>
<td>50.325</td>
<td>5.264</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>53.925</td>
<td>8.662</td>
</tr>
</tbody>
</table>

Table 2: Gender wise mean differences in depression

Table 3: Child Depression by family profile
<table>
<thead>
<tr>
<th>CDI categories</th>
<th>Family Type</th>
<th>Caste</th>
<th>Family Income</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nuclear</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Non Depressed</td>
<td>35 (57.37)</td>
<td>21 (34.42)</td>
<td>15 (24.60)</td>
</tr>
<tr>
<td>n=61</td>
<td>16 (26.23)</td>
<td>15 (24.60)</td>
<td>25 (40.98)</td>
</tr>
<tr>
<td></td>
<td>10 (16.40)</td>
<td>25 (40.98)</td>
<td>15 (24.60)</td>
</tr>
<tr>
<td>Depressed</td>
<td>10 (52.63)</td>
<td>10 (52.63)</td>
<td>8 (42.10)</td>
</tr>
<tr>
<td>N=19</td>
<td>07 (36.84)</td>
<td>08 (42.10)</td>
<td>06 (31.58)</td>
</tr>
<tr>
<td></td>
<td>02 (10.53)</td>
<td>06 (31.58)</td>
<td>05 (26.32)</td>
</tr>
</tbody>
</table>

Figures in parentheses indicate percentage
AN ELECTRONIC VOTING SYSTEM FOR INDEPENDENT NATIONAL ELECTROAL COMMISSION (INEC) IN ZARIA KADUNA STATE, NIGERIA.

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ABSTRACT
The aim of this Research is to design a web based system application for INEC for the conduct of chairmanship and councillorship elections in Zaria local government Kaduna state Nigeria in order to reduce problems been faced by INEC with manual methods. The Research examines the manual method of conducting election exercises and compares with the automated one and pointed out some advantages of automated over manual method. One of the advantages of the designed automated (electronic voting system) is its ability to be run on a web browser. Therefore, many voters who have access to internet through their personal computers can cast their vote within a very short period of time. The research is implemented for INEC Nigeria, for the conduct of chairmanship and councillorship elections in Zaria Local Government, Kaduna State. The study explores the use of open source software, web server is Apache extended with support for PHP and MySQL.

Keywords: Electronic Voting System, INEC and Zaria.

1. HISTORICAL BACKGROUND
Independent National Electoral Commission (INEC) was set up by Decree 17 of 1998 (now an ACT). It is made up of a chairman and twelve National Electoral Commissioners, two from each of the six geopolitical zones. There is also a secretary to the commission. Section 154 (3) of the 1999 constitution spells out the process which must be followed in appointing members of the commission. The chairman and members of the commission are nominated by the president in consultation with the council of state. The council of state is a body made up of past and present presidents, chief justice and the state Governors [1]. The president then sends the names of successful nominees to the senate of the Federal Republic of Nigeria for further screening and confirmation. The successful nominees are than sworn in by the president [3].

STRUCTURE
In addition to the National Headquarters, there are a number of Departments and Directorates as well as the Electoral Institute. INEC has offices in all the thirty six states, the FCT and 774 LGAs of the Federation. At the state level, the offices are headed by president Electoral Commissioners (PECs) assisted by Administrative secretaries and other staff of the commission. The Electoral Officers (E.Os) and Assistant Electoral Officers (A.E.O.s) are responsible for day to day functioning of the offices at the LGA level but are subject to the directives of the RECS [2].

2. PROBLEMS ASSOCIATED WITH MANUAL METHOD
There are a lot of problems faced by INEC while using the manual method. Some of these
problems are as follows.
* Cost of the exercise: whenever an election is to be conducted manually, much money will be spent. This as a result of the commission providing polling materials such as ballot papers, ballot boxes, ink and all necessary material for the election exercise.
* Lack of security: There is lack of security in the manual method because sometimes militant attack the ballot boxes and even the INEC officers who conducts the election thereby destructing the election exercise and causing inaccuracy in the election result.
* Time consuming: The manual method is time consuming in the sense that the voters must be confirmed manually if they are eligible for voting and filling the ballot paper for the election.
* Late arrival of polling materials: Incase of remote areas, election exercise may not start on time due to late arrival of polling material.
* Delay in announcing the election result. Before the result of any election is announced, all the result will be counted one after the other and accumulated. This take some days in case of presidential election.

2.1 OVERVIEW OF AUTOMATED VOTING SYSTEM

The world today has been taken over by computers. With the advent of computer, automation has become the order of the day, replacing the manual method of doing things which include polling exercise (election exercise). Though it has been in used for some years, in most developed countries, this method is an approach to conduct election exercise electronically.

Here also, the information needed by the manual method for conducting election is required too; but stored in an electronic database with any other additional information that may be inputted by the software user.

3. MATERIALS AND METHODS

The Electronic voting system will be designed and implemented using MySQL as the database; Apache will be web server to provide basic functionality of the web services; PHP will be used as scripting language to program the server side that manipulates the knowledge in the database [4].

4. ARCHITECTURAL DESIGN

The factors considered in designing the Electronic voting system are accessibility with minimum requirements on the user’s side. Due to large flow of information delivery over the Internet, the system is implemented as a standard Internet application. The client side requires no more than standard Internet browser installed on the local computer, while the main application functionality is assured by the server side. Figure1 illustrate Electronic voting System Architecture [4].

This includes, user interface made up of access services points (shown as client system below) at the remote site, a high speed, highly reliable and scalable regional network and content management gateway with database server. This architecture allow users to access the system via the Internet using hypertext transfer protocol and the user request is transformed into a structured query language using a PHP common content management gateway, which in turn passes it to the appropriate backend system. The common content management gateway provides a single point entry to the system.
5. IMPLEMENTATION AND RESULT
Implementation involves method and process used in the system design and the delivery of the new system into production. It simply means the conversion of a new system design into operation with entails creating compatible files, installation of software and hardware, running program and training the user/state holders on how to use the system designed

SYSTEM DEVELOPMENT
The system is developed on web server and HTML, with the aid of some browsers such as Mozilla Firefox and Internet explorers.

Stages of system development
The various stages of system development are:
- Identification of system elements
- Table creation
- Creation of html and php pages for data entry and data extraction

<table>
<thead>
<tr>
<th>FIELD NAME</th>
<th>DATATYPE</th>
<th>DATA DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citizen_id</td>
<td>Number</td>
<td>Citizen Number</td>
</tr>
<tr>
<td>User_id</td>
<td>Number</td>
<td>User Number</td>
</tr>
<tr>
<td>Password</td>
<td>Varchar</td>
<td>Password</td>
</tr>
<tr>
<td>first_name</td>
<td>varchar</td>
<td>First Name</td>
</tr>
<tr>
<td>middle_name</td>
<td>varchar</td>
<td>Middle Name</td>
</tr>
</tbody>
</table>
6. AUTHENTICATION AND AUTHORIZATION

Authentication in Web services has to do with ensuring that the identity of a user cannot be forged or altered. Hence, authentication focuses on the verification of the identity of voters. Put simply, the identities of voters must be true and verifiable, where as authorization in the Web service context means ensuring that votes can be cast only by authorized voter.

<table>
<thead>
<tr>
<th>last_name</th>
<th>Varchar</th>
<th>Last Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>p_address</td>
<td>Varchar</td>
<td>Permanent address</td>
</tr>
<tr>
<td>State</td>
<td>varchar</td>
<td>State</td>
</tr>
<tr>
<td>Sex</td>
<td>varchar</td>
<td>Sex</td>
</tr>
</tbody>
</table>

**Figure 6 login page**

This is the interface that enables user to login. In this interface, a link named signup is provided which, a user will click on in order to sign up or register as a new user. The interface will take you to next page.

**Figure 7 Registration form**

This is the interface where a user can fill in the signup form. A user must fill in all the entries before the signing up will be accepted. A user is advised to write down his/her citizen ID, user Registration ID and password.
Figure 8 Voter Form
Here the user will select the party he/she wants to vote for at the polling unit. Then a user will type in his/her citizen ID cast the vote

Figure 5 ER model
The above ER-Model describes the entity types used and their various attributes and constraints.

7. SUMMARY AND CONCLUSION
As technology advances, particularly in the area of information and communication keep growing on daily basis, taking advantage and keeping abreast of these technologies is a paramount concern to users for casting their vote. The research work describes the Design and Implementation of an electronic voting system that can be used by voters to cast their vote through computer. This will help to reduce many problems been faced when using manual method of election exercises.

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[2]. INEC Directorates of political parties monitoring and liaison
[3]. Voter Education Handbook by INEC
[4]. Beginning php6, Apache, MySQL Web development
THE ECONOMIC IMPACTS OF VOCATION TRAINING IN TERTIARY INSTITUTIONS IN NIGERIA

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ABSTRACT
Vocational training can be defined as an instructions intended to equip person’s for industrial or commercial occupations. It maybe obtained formally in trade schools, technical colleges and technical secondary schools or in on-the job training programmes or more formally by picking up the necessary skills on the job. This will be an approach to economic planning that attempt to foster economic growth in Nigeria. The focus of this paper is the economic impacts of vocational training in tertiary institutions in Nigeria. The paper gives a brief detail of economic impacts of vocational training nationally and internationally. It also discusses the importance of vocational training in tertiary institutions in Nigeria. It also gives the concept of vocational technical education for sustainable development. The paper proffers invaluable suggestions on how the federal government should ensure that the vocational technical education and training for self reliance, as a tool for national development.

INTRODUCTION
Advancement and sustainable development is a very vital issue in a global world. Vocational training or education is focused on acquisition of individual skills and capability for occupation; therefore all the vocational courses involved such as fine and applied arts, agricultural science, Home economics, Automobile engineering and computer science. Just to mention but a few, are packaged to provide knowledge and develop the skills of the future youths for sustainable development. Technological development and advancement revolve around a sound vocational/technical education programme (Bulus 1999:22). Contemporary education globally, whether general or vocational, is very expensive therefore any rightful mind will not envisage of wastage in education. The measure guarantee of eliminating wastage in education and also eliminating the unemployment syndrome, is to provide adequate and functional education especially when such education is vocational (preparation for helpful skill occupation). It is mandatory for the government to preserve and propagate pure and undiluted vocation course/skills whether her nation economy is so depressed or not, Sufficient attention has not been given to educational sector especially vocational skills ,due to poor policy implementation, certificated but poorly skill teaching force and In this regard the noticeable lapses in policy implementation of vocational education/skills for sustainable development for our future youths can be re-visited by gearing them into vocational skills, apprenticeship, and a mandatory industrial attachment.

WHAT IS VOCATIONAL TRAINING?
Vocational training are instructions intended to equip person’s for industrial or commercial occupations. It maybe obtained formally either in trade schools, technical Secondary schools or in on –the Job training programmes or more informally by picking up the necessary skills on the job.

Technological development and advancement revolved around a sound vocational/technical education programme as cited by Otuaga, Mayes (2010) in (Bulus
1991:41) vocational skills in schools is a relative modern development. Akaniwor (1988:41) observes that “the bed rock of any technical break through is the existence of appropriate skill, abilities and competence both mental and physical as equipment for the individual to live in the society is a dynamic instrument of change” According to Bulus (1991:30). vocational technical education involves the acquisition of skills and competences that can help individuals to function productively in industries and commercial occupation. Until the 19th century such education, except for the professions, was provided only by apprenticeship. This situation was partly due to the low social status associated with such instructions as opposed to a classical curriculum which was considered “necessary for a youth” with growth of individualization during the 19th century, however, several European countries, notably Germany, began introducing vocational education in elementary and secondary schools. In Great Britain, however, opposition to vocational education persisted into the 20th century. Although a few trade and junior technical schools were established by local authorities before the world war II. By the 19th century, public (common) schools vocational education in he United states consisted of manual training and practical arts. These programmes were generally expanded until 1917 when Federal aid was provided to public schools for trade and industry.

THE IMPORTANCE OF VOCATIONAL TRAINING IN TERTIARY INSTITUTIONS IN NIGERIA

Vocational technical education has played a vital role in tertiary institutions in Nigeria. Vocational technical education is about work and training for work. Raymond (2007). One of the goals of the technical and vocational education as documented in the National Policy on Education (2004) is to give training and impart the necessary skills to individuals who shall be self reliant. When this goal is adequately achieved, it would lead to a sustainable technological development. Raymond, (2007). In this regards it will make vocational technical education and training an interesting one by gearing the students towards self reliant to discourage unemployment syndrome.

Self-reliant is one’s own efforts and abilities (Merrian, 2006). When somebody acquires skills in any occupation, such person can establish his or her own business and even employ others. Igweh (2008). such person is self reliant. Bassey (2009) declared self-reliance as that which pre-supposes the attainment and autonomy without unnecessary resorting to begging or begging. He opined that, “a self-reliant individual is one that achieves steady supply of his needs, one that diversifies his resources to reduce dependency on other assistance “Thus, self-reliance emphasizes growth and development and development in the life of a citizen, politically, socially and economically.

Therefore, a man who is potently self-reliant will ensure an effective control of his resources over national life for proper national development eg Adenuga of GLO network. A country’s well-being depends on its economic development Nwogu, (2009). Walter Rodwey an economist in Igweh (2004), asserted that development in human society is many sided phenomenon which is complex and means different thinkers. Musa (1985). In his view sees the concept of development as an Euro-American term through culturally based, used to characterize the relative standard of living of the people between the highly industrialized nations of the north and the consumer impar dependent nations of the south.

Igweh (2008), stressed that the most suitable definition of development may be that which is based on the experiences of he developing countries which is cited by seers in Igweh (2001). He defined development in terms of reduction in the levels of poverty, illiteracy, and unemployment and income inequality. However, Faladum, Omogiafor and Ezeaku (1999) in Nwogu (2009) remark that “National development encompasses social and political
development as well as economic development which is defined as the attainment of a
number of ideas of modernization such as a rise in productivity social and economic equity
improved institutions and values”. Economic development is thus an important part of
general development in any society.

The main objective of economic development is to raise the standard of living and the
general well-being of the people in an economy where almost everybody can be self-reliant.
It involves changes in the structures of an economy that includes the following:
- Emphasis on developing manufacturing industries as opposed to agriculture;
- Movement of labour from rural to urban industrial areas and;
- Less reliance on imported goods in preference to home produced goods (eg made in
  Federal republic of Nigeria products).

There are few types of technical and vocational training institutions; National policy on
Education recognized outside the university system. Yabam in Igweh(1997) stated that three
abroad classifications are recognized by the National Board for technical Education
(NABTE) They are vocational schools, technical colleges, colleges of education (technical)
or polytechnics, all the above listed are training institutions meant for the productions of
graduates who shall be self-reliant and contribute their quota for national development
through instrument of vocational technical education and training.

Indeed, vocational technical education and training in Nigeria according to Nwogu
(2009) “should emphasize entrepreneurship awareness for it to be relevant in achieving the
national educational aim of inculcating the right type of values and attitudes for survival of an
individual and Nigeria society” Enahoro (2008) in his concept said vocation training is
utilitarianism and it is a concept recognizing the importance of labour. Therefore to train
someone in his appropriate field and for him to substantially contribute his quota to the
overall good of the nation, he or she has to pass through vocational technical education and
training. It is an issue that needs no further investigation to say that when and if it is good
with a nation, it is also good with its inhabitants and vice versa. In this regard, any nation or
country that gives proper training in one sided area of importance to her citizenry or gives
improper training to people in all areas of importance has nothing to gain. People are
differently gifted and therefore, should be given equal vocational technical education and
training for self-reliance in the different occupational areas. Nigeria should be such that
people are trained for the different opportunities or openings that abounds in the country, in
compliance with the tedious task of giving suitable and proper training to individuals for
optimum productivity amongst others.

**VOCATIONAL TRAINING FOR SUSTAINABLE DEVELOPMENT IN NIGERIA**

These are instructions intended to equip person’s for industrial or commercial
occupations. It may be obtained formally in trade schools, technical secondary schools or in
on-the job training programmes or more informally by picking up the necessary skills on the
job. Vocational skills in schools are a relatively modern development.

**THE PROSPECTS OF VOCATIONAL EDUCATION IN NIGERIA**

Vocational technical education and job training has been an integral part of national
development strategies in many societies because of the impact on human resources
development, productivity and economic growth Dike (2007). Nigerians do not seem to
accord vocational technical education the attention it deserves despite its proven
contributions in other nations. Ibenneme (2007). It is important to observe that UNESCO &
ILO (2002) comprehend technical and vocational education to be in the following ways: -
- An instrument for promoting a perfect sustainable development amongst others. Indeed every nation, especially developing countries are making efforts to develop industrially, economically and technically. It is of vital importance to note that any kind of developmental effort or initiatives requires human capital amongst others. The development of human capital requires necessarily skilled human capital and appropriate skills, right attitude and good knowledge of retrieving and processing by utilizing national resources. The artisans, craftsmen, technicians and technologies are adequately trained; they will fit well in small scale enterprises, industries, colleges and universities Igweh (2008). There will be less dependence of foreign technical personnel in our cottage and main industries. Indigenous technology will be encouraged. There will be adequate manpower to handle road maintenance, buildings, electrification, mechanical work, and agriculture and computer services. In this regard, production capacity will be increased while the import duties will be decreased.

- It is a means of preparing the youths for occupational skills and for effective participation nation wide.

- It is an aspect of long term learning and preparation for responsible citizenship.

CHALLENGES FACING VOCATIONAL EDUCATION IN NIGERIA.
Some of the challenges facing vocational technical education are numerous, they are as follow:

- Poor elaboration of the practical aspects of vocational technical education as most tertiary institutions in Nigeria charged with the responsibility to teach vocational technical education courses today are poorly equipped with machines and relevant tools.

- Lack of skilled manpower

- Poor remuneration of vocational technical education.

- Lack of follow-up and continuity in government policies.

- Scarcity of vocational technical teachers

- Lack of adequate technical training facilities and modern equipment.

- Lack of entrepreneurship education in vocational technical education and training.

RECOMMENDATION / SUGGESTIONS
The clamour for technology for self-reliance and vision 20:2020 in Nigeria cannot be realistic without the positive participation of the public and private sector for sustainable development. There is need for government to build cottage industries where various vocational skills could be learnt with minimal cost Otuaga Mayes. (2010:16). Thereafter in conjunction with various financial institutions in the country, soft loans should be granted to the graduands for the establishment of small scale industries.

Moreover, the youths should have intrinsic motivation, There is dignity in labour. Awareness programmes should be organized for the youths at regular intervals on the need to acquire vocational skills for sustainable development.
There should be a consistent policy framework, backed by legislation that makes it mandatory for some percentage of the annual budget for the various levels of vocational technical education training institutions.

The federal government should ensure that the vocational technical education and training for self-reliance is a tool for national development, and teachers preparatory programmes should be supported and serving teachers adequately remunerated. No nation can develop more than the standard of her teachers. Training and re-training of teachers in vocational education is paramount, for pragmatic development to take place in Nigeria. Teachers of vocational courses should be sponsored to attend both nationally and internationally workshops and conferences to enable them be abreast of the modern technological world.

CONCLUSION

The 21st century weather is bright for Nigerian Youths who are equipped with vocational skills. Sufficient attention should be given to educational sector especially vocational skills. In this regards the noticeable lapses in policy implementation of vocational education / skills for sustainable development for our future generations can be revisited by gearing them into vocational skills and a compulsory industrial attachment.

REFERENCES


A WEB-BASED APPLICATION FOR BULK SMS SOLUTION

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ABSTRACT
Sharing of information is critical for communicating with individuals, corporate bodies and organizations. As technology advances, particularly in the area of information and communication keep growing on daily basis, taking advantage and keeping abreast of these technologies is a paramount concern to users. The proposed application will provides bulk SMS solution as a communication medium for clients in fulfilment of their specific needs. It will enable clients to send text message to pre-define individuals, groups or corporate bodies via the internet at a reduced cost. The application web page was developed using HTML (Hypertext Markup Language) and deployed on Apache Friends Edition XAMPP Basis Package version 1.7.3 (a server) the application can be access using a local host URL. The SMS solutions work live on online mode via internet connection.

Keywords: web-based application and Bulk SMS solution.

1 Introduction

Short Message Service (SMS) is the text communication service component of phone, web, or mobile communication systems, using standardized communications protocols that allow the exchange of short text messages between fixed line or mobile phone devices. SMS text messaging is the most widely used data application in the world, with 2.4 billion active users, or 74% of all mobile phone subscribers. The term SMS is used as a synonym for all types of short text messaging as well as the user activity itself in many parts of the world.

SMS as used on modern handsets was originated from radio telegraphy in radio memo pagers using standardized phone protocols and later defined as part of the Global System for Mobile Communications (GSM) series of standards in 1985 as a means of sending messages of up to 160 characters, to and from GSM mobile handsets. Since then, support for the service has expanded to include other mobile technologies such as ANSI CDMA networks and Digital AMPS, as well as satellite and landline networks. Most SMS messages are mobile-to-mobile text messages though the standard supports other types of broadcast messaging as well. (Source: From Wikipedia, the free encyclopaedia: http://www.sms.com)

2.1. History

Historical Background

Fig 1.SMS messages sent monthly in USA (billion)
The technical development of SMS was a multinational collaboration supporting the framework of standards bodies, and through these organizations the technology was made freely available to the whole world. This is described and supported by evidence in the following sections.

The first proposal which initiated the development of SMS was made by a contribution of Germany and France into the GSM group meeting in February 1985 in Oslo. This proposal was further elaborated in GSM subgroup WP1 Services (Chairman Martine Alvernhe, France Telecom) based on a contribution from Germany. There were also initial discussions in the subgroup WP3 network aspects chaired by Jan Audestad (Telenor). The result was approved by the main GSM group in a June '85 document which was distributed to industry. The input documents on SMS had been prepared by Friedhelm Hillebrand (Deutsche Telekom) with contributions from Bernard Ghillebaert (France Télécom).

SMS was considered in the main GSM group as a possible service for the new digital cellular system. In GSM document "Services and Facilities to be provided in the GSM System", both mobile-originated and mobile-terminated short messages appear on the table of GSM teleservices.

The discussions on the GSM services were concluded in the recommendation GSM 02.03 "TeleServices supported by a GSM PLMN". Here a rudimentary description of the three services was given:

1. Short message Mobile Terminated (SMS-MT)/ Point-to-Point: the ability of a network to transmit a Short Message to a mobile phone. The message can be sent by phone or by a software application.
2. Short message Mobile Originated (SMS-MO)/ Point-to-Point: the ability of a network to transmit a Short Message sent by a mobile phone. The message can be sent to a phone or to a software application.

The material elaborated in GSM and its WP1 subgroup was handed over in Spring 1987 to a new GSM body called IDEG (the Implementation of Data and Telematic Services Experts Group), which had its kickoff in May 1987 under the chairmanship of Friedhelm Hillebrand (German Telecom). The technical standard known today was largely created by IDEG (later WP4) as the two recommendations GSM 03.40 (the two point-to-point services merged together) and GSM 03.41 (cell broadcast).

WP4 created a Drafting Group Message Handling (DGMH), which was responsible for the specification of SMS. Finn Trosby of Telenor chaired the draft group through its first 3 years, in which the design of SMS was established. DGMH had about five to eight participants, and Finn Trosby mentions as major contributors Kevin Holley, Eija Altonen, Didier Luizard and Alan Cox. The first action plan mentions for the first time the Technical Specification 03.40 "Technical Realisation of the Short Message Service". Responsible editor was Finn Trosby. The first and very rudimentary draft of the technical specification was completed in November 1987. However, drafts useful for the manufacturers followed at a later stage in the period. A comprehensive description of the work in this period is given in.
The work on the draft specification continued in the following few years, where Kevin Holley of Cellnet (now Telefonica O2 UK) played a leading role. Besides the completion of the main specification GSM 03.40, the detailed protocol specifications on the system interfaces also needed to be completed.

3. Materials and Methods

A Web-based application of Bulk SMS solution will be designed and implemented using an open source solution such as Apache friends’ edition XAMPP Basic Package version 1.7.3 as web server with extended support for MySQL and HTML.

4. Bulk SMS

Large amount of SMS messages sent at the same time is referred to as bulk SMS. Using web-interface or desktop application, one can reach large audiences, groups or individuals almost instantly via internet connected to computer. SMS is the only medium that enables almost instantaneous notification of a targeted group of people, regardless of their location! Bulk SMS application could be deployed for:

- Wedding Invitation
- Birthday Invitation
- Meeting Notification
- Political Awareness/ Campaign
- Special Seasons Greetings

- Student groups communicate important information or reminders quickly.
- Religious bodies can communicate more personally with its members and share spiritual thoughts daily.

5. Architecture of Web Application

Fig. 2      Architecture of Web Application

Applications are usually broken into logical chunks called "tiers", where every tier is assigned a role. Traditional applications consist only of 1 tier, which resides on the client
machine, but web applications lend themselves to an n-tiered approach by nature. Though many variations are possible, the most common structure is the three-tiered application. In its common form, the three tiers are called presentation, application and storage.

**Client:** A web browser is the first tier (presentation), an applications developed with MySQL and PHP that make use of a single client. This is not the only possibility for internet based applications, so the only client one should be concerned with is the web browser.

**Middleware:** An engine using some dynamic Web content technology (such as ASP-Active Server Pages, ASP.NET, CGI-Common Gateway Interface, ColdFusion, JSP/Java, PHP, Perl, Python, Ruby on Rails or Struts2) is the middle tier (application logic). PHP is used since it belongs to a class of language known as middleware. It works closely with the web server to interpret the request from the web.

**Database:** A database is the third tier (storage). This is provided by MySQL. The web browser sends requests to the middle tier, which services them by making queries and updates against the database and generates a user interface.

6. **Result and Discussion**

**Database and File Specifications**

The database was designed using PHP and MySQL. In MySQL, records are stored in the table created that are representation of files. The specification of the table is as follows:

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Data Type/Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID</td>
<td>INTEGER(10)</td>
<td>Auto Increment of number sms sent</td>
</tr>
<tr>
<td>PHONE NUMBERS</td>
<td>VARCHAR(1000)</td>
<td>Phone number(s) of sms recipient(s)</td>
</tr>
<tr>
<td>MESSAGE</td>
<td>VARCHAR(1000)</td>
<td>Content of sms sent</td>
</tr>
<tr>
<td>REMARKS</td>
<td>VARCHAR(1000)</td>
<td>Delivery message</td>
</tr>
</tbody>
</table>

7. **System Implementation**

The implementation involves the integration of different technologies to actualize the desired system. The main goal being put forward while designing the system is its simple accessibility with minimum requirements on the user’s side. Due to large flexibility of information delivery over the internet, the system is implemented as a standard internet application. The client side requires no more than the standard internet browser installed on the local computer while the main application functionality is assured by the server side.

The main objective of the system is to develop and implement a Web-based Bulk SMS Solution for user. Web applications are by nature distributed applications, that is, one part of the application is executed on the web server while another runs on the client computer within a web browser window.
The implementation begins by writing the code for the project, then program the code. The program and the web contents are stored in a folder. The folder is hosted on XAMPP in a hard drive. Application starts when launch a web browser (IE or Firefox) and types in web address (URL) e.g. 127.0.0.1/sms or local host/sms and press enter button, the web browser sends this in a so called http request to the web server. If the web server receives a request for a static HTML file (i.e. .html or .htm file extension), it merely locates the corresponding file and sends it back to the computer that had requested it. But, if the web server receives a request for dynamic files (such as .php, .asp, .jsp etc) it locates the Php file, parses and executes its contents and displays them on the web page.

Since the application is meant for sending SMS message one need to subscribe for Bulk SMS from vendor (e.g. Kullsms, SMS Solution, SMSLive247.com etc). This can be done by registering with any Bulk SMS vendor as agent/reseller or user.

After registration, an account is created for the member who can access the Bulk SMS by making payment at their designated banks account through any payment mode (ATM, cash, check etc). The value of the Bulk SMS purchased is credited to the subscriber’s account for use. The bulk SMS used for this research work was subscribed from SMSLive247.com powered by iDevWorks Technologies Services.

![Fig 4.1 Home Page](image1)

This display the full page of the Bulk SMS Solution

![Fig. 4.2: Menu Link](image2)

When clicked takes one to the figure display below
Fig. 4.3 Send SMS Block

Display where to enter the phone number(s) of intended SMS recipient(s) with a message in message text area has shown in the fig below then click send message.

Fig 4.4 sent message display
After clicking send message and the message is sent, the delivery message confirming that the message has been sent successfully is displayed.

8. Summary and Conclusion
This work focuses on increasing the importance of integrating SMS platform into organisation that has web site. Bulk SMS solution provides a variety of SMS message catering for all business needs in order to enable easy two-way communication with clients on an individual or bulk basis. The platform makes use of direct links into local as well as international networks and gateways. We have several SMPP links with all the local GSM Networks (MTN, Airtel, Glo and etisalat), which enables large volumes of SMS, EMS and MMS messages to be sent immediately on request. Bulk SMS is a web based application that combines the proven technologies of desktop computers and the internet platforms, allowing one to maintain and send sms messages at the click of a button. SMS Gateway allows for easy integration of various API's to connect the client computer applications with the GSM networks over the internet.

5.2 Conclusion
Bulk SMS is an application designed to provide SMS communications system for clients in the fulfilsment of their specific needs. SMS solution can be fully integrated with existing systems and databases. It can provide an audit trail of network delivery reports and traffic volume and can design analysis tables that best fit their exact requirements. Bulk messaging is a cost effective marketing and communication tool for both large and small businesses. Users are reporting an excellent response to messages sent.

References


HUMAN RELATIONS CONCEPT: A DYNAMIC APPROACH TO ACHIEVING EFFECTIVE GOALS IN SCHOOL ADMINISTRATION.

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Abstract
The emergence of human relations concept in practical administration generally brought about changes in organizational management structure. Eventually, this realization has led to creative thinking and bridging various lacunas copiously seen in many organizational lives. The application of human relations approach has helped many organizations to survive in face of tiny resources today. Most organizational success can amply be linked to the degree of human relations approach adopted in the management of organization human resources. This paper therefore, viewed the human relations conceptualization as good breath in resource development and effective management process in all organizations including school organization by taking an overview appraisal of the concept, its importance, discussion, summary, recommendations and references.

Keywords: Human relations, Concept, Achieving, Effective goals, School Administration.

Introduction
The conceptualization of human relations idea in management studies is often seen as embedded into the organization theoretical model which guides and helps to explain patterns of regularities in total organization life. Human relations approach is viewed clearly as an organization theoretical model in its own perspective that enhanced the human feelings while in organization. Nevertheless, theory generally tries to bring out the intrigue guide to the study of phenomena and therefore, serves three functions in administration: - it enables general model for analytical reasoning, point of reference and decision making (Hoy & Miskel, 2008). The reference of administrative theory as effectively describing phenomena has led to an increased understanding of many concepts, generalizations and agreements and establishing administrative frameworks in human relations model as practiced by administrators today.

The development of organization perception on human management has changed because formal and informal aspect of organizational thinking according to human relations school must be merged together in pursuit of the set out goals through adequate decision making. Herbert Simon proposition on proper decision making is absolutely important in organizational development process. With this departure from the scientific management thought, the cooperative efforts of individual member are fully harnessed for effective group goal achievement through integration of formal, informal and decision making method in the organization. This concept provides effective tool to motivate performance in organization based on Mary Parker Follett’s value and premise which believes that democratic procedures are the best means to achieve individual fulfilment within groups, because only through them would all participants feel both involved and responsible (Babcock, 1998).

The classical and neoclassical organizational model tends to occasion doubt on human substance in organizational life. Their consideration as it were, lent itself to appreciating human efforts like machines. They rely mostly on formalization aspects of organization
alienating the human angle or informal grouping as facilitating factor in accomplishing organization goal. The height of this period became the dehumanization era when viewed from the processes involved in this type of organizational model from management perception of the workers.

The industrial revolution in place aided in relative terms to contribute, but no organization can be effective without the human elements, even, the classical thinkers themselves formed part of the human elements but alienate the workers because of maximization of profit. All these are based on the essence of over utilization and marginalization of work force to enhance more production of goods and services by obviously equating man to machines.

The consideration of human importance in the system was not much paramount in the classic assumptions of Taylor (1856-1915) father of scientific management as later viewed by the behavioural science school. The mechanistic man was de-emphasized by the introduction of industrial psychology into organization management by the behaviourists. They see human needs as crucial in stimulating better work environment and relationship in achieving increased productivity which hitherto, was constrained by deteriorated work conditions that kills morale and efficiency.

The human relations idea widen the views of many that people need to work with freedom as to meet their needs as well as organization needs leading to increased productivity. This effort was supported further by the works of Maslow (Need hierarchy), Herzberg (Two factor theory), Mac Gregory (theory X and Y), Simon (decision making process), Vroom (valance – expectancy- instrumentality) and many others have eroded the machine man idea , giving way to the human that has needs to be met by the organization in course of pursuing organizational goal.

The emergence of human relations concept in administrative literature has energized and legitimized the feelings that really human beings constitute the life of every organization. The Hawthorne studies pioneered by Elton Mayo (1880 -1949) and impeccable ideas by Mary Parker Follett (1868–1933) laid a strong emphasis on the influence of human relations within the group (Babcock, 1998). Babcock further upheld that her analyses did not yield a step-by-step method of management; rather they were her reflections on how best to organize group efforts by recognizing the abiding truths of how human beings interact with each other. This process leads to results accomplishment in organization as such relationships create opportunity for knowledge sharing in solving organization problems.

Eventually, this concept has gained ground virtually in all management or administrative studies (Hoy & Miskel, 2008, Armstrong, 2003; Luthans, 2005). Also important is Follett (1868 – 1933) noble emphasis that the universal goal of every organization involves an articulated, integrated and mutualized member’s effort in collective performance to achieving responsible goal. At this point, leadership seeks to know why employee act differently and what motivates their action at work. Infact, this turn around facilitates hegemonic relationships that propelled efficient individual role performance and effective group goal achievement and maintenance.

Reference to Follett’s three notable conceptualizations, the workers is allowed to take appropriate decisions concerning them; workplace to be very dynamic and supervisory tasks to emphasize socio psychological relationship in the organization. These Follett’s basic propositions brought about the need for good interpersonal relations often emphasized as propelling force in organization group goal achievement (Ukeje & Okorie, 1999; Mullins, 2005; Obasi & Oluowo, 2008). The Hawthorne studies provided new conceptual views on workers as an integral part of organizational success. This congenial state enhanced productivity amongst work group; making it necessary that organization cannot perform
without good human relations especially the school system which is not an absolute profit making organization.

The school is conceptually an open social system with five important sub systems; the structural, the individual, the cultural, the political and the pedagogical (Hoy & Miskel, 2008), is primarily involved in teaching and learning. Based on achieving this statutory task of teaching and learning in a diverse situation, there must be good synergy of school members’ efforts in performing specified activities towards accomplishment of set out goals of education. To this end, the good part of people is often required for effective administrative performance. Deming (1993) cited in Mullins (2005) sees organization as a system with aim or purpose which precedes the organizational system and the people working in it. This supposed to be the stand for every social organization because the people are the organization. The organizational leaders cannot perform without soliciting the cooperation of the people.

The administrator harmonizes appropriately both task and human relationship in order to gain the confidence of the members (Obasi & Oluwo, 2005; Mullins, 2005) because the system must be defined in terms of the aim, not in terms of methods. When the whole system is optimized, everybody wins. Any less than optimization of the whole system means eventual loss to everyone (Deming, 1993). Based on this, the leader must assess the organization political background and building significant relationship channeled towards meeting simultaneously the set out goals and individual needs.

In achieving this aim, the administrator needs to foster this relationship to encourage intellectual stimulations among staff in effectively discharging right academic contents to the pupils. In schools as a social system, human relations have an important role in facilitating results. The view and expectations about people determines the good and real understanding in a rationalized manner, because relationship in schools must not be based on morality alone, if the quality of education is to be maintained as other cultural and sociological factors contribute to effective promotion of school climate.

The type of school leaders in place determines the quality of interpersonal relationships existing in the system. This follows that the “do it now or never” leaders are not good administrators and “never real achievers” (Okorie, 1999). The strategic importance of the school in achieving quality teaching and learning propels the emphasis clinical approach in supervisory and inspectoral practices as it brings out the real people to achieve the expected specific and measurable goals. School designated goals, are realized through collegiate relationship between the head, staff, students and community.

To facilitate and get good result, good leaders do not achieve in isolation. It involves total inclusion of tact and approaches that pulls concealed and collective efforts of all members towards system management. Team spirit helps to foster development and growth through proper capacity building leading to increased Morales, identification and belongingness in organization (Okorie, 1999, Mullins, 1999, Armstrong, 2003).

Many scholars and practitioners condemned the dictatorial system of administration where managers or administrators create empires around them and deploy coercive approach of leadership in soliciting for the efforts of organization members. The reward and punishment tool used by many administrators in trying to effect compliance in their organization is absolutely unproductive if applied in school system cannot survive, since the much needed efforts cannot be harnessed through coercion, but supportive appeal to staff members so that they can cooperatively pass the real academic substances to the students.

All these follow the contemporary idea of no one best way to facilitating support. The education laws (edicts) in various places do not so much provide the school administrators much power. The administrators are only empowered by law to make recommendations to
the schools board that takes decisive measures. The spirit of the law also prohibits actions that are dehumanizing in all circumstances as well as misconceptions of the interest of the school, hence, the need for effective human relations in school organization.

Educational leadership is not simple task. The school leaders must understand the administrative principles as it affects the day to day running of the school. In as much as it stands, staff integration in the internal school administration is an appropriate tool to achieve qualitative educational goal. It obviously improves curriculum and instructional development as good supervisory and inspectoral practices leads to qualitative teaching and learning. The cooperation of subordinates is not achieved coercively, they pledge their loyalty only to those leaders who understand the importance of their effort in propelling the administrative mechanism of the organization. This supports the assertion that loyalty is only given by subordinates as they think leader is worthy of it (Newman, 1997:p.135).

Leadership takes care of effective recognition of organizational members feelings and interest and that good leader requires to act within the limits of human relations rules guiding the corporate existence of the system, because poor management of staff often result to resistance to rules, policies and procedures, thus sterility of organization purpose and goals. The need for good policies is imperative and evidently noted as good human relations. Poor relationship has led to many strike actions in Nigerian schools due to poor management by the local, state and federal government paralyzing academic activities; all these epitomize poor relations by both military and political leaders managing the educational sector.

The school administrators need to maintain a good working climate for their staff, student and community as to promote school growth and maintenance. The learners see the uncooperative attitude of the administrator as an impediment in school success. Therefore as Newman (1997:p.115) points out “success in life depends upon the support and help of other people. No one makes it alone”. This is obvious as the school primarily exist for formal teaching and learning to bring about behavioural change of learners for individual and societal benefits. It requires a good atmosphere to flourish even as Hoy and Miskel (2008) noted power and politics play a lot in the school system but it must not be such that will damage the academic life of the learners. Both are required to facilitate results in many perspectives when appropriately applied in managing a social system. The school leader is for the interest of all and cannot work effectively by allowing the elements of power and politics to affect their decisions unlike other organizations because the school is delicate system that can make or destroy a nation.

Organization Concept of Human Relations

The dream of any organization is an effective leadership process to accomplish their needs and goals. Though, it is difficult to have uniform organizational leadership pattern. Charisma, modesty, humane approach, fairness, equity, qualification, age, education and professional development and quality style applications among several traits that differentiate one organizational leadership from another.

Successful organization must require good leadership and the leader shows willing to pull the resources together. Akomolafe (2008) maintains that "an organization needs leaders with both strong and good characteristics, people who will guide them to the future and show that they can be trusted". Following this idea, an organization success depends on trustful leadership approach towards cooperatively embracing all the members into organizational goal achieving process.

Trust builds confidence on people and leaders accomplish tasks easily when subordinates have trust on them because of their actions. Akomolafe (2008) similarly suggested that "one way of the ways to build trust is to display a good sense of character composed of beliefs, values, skills and traits. Organizational success is a measure of human
relations practice in place that enables the subordinates to buy the vision of the organization leaders.

**Human Relations Concept in School Administration.**

It is quite obvious that the leader is exerciser of tact and diplomacy (Newman, 1997), based on this he stressed that you “don’t lead your team with a whip, give them a dream and help them reach it”. The implication is that good leader must be visionary and capable of integrating the organization as a whole by recognizing the importance of the people in the system. Human relations applications is necessary in school administration because it implicitly or explicitly express the kind of commitment envisaged that determines the compatibility of members and the head of the school on one hand and the school and education board on the other hand in favourably achieving the expected educational result. It nurses the school commitment in creating conditions favourable to exploit the potentialities of school community members which includes staff, students and the larger community in pursuance of the need to achieve school goals.

Human relations proponents see the school organizations as people orient as such people constitute the network which demands cooperative efforts to meeting the set out goals. In other hand, the exposition academically and otherwise of the school administrator may often than not contribute to the quality of interpersonal relationship existing in the school. In holding this resolve, administrative styles adopted by administrators greatly determine the degree of cordial relationship that may exist between leaders and subordinates. Subordinates are interested on leaders with visionary ideas, concepts and relative capacity to carry them along the organization mission and vision and not that of the leader alone.

However, administrators can create conflict through misapplication of style in running of activities. Conflict arises when the role exhibited is incompatible with the subsisting established procedures, roles, rules or regulations. Resistance is the resultant effect when this situation arises. The system suffers when leaders and subordinates are in running battles owing to poor relationship. Even though, the administrator has all the skills, knowledge, experience and tact in leadership, he must have a complete built team to pilot the school activities to fruition.

Conflicts arising from poor human relationship abate time management creating poor school climate for accomplishment of tasks and goals. To secure students, staff and community cooperative efforts for proper teaching and learning to take place, administrators must understand the implications of good human relations in the entire school administration. The end result of education is meeting societal expectations through provision of qualitative skills on the students that make them worthy citizens. In essence, human relations involve the skills or capabilities to effectively work with and through other people in the group or organization. Management is about human being that is people constitute the central part of every social system. It requires concerted efforts to exclusively generate awareness of human rights, feelings and teamwork, in ameliorating increased diversity evident in the workplace.

Good human relations in the school facilitate good teaching and learning as staff and students are equally integrated into the system. An administrator adopting human relations skill appropriately leads the school to academic height. Conflicts are prevented to large extent by deploying discretion in managing subordinates. This very aspect of human relations essentially pilots easy accomplishment of tasks, whereas poor relations disintegrate school management; the very essence of organizational politics and power (Hoy & Miskel, 2008:p.247).

Good human relations helps to decrease personal stress and complication involved in decision making since subordinates are involved in the identification and solving of the school problem, thus group dynamics. Kossen (1994) emphasis on group dynamics portends
the ways in which groups must operate—is a cornerstone in the study of human relations. Sagepub (2011) pointed out “its task is to make people capable of joint performance, to make their strengths effective and their weaknesses irrelevant” and further upheld that human relations theory is about “humanization as technique rather than mechanical contraptions.” In light of this, administrators to harness the benefit of this concept, organization members should not be considered as isolates in whatever circumstance rather seek their cooperative effort for efficient and effective participation in enhancing good performance level. As Okeke (1982) noted that

A climate of impersonality between the principals and their subordinates at the secondary school level is an unwholesome situation and does not augur well for effective administration. Where there is much pressure on the teachers to perform their duties without corresponding regard for their individuality, concern and growth, the human element in such an organization stands neglected. Where this one happens the subordinates are unlikely to give their best. For effective leadership cum administration, therefore, a high combination of consideration and initiating structure characteristics should be exhibited by the principals. p63.

The above expression further seeks to suggest the need for human relations practice in school internal administration. This postulation enables good administrators to get the support and commitment of staff for efficient and effective delivery of planned curriculum contents. Analogically, the school if regarded as a human factory; its products be adequately prepared for quality in meeting the common needs of the society through a just in time approach. Administrators, staff and students must accept the fact that knowledge acquired is for societal good, and it’s not a personal benefit.

**Summary:** Even though, we sought for good human relations practice in the school, administrators must be cautioned of the fact that the school is not a personal or family business. It is a formal social system. The school head is appointed to control administrative and curriculum implementation through proper teaching and learning so that the goal of education is realized. It must not be embedded by elements of favouritism, nepotism or other unwholesome practices in pretext of putting human relations in practice rather than theorizing. As Max Weber noted that for organization to be effective it must be rendered completely impersonal and rational.

Based on these, school administrators to function efficiently and the school to effectively pursue its academic excellence, there must be in place concept of bureaucracy, as this in a way helps to control favouristic and nepotic acts as practiced by some administrators. In view of this, human relations practice should not turn the administrator as "Father Christmas" or becoming indecisive not to hurt anybody. Everybody must work appropriately to carry out the proper academic contents to the students as to build confidence on the system.

**Recommendations:** The followings are recommended for efficient and effective human relations practice and performance by school administrators:

i) Principalship position should not be left in the hands of quack that do not have the requisite idea of the teaching profession and educational administrative and managerial skills. A good school administrator must be conversant with pedagogical methodology and in constant research in administrative studies.

ii) Principals should be trained on leadership or administrative skills through well thought out courses on educational management from recognized university.
iii) Principals should be professional developed through in-service, workshops, and seminars and other pedagogical processes with their teachers to acquire new ideas, approaches and humanistic skills of managing people.

iv) Principals should always offer helping hands to their staff, and show equal concern for the task and relationship in the internal school management.

v) There should be consideration of human factor by principals while carrying out their daily duties as human facilitates system goals realization.

References.
THE STATE OF SCIENCE AND TECHNOLOGY INFRASTRUCTURE IN SECONDARY SCHOOLS IN NIGERIA

Salawu Abideen Alamu

Abstract
Science and technology (S&T) education is crucial to the achievement of socio-economic development of any society and also a critical element in the attainment of the Millennium Development Goals (MDGs). Standard laboratories and equipments as well as reagents are S&T infrastructures essential for providing qualitative education for producing national technological manpower. This study evaluates the condition of S&T infrastructures in the Nigerian secondary schools. The study utilises primary data collected from public and private secondary schools across the six geo-political zones in the country. Findings show that there are inadequate teachers, laboratories and necessary equipment for teaching S&T related subjects in most of the secondary schools in Nigeria. Also, electricity supply from the national grid to secondary schools is poor because only 30% of them have light at most 4hours a day. The study therefore recommends the provision of adequate funds and electricity generators for these institutions to enhance the teaching and overall development of S&T education in Nigeria. In addition, adequate and qualified personnel (teachers and laboratory technicians) should be provided while good maintenance culture and improved security of laboratories and equipment in secondary schools should be imbibed by all secondary schools in the country.

Keywords: Science and technology, infrastructure, Nigeria

INTRODUCTION

1.1. Background to the Study
Science and Technology (S&T) has been globally recognised as major instrument of economic development and social transformation. As a result, every nation has continued to pursue S&T knowledge in order to remain relevant in a globalised world economy. A major source of S&T knowledge and skills are educational institutions at all levels. The purpose of education is to generate and apply knowledge resulting in improvements in science and technology, while the S&T infrastructures required for knowledge generation and the attendant learning processes are the lifeline of the educational system. The state of available S&T infrastructures in educational institutions is a determinant factor of the capacity of the educational system to produce the requisite human capital necessary for achieving competitive economy and social transformation.

The production of adequate and competent technological manpower is a major challenge in Nigerian education industry. The education industry in the country has been battling with various aspects of infrastructure development challenges for improving the quality of education and expanding access. The various government efforts to improve infrastructure in educational institutions include construction of classrooms, lecture halls, laboratories and staff quarters as well as supply of water and electricity to improve quality of education and manpower production.
This study examines the condition of S&T infrastructure in secondary schools in Nigeria. The study aims to contribute to the attainment of Nigeria’s Vision 20:2020 and socio-economic transformation agenda currently pursue by the Federal Government of Nigeria (FGN).

1.2. Problem Statement
It is generally acknowledged that the delivery of education in Nigeria has suffered from many years of neglect. This led to frequent industrial actions by trade unions in educational institutions and students unrests caused by discontent arising from poor state of educational infrastructure.

Again, the various efforts to address the challenges of educational infrastructure include establishment of model schools, creation of specialised colleges, establishment of new public and private secondary schools. Other efforts included the establishment of specialised funding support for infrastructure from donor agencies and local institutions such as the Education Trust Fund (ETF) and the Universal Basic Education Commission (UBEC) among others. The extent to which these mechanisms support or contribute to the development of S&T infrastructure in the educational system has been unclear.

In addition, investment in S&T infrastructure still remain a factor not raised to the forefront when considering issues of educational development in Nigeria, and where it does, such investment is often subsumed under general infrastructure items. Currently, the quality of education provided remains grossly deficient and unable to build the human capital required for a competitive economy.

1.3 Research Questions
The research questions addressed by this study are:
   a) What is the current state of S&T infrastructure in secondary schools in Nigeria?
   b) What are the constraints and opportunities for the development of S&T infrastructure in secondary schools in the country?
   c) What are the necessary policies that will enhance the development of S&T infrastructure in secondary schools in Nigerian?

1.4 Research Objectives
The broad objective of this study is to examine the state of S&T infrastructure in secondary schools in Nigeria. The specific objectives are to:
   a) examine the current state of S&T infrastructure in secondary schools in Nigerian;
   b) identify the constraints and opportunities for the development of S&T infrastructure in secondary schools in Nigerian; and
   c) make policy recommendations on how the develop S&T infrastructure in Nigerian secondary schools.

1.5 Justification for the Study
Nigeria is technologically poor due to poor investment in human capacity development and necessary infrastructure. Presently, the 60:40 ratio of students’ admission into science and art disciplines in tertiary institutions is yet to be achieved in the country. This study becomes necessary in order to foster national technology capability building. Besides, it is unknown whether any study has examined the state of S&T infrastructure in secondary schools in Nigeria. This study aimed at bridging this knowledge gap and also proffers policies and actions that will enhance availability of S&T infrastructure in Nigerian secondary schools.
2.0 LITERATURE REVIEW

2.1 The Meaning and Role of Science and Technology Infrastructure
Science and Technological Infrastructure can generally be defined as intermediate inputs that provide the basis for the functioning of other technologies or provide essential services to other sectors of the economy. Technology infrastructure thus consists of science, engineering and technical knowledge available to industry. Such knowledge can be embodied in human, institutional, or facility forms. More specifically, technology infrastructure includes generic technologies, technical information, and research and test facilities, as well as less technically explicit areas including information relevant for strategic planning and market development. Science and Technology infrastructures amongst others are some of the minimum requirements that feed into technological and industrial development of any economy. Tassey (1992) describes Science and Technological Infrastructures in much wider terms, as 'science, engineering and technological knowledge available to private industry … embodied in human, institutional or facility forms'. He concludes that at national and firm levels respectively, there is an increasingly dependence on service delivery of Science and Technology Infrastructure.

The role of Science and Technology Infrastructure as an engine of development is an emerging issue that is beginning to feature prominently on the Nigerian scene. This is being demonstrated aptly in the National Education and also National S & T policies and in subsequent economic developments and reform framework of the country. The current economic reform framework is the Vision 20:2020 (NV20:2020), and it features S & T infrastructure as a cross-cutting issue that has to be promoted in order to achieve economic development objectives (NPC, 2007). The state of poverty in the country and the challenge of meeting the Millennium Development Goals, in this respect, in particular have drawn attention to the role of S & T infrastructure for solutions of technological adaptation and diffusion based on local conditions and knowledge. For example those that can boost agricultural productivity and food storage capacity, reduce post-harvest losses, promote renewable energy (including bio-fuels and solar), develop rain water harvesting systems, deliver potable water to rural villages, and improve basic health care.

2.2 The Role and Importance of Science Laboratories
At every level of science education, laboratories are perceived as a vehicle for curriculum enhancement. Studies including Hadley & Sheingold, 1992; McDaniel, Melnerney & Armstrong, 1993; Hannafin & Saverye, 1993) have indicated that a properly equipped and functional science laboratory has the potential for enhancing science learning. Science laboratories have a central and distinctive role in S&T education, and science educators suggest that there are rich benefits in learning from using laboratory activities.

In many African countries, research has revealed shortages in the number of laboratories in schools. A study by Jones (1990) found that 45% of the schools surveyed in selected African countries indicated insufficient laboratories. Alebiosu, 2000 and Onipede, 2003 reported that many schools in Nigeria do not have laboratory with minimum standard facilities. This finding agreed with Barrow’s (1991) findings in Saudi Arabia which also indicated inadequacy in the provision of laboratory facilities in schools. The findings were also consistent with those of Black et al. (1998) who found in Uganda that science education is faced with the problem of lack of resources with half the schools having no real laboratory. Keister, (1992) observed that shortages of laboratory facilities could have serious implications on the quality of schools’ output.
3.0 METHODOLOGY
3.1 Primary Data Collection and Scope of Study
This study covered both the private and public secondary schools in selected states in the six geopolitical zones of Nigeria. The choice of the secondary schools is anchored on the fact that it is at these levels that education become profound and learning is tailored to breeding future physicians, scientists, engineers, technicians and other professionals. The choice of states for the study is based on investment in S & T infrastructure in the educational sector, and availability of the frame/list of public and private tertiary institutions in 2010.

3.2 Sample Selection
One state was selected in each of the six geo-political zones for the study. Based on perceived performance on investment in education with focus on S & T infrastructure in 2010, one state was selected from each of the geo-political zones as follows:

(i) Edo State - South-South
(ii) Enugu State - South-East
(iii) Katsina State - North-West
(iv) Kwara State - North-Central
(v) Lagos State - South-West
(vi) Bauchi State - North-East

The Ministries of Education in the selected states were contacted for the list and location of secondary schools in their respective states. The lists provides sample frame from which twenty secondary schools that participated in the survey were chosen in each of the states selected. The secondary schools were stratified into public and private secondary schools, and urban and rural secondary schools. Secondary schools located in the state capital and local government headquarters were generally regarded as urban schools while those elsewhere were regarded as rural schools.

There are two types of semi-structured questionnaires employed as instruments for eliciting the primary data/information from respondents. One questionnaire was designed for secondary school principals and one for teachers of S&T related subjects. In each secondary school, five questionnaires were administered. Altogether, 600 questionnaires were administered in secondary schools while 438 questionnaires were retrieved representing 73% retrieval rates.

For the primary data collection, field research assistants were recruited and trained in each state served as enumerators. The questionnaire aimed at collecting data on S&T related issues such as nature of S&T related investments in the educational sector, availability of teachers in S&T related subjects, number and quality of S&T laboratories available in the institutions, capability to use laboratory equipment, availability and adequacy of chemical reagents in the institutions, the availability and adequacy of S&T equipment in the schools, the age and functionality of the available S&T equipment and materials, the adequacy or otherwise of S&T teaching materials and personnel and level of availability of water and electricity. To gain deeper insights into the constraints on S&T infrastructure development and how to overcome them, interviews of directors of research, planning and statistics in each of the selected state’s ministry of education were carried out.

3.3 Data Analysis
The Statistical Package for Social Science (SPSS) was used to analyze the questionnaires, following which descriptive statistics such as frequency counts, charts and tables were used as appropriate to explain the features of science and technology infrastructure in the sampled
secondary schools. Chi-square was calculated to measure the difference in significance between private and public educational institutions.

4.0 FINDINGS

4.1 State of Science and Technology Infrastructure in Nigerian Educational Institutions

4.1.1 Human Capital Outlay
An important determinant of economic growth and development is human capital outlay. The quality and nature of education determine the knowledge and skills available for human capital upgrading. From the findings of the study, three elements of the results provide some insights to the human capital outlay in the Nigeria educational sector. These are qualification of teachers of secondary schools; quantity and level of experience of teachers; and ratio of teachers to students.

4.1.2 Qualification of Teachers
Table 4.1 shows the distribution of the highest qualifications of teachers in the sampled secondary schools. 82% of the teachers have at least a bachelor degree in their subject areas, while the rest have HND or NCE in S&T related subjects. In fact, about 91% of the teachers have at least HND or B.Sc. It thus appears that very high proportion of teachers in S&T related subjects have appreciable requisite qualifications in S&T subjects. It is often advocated that teachers in S&T subjects should also possess training in education. From the results in Table 4.1, only 8.4% of the teachers have a postgraduate diploma in education and only 8.7% have national certificate in education.

<table>
<thead>
<tr>
<th>Highest Qualification</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCE</td>
<td>38</td>
<td>8.7</td>
</tr>
<tr>
<td>HND</td>
<td>41</td>
<td>9.4</td>
</tr>
<tr>
<td>B.Sc.</td>
<td>272</td>
<td>62.1</td>
</tr>
<tr>
<td>M.Sc.</td>
<td>50</td>
<td>11.4</td>
</tr>
<tr>
<td>PGD</td>
<td>37</td>
<td>8.4</td>
</tr>
<tr>
<td>Total</td>
<td>438</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: Field Survey, 2011

4.1.3 Quantity and Experience of Teachers
Table 4.4 shows the teacher to students’ ratio. The Table shows that, there are 4,793 teachers in S&T related subjects and 90,672 students. This implies a teacher to students’ ratio of 1:19. Except for wood work and metal work, the teacher to students ratios are very poor in all the S&T related subjects the most affected subjects being computer science and introductory technology with teacher to students ratios of 1:251 and 1:201 respectively. This shows that the quantity of teachers for S&T related subjects in the sampled secondary schools is inadequate.

<table>
<thead>
<tr>
<th>Subject</th>
<th>No. of teachers</th>
<th>No. of students</th>
<th>Teacher to students ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry</td>
<td>292</td>
<td>31124</td>
<td>1:107</td>
</tr>
<tr>
<td>Physics</td>
<td>269</td>
<td>32897</td>
<td>1:122</td>
</tr>
<tr>
<td>Biology</td>
<td>364</td>
<td>60636</td>
<td>1:167</td>
</tr>
<tr>
<td>Introductory Technology</td>
<td>124</td>
<td>24881</td>
<td>1:201</td>
</tr>
<tr>
<td>Integrated Science</td>
<td>217</td>
<td>26938</td>
<td>1:124</td>
</tr>
</tbody>
</table>
From Table 4.5 showing the distribution of the subject areas of teachers’ qualification, the vast majority (71%) of the teachers are in the traditional science subject areas of chemistry, physics and biology. The remaining 31% of the teachers are distributed over other S&T related subjects as shown in Table 4.5. These results indicate that secondary school teachers’ experiences are still mainly in basic science subjects comprising of chemistry, physics and biology.

Table 4.5: Subject area of teachers’ qualification

<table>
<thead>
<tr>
<th>Subject</th>
<th>Frequency</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry</td>
<td>104</td>
<td>24.4</td>
</tr>
<tr>
<td>Physics</td>
<td>91</td>
<td>21.2</td>
</tr>
<tr>
<td>Biology</td>
<td>110</td>
<td>25.6</td>
</tr>
<tr>
<td>Introductory Technology</td>
<td>18</td>
<td>4.2</td>
</tr>
<tr>
<td>Integrated Science</td>
<td>12</td>
<td>2.8</td>
</tr>
<tr>
<td>Computer science/mathematics</td>
<td>22</td>
<td>5.1</td>
</tr>
<tr>
<td>Agriculture/Animal Science/Home Mgt/Food &amp; Nutrition</td>
<td>59</td>
<td>13.8</td>
</tr>
<tr>
<td>Basic Electronics</td>
<td>4</td>
<td>.9</td>
</tr>
<tr>
<td>Metal Work</td>
<td>2</td>
<td>.5</td>
</tr>
<tr>
<td>Wood work/carpentry</td>
<td>3</td>
<td>.7</td>
</tr>
<tr>
<td>Education/Guidance &amp; counselling</td>
<td>2</td>
<td>.5</td>
</tr>
<tr>
<td>Environment/Geography</td>
<td>2</td>
<td>.5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>438</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

Source: Field Survey, 2011

4.2 Science and Technology Hardware

Science and technology hardware in educational institutions is very crucial to the advancement of practical teaching and learning. It includes the science laboratories, equipments, and teaching aids such as ICT facilities (computers, the Internet) as well as the support infrastructure (electricity and water supply) which are expected to aid the best functioning of the science and technology hardware. Science laboratories, in particular have been found to be central to the teaching of science. These laboratories are the workshops where practical activities are conducted to enhance a meaningful learning of science concepts and theories (Seweje, 2000; Olubor and Unyimadu, 2001).

4.2.1 Science Laboratories

The results of our survey showed that 82.5% of schools in our study have between one and five science laboratories, while the remaining 17.5% have over five science laboratories. The minimum age of these laboratories is one year; while the maximum age is 30 years. About 55% of schools have laboratories within the age range 1 and 10 years old, while the remaining 45% are above 10 years old.
For each of the three core science subjects, which are Chemistry, Physics and Biology, over 90% of schools claim to have separate laboratories. Furthermore, while 68.4%, and 50% have laboratories for agricultural science and introductory technology respectively. It was observed that integrated science and introductory science are often taken as the same subjects in many schools, and this may explain why only 39% claim to have a separate laboratory for integrated science. Figure 4.1 shows the responses received on the specific types of laboratories that exist in the schools in our sample. In addition to having specific laboratories, almost 60.0% of the schools attested to the fact that their schools have at least one science laboratory, which may be classified as multipurpose laboratory used for practical sessions for a combination of subjects. The four most common combinations of subjects for which these multipurpose laboratories were used for, are as follows:

a. Chemistry, Physics, Biology Agriculture, Animal Science, Home Management, Food and Nutrition
b. Chemistry, Physics, Biology, Agriculture, Animal Science, Home Management, Food and Nutrition and Basic Electronics
c. Chemistry, Physics, Biology, and Introductory Technology/Integrated Science
d. Chemistry, Physics, Agriculture, Animal Science, Home Management, Food and Nutrition

Figure 4.1: Types of laboratories in Nigerian secondary schools

<table>
<thead>
<tr>
<th>Perception on quality of science equipments</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of Schools</td>
</tr>
<tr>
<td>Chemistry</td>
</tr>
<tr>
<td>Physics</td>
</tr>
<tr>
<td>Biology</td>
</tr>
<tr>
<td>Integrated science</td>
</tr>
<tr>
<td>Computer science</td>
</tr>
<tr>
<td>Agricultural science</td>
</tr>
<tr>
<td>Basic Electronics</td>
</tr>
<tr>
<td>Metal Works</td>
</tr>
<tr>
<td>Wood Works</td>
</tr>
</tbody>
</table>

Source: Field survey, 2011

4.2.3 Quality of Science Equipment

Respondents were asked to rated how they perceived the quality of science equipments in the laboratories on a likert scale reported as poor=1, fair=2, good=3, very good= 4 and excellent=5. The perception of respondents (see Table 4.7) show that about 35% perceive the equipment as good, while 12% perceive the equipments to be excellent, and 17.10% perceive them as poor.

Table 4.7: Perception on quality of science equipments
Further analysis was done based on the computation of the level of significance of the perception levels on quality of equipments by teachers in the public and private secondary schools. The results show that there is a significant difference in the perception on quality of equipment at secondary school level (p= 0.0000).

### 4.2.3 Sources of Laboratory Reagents/Consumables in Secondary Schools
The main sources of laboratory reagents and consumables in the secondary school surveyed are the school (68.5%) and the State Government (70.9%). The PTA has not been active in this line of activity with only 7.5% of schools reporting this trend.

### 4.3 Electricity Supply
Electricity supply is one of the factors that are likely to influence the functionality of science laboratories, as it an essential input to many scientific processes. The regularity of electricity supply from PHCN (national grid) to educational institutions is generally very poor. As shown in table 4.11, about 30% of schools have light for not more than 4 hours, and only 21.05% of respondents at secondary education claim to have electricity from PHCN for more than 6 but not more than 8 hours per day.

<table>
<thead>
<tr>
<th>Regularity of electricity supply from PHCN</th>
<th>Secondary schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not more than 2 hrs</td>
<td>29.9</td>
</tr>
<tr>
<td>More than 2 but not more than 4hrs per day</td>
<td>29.9</td>
</tr>
<tr>
<td>More than 4 but not more than 6hrs per day</td>
<td>21.0</td>
</tr>
<tr>
<td>More than 6 but not more than 8hrs per day</td>
<td>7.6</td>
</tr>
<tr>
<td>More than 8 but not more than 10hrs per day</td>
<td>8.9</td>
</tr>
<tr>
<td>More than 10hrs per day</td>
<td>2.7</td>
</tr>
</tbody>
</table>

**Source:** Field Survey, 2011

With the results obtained on the regularity of electricity, it is therefore also not surprising to report that 74.1% of schools and 85.7% of faculties surveyed attest to the fact that they have alternative sources of electricity power supply to their laboratories. The alternative sources include electric generators, solar panels and inverters, as shown on table 4.1.
Table 4.12: alternative sources of energy supply in Nigerian institutions

<table>
<thead>
<tr>
<th>Sources</th>
<th>Secondary Schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric Generator</td>
<td>83.7</td>
</tr>
<tr>
<td>Solar Panel</td>
<td>4.8</td>
</tr>
<tr>
<td>Inverter</td>
<td>4.0</td>
</tr>
</tbody>
</table>

Source: Field Survey, 2011 (Multiple responses and therefore add more than 100%)

4.4 Constraints To The Development Of S&T Infrastructure In Nigerian Educational Institutions

All impediments to the availability of viable and adequate S&T infrastructure in the educational institutions are referred to as constraints in this study. The general constraints identified to the development of S&T infrastructure in secondary schools include lack of qualified laboratory technicians, inadequate laboratory equipment, poor to high quality reagents, poor electricity supply and poor funding among others.

Analysis of the interviews conducted on selected key officials in the respective State Ministries visited, also highlighted some concerns on the constraints and suggestions for improvement of Science and Technology Infrastructures. These responses are presented in Table 4.14, and it shows that inadequate fund (100%) was considered as the major constraint to the development of S&T infrastructure in the education sector. The inadequate number of qualified teachers (80%) and poor electricity supply (60%) were reported by these officials as second and third constraints respectively. Other constraints were poor maintenance culture, poor management of funds and vandalisation of equipment (16.8% respectively).

Table 4.4: Constraints to s&t infrastructure development identified by government officials

Source: Field Survey, 2011.

Results of the analysis carried out on the suggestions made by government officials to remove the constraints show that all respondents (100%) suggested improvement in the level of funding of education as a strategic way for improving S&T infrastructure development. This was followed by the suggestion on training and re-training of teachers (80%), procurement of electricity generating sets (60%) improved security, proper management of funds and good maintenance culture (about 20% respectively).
RECOMMENDATIONS

- **Improved Funding**: To move Nigeria forward technologically, there is need to provide adequate funds to provide all the necessary S&T infrastructures like laboratories, reagents and equipment for secondary schools.

- **Provision of Necessary Amenities**: There is a need for adequate and regular electricity supply and water supply to run the S&T infrastructure in Nigerian Educational institutions. Electricity generators should be provided for the schools to complement power supply by the Power Holding Company of Nigeria (PHCN). All educational institutions should be provided with regular water supply from a well or borehole.

- **Production of Qualified Personnel**: Adequate and qualified personnel (teachers, laboratory technicians) should be provided in the Educational institutions. In addition, there is need to train and retrain these personnel to perform effectively.

- **Good Maintenance Culture and Proper Management of Funds**: Good maintenance culture and improved security of school properties should be imbibed by all educational institutions. In addition, the provision and proper management of funds to source Science and Technology Infrastructure should be taken as a collective responsibility of the educational institutions, the state government, parents, and private individuals/organisations.

REFERENCES


TEACHING THE VIRTUAL COURSE DEVELOPMENTAL PSYCHOLOGY FOR PRE-SERVICE TEACHERS

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Jerusalem, Israel

Abstract
The course: "Developmental Psychology" is not only a must for any teacher-to-be because of curriculum demands, but also because it is impossible to be a good teacher without both knowing and understanding the various stages children go through from birth to adulthood. These stages include two main domains: the "psychological" one, namely, all emotional, social, and familial aspects, and the cognitive area, consisting the verbally- and the mathematically-based areas, including perception, memory, analysis and synthesis, etc. In this presentation I will give an example of a virtual 2-, 4-, or 6-hour a year undergraduate or graduate developmental psychology course that will cover all main subjects essential for a teacher or a teacher to be. All subjects are to be presented in length, along with all relevant learning materials, timetable, certain aspects of policy, and many advices that had been applied previously. In addition, some examples of "face to face" activity are to be presented for the use of the lecturer who wishes to meet her or his "virtual" students a few times a year and have them practice "real classroom situations" under her or his guidance.

Introduction
The course: Developmental Psychology" is not only a must for any teacher-to- be because of curriculum demands, but also because it is simply impossible to be a good teacher without both knowing and understanding the various stages children go through from birth to adulthood. These stages, discussed widely by various scholars, include two main domains: the "psychological" one, namely, all emotional, social, and familial aspects on one side, and the cognitive area, consisting not only verbally- as well as mathematically-based areas, but also all those that have to do with perception, memory, analysis and synthesis, etc.

In-between these two main areas there are dozens of sub-areas to be studies and discussed: gaps between the two main cognitive areas, gaps between any two of the following: cognitive-, fine-motor-, gross-motor, emotional-, physical-, sexual-, or social-domains. Such gaps, which are the main cause of uneven development, need to be studies, so that the teacher will be able to notice their existence as soon as possible and to her best to help the child overcome them.

There are two main schools regarding the question: "what is to be done in case of gaps between two or more areas in the child's development". The practice used most frequently is that of "fixing the child". This means, that is a child is slow in developing her or his fine-motor skills, he or she is to be sent to an occupational therapist. If the child has any kind of language difficulties, the communication clinician will "fix" her or him. In the role-playing section of this lecture I will introduce three examples of real-life situations all belong to a second category: advancing "with the child", relying on her or his strength, rather than "fixing" her or him.

Who needs virtual classes?
Offering a virtual class to "regular" university students intrigues asking the question: why to bother if a similar class is available in the regular, old-fashioned frame? I will hereby give a few answers all rely on my own experience of working in "traditional" higher education
institution. The common factor among all "virtual" students can be summarized as: "they have had difficulties attending regular classes because of various reasons".

Some of my students had difficulties participating in classes mainly because they were females in a traditional society. For example: many Arab students had to be back at home, sometimes 40 km away from college, before sunset. If the developmental psychology "regular" 90-minute class started later than 2 o'clock in the afternoon, they could not take it because in Israel it gets dark in the winter quite early. Other students, mainly religious Jewish young women, had children and they could not take any afternoon classes at all, because they had to be at home between 1-2 pm, when the children were back from school. Though quite few, I also had some male Jewish students; all of them worked full-time so they were glad to take any virtual course in order to complete their degree.

The main subjects in the "developmental psychology" class:
1. Introduction to developmental psychology (Levine, & Munsch, 2011; Bronfenbrenner, & Evans, 2000);
2. Theories in developmental psychology (Hoover, 2004 [on Bowlby]; Bawlbs, 1999; Mahler, 1969; Sagi-Schwartz, 2004).
3. The development of intellectual abilities (Anna Freud, Piaget)
4. Social development (Kohlberg, Erikson, Van der Veer, & Valsiner, 1994);
6. Moral development (Kohlberg; Piaget)
7. Introduction to gender development (Rich Harris, Gender rules, pp. 204-224);
8. Emotional intelligence (Matthews et al., 2004).

Each of these subjects can be studied in 3 levels: the equivalent to 2-, to 4- and to 6-hour weekly course.

The 6-hour a week, 2-semester course

Aim of the course:
1. To deepen the knowledge about the various stages of children's development, in regular and special education classes;
2. To refresh the practical knowledge already acquired by educational professionals in all relevant subjects regarding children from birth to adolescence;
3. To be able to apply the acquired knowledge in real life situations in kindergartens and schools;
4. To practice the reading of professional, scientific materials relevant to the educator's work;
5. To be exposed to a variety of opinions, attitudes and approaches in order to be able to choose the most relevant ones for each student in need.

Content of the course: List of subjects

Introduction to developmental psychology (DeHart et al., 2003);
Theories in developmental psychology;

Social development (Erikson)

Cognitive development (Piaget) [e.g. Numerical estimation (Booth, & Siegler, 2006)].

Moral development;

Nurture versus nature in child development;

The role of games in the physiological, physical, social, psychological and cognitive development of children (Davidson, 2010; Smith, 2009);

Socialization processes of the child and the adolescent

Individual differences in Temperament among children

Sensual sensitivity;

Asperger's syndrome among children

Down Syndrome (Gaad, 2006).

Attachment in early age: selection of attitudes

Attachment patterns and their cultural context

Gender differences in kindergarten and in school

Child in society

From childhood to adolescence (Steinberg, 2005)

Learning ways and the students' tasks

1. All learning materials are to be easily accessed through the college web. Most of these materials are to be either articles or book-chapters screened-by-the-teacher or freely accessed. In case the teacher chooses to use a textbook he or she must purchase the books for the students. One such example if the book: Developmental Psychology: Childhood and Adolescence, by Shaffer and Kipp (2009). A new book costs 201.06$. The 1996 edition costs less than 1$!

2. It is highly recommended that the order of the reading is done by the students according to the order of the tasks to be submitted.

3. All assignments must be sent on time, according to the course schedule [see an example for a suggested timetable for the 2012/13 school year].

4. All interactions with the teacher should be either through the college web or the teacher's private email.

5. Each student must complete all 8 assignments during the school year.

6. As the course is modular, it should be emphasized that each of the 8 handed assignments must be about 500 worlds long for the minimal – 2 weekly hour course; 100 words, for the 4 weekly hour course, and 1500 words for the maximal, expended 6 weekly hour course.
Calculation of the final grade:
10% for each task; total: 80% of the grade;
10% for connection with the teacher in each semester; total: 20%.

THE FRAME OF THE COURSE
The list of students and dates of handing the assignments and grades must be updated;
The teacher will save all emails from students – in case of differences between the date
you have received the assignment and the one claimed by the student;
Grades policy must be clear. In case of any misunderstanding a clarification mail will be
sent to all students.

THE SETTING

Timetable for handing the tasks [example for the 2012/13 school-year]:
Task No. 1: October 1, 2012;
Task No. 2: October 29, 2012;
Task No. 3: November 26, 2012
Task No. 4: December 23, 2012
8-week break
Task No. 5: February 18, 2013
Task No. 6: March 18, 2013
Task No. 7: April 15, 2013
Task no. 8: May 13, 2013

Rules regarding late handing of tasks:
1. In case of 1-7 days delay – up to the teacher's consideration;
2. in case of 7+ days: minus 10% of the mark for each week or part of it;
3. In case of family emergency, serious illness of the student or a close relative - up to the
teacher's consideration;

Gender-related exceptions: Pregnant students or new mothers:
1. Flexibility regarding handing the assignments;
2. Insisting of an equality policy, namely, the student must hand all assignments. Flexibility
means sometimes a longer interval between two deadlines, and/or handing the last
assignment/s after all students had already done that.

Policy against copying:
No tolerance policy.

Late registration
a. Late registration is to be allowed only after getting permission by the university authorities
[e.g. head of department; secretary for students' affairs].
b. No late registration is to be allowed after the students had submitted their first assignment,
namely, more than 4 weeks from the beginning of the year.

Communication with the students:
1. Keeping in touch
a. Offering face-to-face optional meetings at each beginning and end of semester [see examples in the last part of this article];
b. All students must have access to the internet.

2. Possibility for private communication

The instructor's email will be available for any student from the decision stage": when the student has to decide if she or he wants to take the course, until its end. The instructor must answer of the students' emails within a week of receiving them.

The course WEB

All course materials [e.g. the curriculum, learning materials, list of assignments, time-table for sending the assignments] must be available and easy to access on the web. The web must start operating, with all materials included, during registration time.

EXPECTED PROBLEMS

Dropout

Students whose literacy abilities are limited, due to a weak educational background, bilingual students who are not fluent in English, or students with too many other responsibilities, such as parenthood or working full-time job, might find it very hard to complete all assignments on time and eventually they drop out of the course. Though dropout cannot be avoided, some means can reduce it to minimum. For example:

1. Welcome the newly registered students in your first mail and assure them that each student who is persistent, hard working and not ashamed to ask for help will get at least a "passing" grade;
2. Send an encouraging mail to your students after each deadline for mailing each assignment and another one after you have graded the students' work. Focus on the students' successes, strong points, and achievements;
3. Send personal mails to students who are late in handing their assignments, reminding them that you are still waiting for their work;
4. Always believe the student: when a student asks for an extended deadline, do not check up on her or him, but rather agree to accept the work. Remember: dates are only a necessary frame; the important thing is that the work is done!

Copying

No tolerance can be accepted towards copying. The two main means that will show our students that you are serious are:

1. Check the first assignment of all your carefully. If you see even one copied paragraph, namely, one identical paragraph in two assignments, write to both students that you cannot accept their work. Believe me; when you do it just once, you guarantee that nobody will copy any more paragraphs in your course!
2. A part of each assignment will be giving examples from the classroom, family or everyday life to the phenomena discussed. When two students will give the same examples, using the same words, you can be sure only one of them thought about it. Do not tolerate it! Once your students know that you do not preach about copied work but rather disqualify it, this phenomenon will stop quickly [if started at all].

Along with the home-learning the students will be offered 4 90-minute meetings, each dedicated to a concrete example taken from the course materials. Here is the detailed descriptions f thee activities

Example No. I: Fine- and gross motor skills:

Graphomotor difficulties (Thorne, 2012):
Characteristics:
"Laziness"; "not paying attention"; intentionally slow"; "lack of motivation"; "negativistic"; "If you want – you are able to", etc.

Techniques used:
Abstention: doing something else [e.g. going to the toilet, not finding a pencil and thus having to sharpen a new one, being extremely thirsty or hungry when having to write]
Accompanied typical problems:
Fine motor skills problems;
Gross motor skills problems;
Organizational problems; emotional problems;
Attention deficit, with or without hyperactivity disorder.

In addition to the learning about all these disorders, problems, and emotional states, we shall learn a variety of help techniques;
- Self-regulation as an educational-therapeutic tool;
- Time management;
- Cognitive behavioral therapy
- Problem-solving discussion;

The 4-stage of the interview-conversation for solving problems:

<table>
<thead>
<tr>
<th>Stage</th>
<th>Typical questions</th>
<th>Relevant to:</th>
<th>Main skills of the interviewer</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Investing the reevaluation of the event</td>
<td>* Wow do you perceive now what happened? * Are you satisfied of the results?</td>
<td>* Argument</td>
<td>*Confrontation *re-phrasing *interpretation</td>
</tr>
<tr>
<td>3. Discovery of alternatives and re-planning</td>
<td>* What do you think you should do? How will you do that? What is our plan?</td>
<td>* Argument</td>
<td>* Logical results * Feedback * Instructions * Counseling</td>
</tr>
<tr>
<td>4. Affixing the connection and supervision of it</td>
<td>* How can I help?</td>
<td>* Feeling * Result</td>
<td>Each of the above-mentioned</td>
</tr>
</tbody>
</table>

Example No. II: Confrontation

The students that wish to participate in this second "face to face meeting" will be invited to take part in role-playing (Harrigan et al, 2010), where the main characters are two siblings.
quarrelling with each other, and a parent. In case the students have a difficulty finding a "reason" to quarrel about (e.g. because of being too shy), the teacher might can suggest a subject such as: "how come you two cannot decide how to divide the time so each of you can have fair access to the computer?" Once there is a "title" to the confrontation, the teacher's involvement is reduced to a minimum.

During the confrontation the audience, namely, the students that do not participate in the role-playing, might interfere. It is the role-players' task to react to their remarks or answer their questions, and the teacher is required to sit still as long as the conversation going on can be defined as "civilized", even if noisy. This confrontation helps teachers, and techers-to-be, not only to connect to the "child within them", but to notice many similarities between family- and school interactions. For example: when one of the children finds it hard to sympathize with her or his sibling, the teacher understands that it might be more difficult for a certain child than to his sister or brother to fully develop her or his capacity for empathy. Understanding that parents, in many cases, like one child more than her or his sibling might help teachers accept that they, too, usually feel much more comfortable with some students than with others. Deep understanding of this "hard to control fact" helps dealing with it.

Example No. III:

Re-designing of behaviors through empowering behaviors

This issue will be introduced during either one "face-to face" meeting or divided into two – the third and the fourth, last meeting. It is to include the following:

1. De-sensitization practicing;
2. How to live with anxieties – practical examples;
3. Maximal use of compensation techniques;
4. Practical counseling in developing fine-motor skills.

All these issues are to be demonstrated thought role-playing.

Biological and environmental factors in child's development:

Hereditity: the gene each individual receives from her or his parents;
Environment: all life-events and experiences
Maturation: the various stages enabling the child to acquire new abilities, and perform new actions.
Growth: the increase in the number of cells or in their mass, in one organ or many;
Learning: a continuing behavioral change influenced by age and experience.
Developmental coordination disorder: the scientific study of systematic psychological, emotional, and perceptual changes that occur in human beings over the course of their life span.

SUMMARY AND REFLECTIONS

I taught the course "developmental psychology" several times, both at the university and in two teachers' colleges, to Arab and Jewish students, to under-graduates and graduates. I taught the course as a regular, frontal curse, and as a virtual one.

Let me share with you some of the most interesting cases, where the virtual course was the only possible available for the student to master this important subject. Some of the examples have been taken from my experience in the Jerusalem "Efrata Teachers' College" for Jewish religious students, and some – from the course I had taught at the Galilee "Sakhnin Teachers' College" for Arab students, mostly Muslim, but some Christian and dome Druze as well. Both colleges were co-ed, but men were but a small minority of the students.
• 4 students who completed their first degree from the University of Amman in Teaching English, and thus their Hebrew was not good enough for regular Hebrew classes

While the official language in Israel is Hebrew, the Arab education system has traditionally been separated from the Jewish from kindergarten to higher education. Many Arab students invest a lot of effort in order to be more advanced in Hebrew, and by the time they graduate from high school their Hebrew, though a second language, is good enough for reading, conversing, and participating in higher education classes where must be fluent in Hebrew and have a good reading in English as well. However, every year a substantial number of Arabs chose to study in an Arab university. Most young people belonging to this group are Druze from the Golan Height who leave Israel at the beginning of the academic year for Damascus, and are allowed to return to visit their families only once a year, on a certain date in June, after the academic year is over. A smaller group is Muslim Arabs, mainly females, prefers to study in Jordan, at the well-known university of Amman. These students have no motivation to learn Hebrew when in school, and thus, if they choose to continue their studies upon returning to their homes in Israel, they face a serious lingual problem.

My 4 female students, who registered to studies for a diploma in special education at the Sakhnin College, asked me if they could participate in my developmental psychology class, even though they could not read Hebrew. Not only did I give them a positive answer; I also asked them to contact me through my private mail. These students completed my course successfully; they also inspired me to learn a lot about the lives and experiences of girls growing up in a traditional, rural society and then, at age 18, leave to another country, which had been considered an enemy-country of their own for many decades. These girls showed me that desire for good education had enormous power; it could have helped overcoming almost all obstacles. They also set an example for many other young Muslim women from their own and neighboring villages.

• A high-risk pregnant woman, from the first semester of her pregnancy until giving birth to two healthy boys

This Jewish religious student, from the "Efrata teachers' College", wrote to me about her special condition before registration to my course. She wanted to get all assignment ahead of time, and hand them to me before the end of the first college semester, in case she should have to go through a Caesarean section before the expected end of her pregnancy which was due to April. I agreed to have her in my course, and promised to send her the new assignment as soon as she mailed me the previous. However, I asked her not to share her work with any of the other students in the course. As the list of the students and their emails was available to all of them, I had no control of connections, relationships, or sharing works among the other students, but in her case, as she had intended to have the work done in half of the expected time, I decided to rely upon her word. She promised me to do that, and she kept her words as far as I know: I had not found any traces of other students copying from her…

At the beginning of April, about two months before the end of the ear, I received a "thank you" mail from these students, as well as three pictures of her and her twin boys. She was smiling in all of them…
However, there were other cases as well. For example: a 19-year old student whose pregnancy was noticeable at the beginning of the school-year. I offered her to join the virtual "Developmental psychology" course, but she said she preferred learning in the classroom; "like it was in high-school". When asking: "and what are you to do after you have a baby?" She said: "we live in the house of my in-laws; my husband is the first-born son and my child is going to be the first grandson, so my mother-in-law cannot wait until she can take care of him". "Do you already know it is going to be a boy?" I asked. "Of course, this was the only reason I agreed to take an ultrasound; I personally do not care at all whether I have a boy or a girl, but my husband and his parents do. Now that I know my baby is of 'right' sex for the first grandson, I am not allowed to do anything at home; they want me to be strong and healthy so I can concentrate in my studies. When the child is born, I'll stay at home for 3-4 weeks, but not longer".

And indeed, this student missed but 3 weekly classes after her baby was born, and she rejoined us in the classroom, happy, healthy, with high motivation to catch up with what she had missed.

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1 In Israel the academic year starts usually in October and rarely at the beginning of November, after the Jewish high holidays, celebrated according the moon-year, are over.


Rich Harris, J. (2009). *The Nurture Assumption: Why Children Turn Out the Way They Do* (2nd ed.). New York: The free Press. Chapter 1: "Nurture" is not the same as "Environment" (pp. 1-11); Chapter 10: Gender rules (pp. 202-224); Chapter 13: Dysfunctional families and problem kids (pp. 272-313);


IMPROVISING TEACHING / LEARNING AIDS IN CLASSES OF GEOGRAPHY IN OGUN STATE (NIGERIA) SENIOR SECONDARY SCHOOL (SSS)

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Abstract
Geography is a significant school subject but there are pull and push factors militating against effective teaching and learning about it at the Senior Secondary School (SSS) level of education in Ogun State (Nigeria). One of these is the dearth of resources. The objective of this piece is to look at the SSS Geography syllabus and suggest materials for improvisation of teaching aids. Geography of Ogun state was reviewed. WAEC, NECO and UTME syllabi were perused and specific topics of teaching and learning identified. The WAEC syllabus was tabulated into six parts and notes produced on each. Using the notes, materials from the local environment were suggested and procedures for their uses described. There is no aspect that absolutely lack materials for effective teaching and learning. Extensive use of chalk boards, chalk of various colours, pencils, Atlas maps and sketches of maps were suggested. Field works, Field Visits, Excursions and others were suggested as complementary to studying and fiddling with materials. The work also suggests use of School Van, Home Works, Projects, Assignments, Geography Laboratory and Meteorological Garden as imperative. The first two years may be traumatic and cumbersome but subsequent years will be building on the previous experiences and materials.

Keywords: Geography, teaching/learning aids, improvisation, Ogun State.

Introduction
The significance of Geography as a school subject cannot be over emphasized (Woodridge and East 1951, Aderogba, 1990, 2009 and 2011; and Boehim, 1996). It combines with many school subjects - Arts, Social Sciences, Pure Sciences, Mathematical Sciences, Languages and Technical Education to make a child qualify for tertiary education in Nigeria, and outside the country too. Similarly, it has led to making of professionals in various fields of human endeavour – Planning, Administration, Academics, Catographic, hydrologic, climate, environmental and others - just to mention but a few. Boehim (1996) produced in tabular forms, major areas of study in Geography and the associated professions. Abegunle, (1988) wrote on “The Promotion of career opportunities through the Senior Secondary School Geography”. Similarly, Sada (1976) and Areola (1978) wrote on the roles of Geography and geographers in nation building. But there are complaints about the large scope and abstract nature of the subject. The complaints are widespread among students; and teachers alike. That the subject is abstract is accentuated by the assumption that it is difficult to teach and learn about, and more importantly there are no readily available teaching aids for effective teaching and learning about the subject, (Eya 1983 and Aderogba, 2009), These probably explain the push and pull factors (Akande 1982, Adetuberu 1983 and Ajaegbu 1983); and skepticisms of Senior Secondary School (SSS) students to register for the subject in their West African Examination Council (WAEC), National Examination Council (NECO) and University Matriculation Examination (UME) for admission into tertiary institutions, (Aderogba 2011). That is, talk less of reading Geography as a major course of study at the tertiary level of education, (Aderogba 2005, 2012 and Aderogba and Ogunowo 2010).
However, the objective of the study is to examine each aspect of the syllabuses of WAEC, NECO and UTME and identify materials for improvisation of aides (resource) for teaching and learning about the subject in Ogun State, Nigeria. That is, towards reducing the abstract assumptions in the subject and for ease of teaching and learning about it at the SSS level of education, and to accomplish the objective of teaching and learning about the content of the syllabus of study.

**Study Area**

Ogun State is one of the thirty-six states of the Federation, (Nigeria). In February 1976, the territory was carved out of the old Western State by the military administration of General Murtala Muhammed and General Olusegun Obasanjo. The new state was made up of the former Abeokuta and Ijebu provinces of the former Western State, which itself came into being when it was carved out of former Western Region in 1967. She is administratively divided into twenty (20) Local Government Areas. The state administrative affairs are presided over by the Executive Governor who is being assisted by the Deputy Governor. There is a legislative arm that is presided over by the speaker of the State House of Representative. On the other hand, the Local Government administrative affairs are presided over by the Executive Chairmen of the Local Government Councils.

She is fondly referred to as the Gateway State in recognition of its strategic position as the link by road, rail, air and sea to the rest of the country. Apart from Abeokuta, the capital, which is an important market centre and a terminus of the roads and railways coming from Lagos and other parts of the country, there are also other major towns like Sagamu, Sango, Ota, Ijebu-Ode and Ilaro.

The state is located in the Southwest Zone of Nigeria with a total land area of 16, 409, 26 square kilometers. It is bounded on the west by the Benin Republic, on the south by Lagos State and the Atlantic Ocean on the East by Ondo state, and in the North by Oyo and Osun states. It is situated between Latitude 6.2°N and 7.8°N and Longitude 3.0°E and 5.0°E.

The climate follows a tropical pattern with the raining season starting about March and ending in November, followed by dry season. The mean annual rainfall varies from 128cm in the southern parts of the state to 105cm in the northern areas. The average monthly temperature ranges from 23°C in July to 32°C in February. The Northern part of the state is mainly of derived savannah vegetation. While the central part falls in the rain forest belt. The extreme southern part has mangrove swamp.

The geographical landscape comprises of extensive fertile soil suitable for agriculture, and savannah land in the north western part of the state, suitable for cattle rearing. There are also vast forest reserves, rivers, lagoons, rocks, mineral deposits and oceanfront. South-west of the state is covered by mangrove swamp forest. Leaves, timber, firewood, yam stakes, sponge, fruits, seeds, herbs and others are a few of the resources from the forests.

Substantial proportions of the forest have been replaced by human activities, roads, residential buildings, offices and manufacturing industry buildings; and cultigens. The state is drained by Ogun, Oyan, Makun and Osun rivers and their tributaries. They all drain their waters into the Atlantic Ocean in the south. They are significantly known as sources of sharp sand used for building and constructions in the cities and towns of the state and in Lagos Metropolis.

The population of the state that is made up of Muslims, Christians, African traditional religion and atheists is 3,728,098. The population is dominated by Yoruba speaking people (Egbas, Ijebus, and Aworis). There is no other tribe of Nigeria that is not represented in the state particularly in her urban centres of Abeokuta, Ijebu-Ode, Shagamu, Ijebu-Igbo, Sango, Ilaro, Agbara, Ota and Ayetoro. There are a few of other nationals too - black and white.
Over 45% of the population is under 40 years old. Less than 10.50% is 70 years and above. Again, over 60% of the population is engaged in agricultural practices. About 25% of the remaining population is engaged in white collar jobs working in government secretariats, in the manufacturing industries; as teachers, and lecturers; and hospital workers. More than 10% of this proportion commutes to work from Sango, Ota, Shagamu and Ijebu-Ode, in particular, in Lagos Metropolis in the south (that is, outside the state). The over 60% of the populace that engage in agriculture plant cash crops (cocoa, rubber, oil palm tree and others) and some food crops (yam, maize, cassava, pepper, vegetables, cocoyam and others). There are pawpaw, plantain, banana and few economic trees growing wild. The guinea savannah to the north and west supports grazing of animals. Mechanized agriculture is not common yet.

Apart from the two state own Universities, there is a Federal University, and eight privately own universities. Other tertiary institutions include the Colleges of Education and Medicine; Schools of Nursing and Health; and the polytechnics – privately and publicly owned. There are over one thousand secondary schools and two and a half times that number of nursery and primary schools. Over 85% of them are privately owned. More than 45% of these are located within Ifo-Ota-Agba axis of the state. There are a number of manufacturing, food processing, brewery and other industries too. Notably among these are Ewekoro Cement Works, Shagamu Cement Works, 33 Sona Brewery at Imagbon (Ijebu-Ode), Bisrod Furniture, Ijebu-Ode, Ceramic Manufacturing Industry at Abeokuta, and Sona Brewery at Ota. A number of manufacturing and assembly plants are just springing up with the largest proportion still in Abeokuta - Ijebu-Ode – Shagamu – Ifo – ota - Agbara Complex. Garri, kolanut and oil palm, timber, Saw-milling and plank processing are among the light and local industries. Quarrying of granite, gravels and laterite is common in the state. The relatively good roads encourage haulaging to the Metropolitan Lagos, being the major market. Though could be better, the state has good network of roads that link her with Lagos, Ekiti and Oyo states, and the Republic of Benin. Over 45% of these roads are dual-carriage ways. But, neither is there any sea nor air port. There have been proposals for a cargo airport. Railway traverse the state but train only convey passages to and from its extreme southern end to Lagos Metropolis. A few engage in international trades, but the Egbas and the Ijebus are noted for trade and commerce within and outside the state. They trade in agricultural produce and retailing of imported manufactured goods and services. Again, apart from Government lock-up shops and stores, all major streets of the cities and towns have shops retailing goods and services or as bars and restaurants. Apart from the state owned hotel, Gateway Hotel, there are a number of other hotels, brothels, motels, restaurants and bars. There are few miniature shopping Malls at Abeokuta, Ijebu-Ode, Shagamu, Sango and Ota only.

Undoubtedly, it is a region of contrast. But, water, electricity, feeder roads, security, health care delivery system, unstable government policies and programmes and qualitative education are serious threat to development. It is regrettable to note that crime rate is high. The state is really a wholesome laboratory for particularly teaching and learning about SSS Geography as Aderogba, (1990) explain in her paper “Towards a maximum use of Local Environment, (Resources) for Effective Teaching and Learning about Geography in Nigeria Senior Secondary Schools”; and as Eya (1988) earlier presented.

Methodology
The entire WAEC, NECO and UME syllabuses of Geography were perused and salient aspects/topics on (1) Elements of Practical and Physical Geography, (2) Human Geography,
(3) Regional Geography of Nigeria, (4) Field Work, (5) Geography of Africa, and (6) Selected Topics were identified. WAEC note on all of these assisted to define the topics (content) of each part (WAEC, 2012). See the Appendix. Teachers of Geography (of not less than ten years of teaching experience; and holders of B.Sc., B.A. or B. Ed in Geography), in twenty five schools were interviewed on the materials and improvisation of materials for teaching and learning about various aspects of the subject. They also provided some solutions to the dearth of materials for teaching and learning. Above all, they were enthused and suggested what could be obtained where to improvise for teaching and learning, using the resources in the local environment. Two Hundred and fifty (250) students from twenty five (25) schools of the state were similarly asked questions about those aspects of the subject that were found difficult to learn about. They all succinctly outlined what may encourage effective teaching and learning about various aspects of the subject. Fifty (50) old students of Geography (thirty in tertiary institutions and twenty out of school) were similarly interviewed. Their opinions and suggestions do not differ significantly from those that were still in schools and colleges. The over thirty years of experience of the author in the teaching of Geography was brought to bear.

The over thirty years of experience of the author in the teaching of Geography was brought to bear.

The entire syllabus is divided into six (WAEC 2012, NECO 2012 and JAMB 2012), See the Appendix:

- Elements of Practical and Physical Geography;
- Human Geography;
- Regional Geography of Nigeria;
- Field Work;
- Geography of Africa; and
- Selected Topics.

The WAEC notes are replicas of NECO and UME syllabuses. The materials and the procedure for teaching and learning about Geography for the three Examinations are the same; the schemes of works are also the same. See the Appendix. All aspects have material resources, animate and inanimate, tangible and intangible, that can be drawn from the environment of the state for teaching and learning. See the Appendix.

The words schools and colleges were used interchangeably in this work to mean formal places of study where Geography is taught and examined along with other school subjects at the SSS level of education.

Findings
The entire syllabus is divided into six (WAEC 2012, NECO 2012 and JAMB 2012), See the Appendix:

- Extensive use of chalk and chalk board for sketching, drawing, demonstration and all others;
- Drawing and painting with different colours of chalk, chalk boards; and colour pencils on papers and card boards;
- Adequately equipped Geography Laboratory, one per school;
- Adequately equipped Geography Garden, one per school;
- Adequately equipped Meteorological Gardens, one per school;
- Home work and group assignments, simple projects and others;
- Visits to agricultural fields, agricultural practices around and within school;
- Visits to mining of gravels, stone and other land/soil minerals;
Extensive use of Atlas maps, Charts, Tables, Models and others where available;

Field Work, Field Study, Field Trips, Excursions, and others should be undertaken and the learners made to study, observe, count, measure, sketch, play/fiddle, with examples, objects, materials, articles and others in the field;

Reports should be written by students and moderated by the instructors/teachers;

Everywhere, at all times, should be considered as laboratory and or an aspect of it for specific aspects of the subject: Forests and woods, grasses and swamps, springs, rivers and lakes, sunny and raining days, mountains and hills, residential areas, roads, paths, railways, flying aircrafts, ship, animals, birds, insects, human beings, workshops, schools and colleges, mosques, churches and other religious places of worship, industrial areas; (heavy and local), assembly plants, production centers, petrol filling stations, hospitals and maternity homes, sky and clouds in the sky; different vegetation covers and bare grounds; wind, households, family groups, compounds, communities and others; waste dumps, pipe borne water, schools and colleges, palaces of kings, king and the subjects, train stations, moving train and vehicles, markets, stores, articles of trade, manufactured goods, agricultural produce, erosion and erosion passages, soil and soil types, rocks and rock types, flowing rivers and their courses, features and land forms along river valleys; electricity poles, national grids, police posts/stations, post offices, rail lines, hotels, motels, brothels, restaurants and bars - just to mention a few around and in the immediate surroundings of schools;

Drawing and sketching of maps, filling and locating places and features on sketch maps;

Active participation in debates, quiz and essay competitions and others within and between schools and colleges, on geography topics;

References to past questions of WAEC, NECO and UTME examinations;

Teachers/instructors regularly attending training and retraining programs, workshops, seminars, conferences, debates, up-grading and up-dating programs and others on Geography and Geography topics;

Reference to examination marking guides by students and teachers of Geography; and

Self/group examinations/revisions should be encouraged and supported by schools and parents.

At least, it was once written by a geography scholar that “peeping through the window of a classroom, you can easily improvise materials for teaching and learning about 88% of the topics in School Geography”, (Aderogba 1990). It is only a try that can convince one. Though not within the scope of this work, Teachers and Laboratory Instructors may have to elaborately disabuse the mind of students and learners that Geography is neither a wide, abstract nor difficult subject. It is not; and every aspect is interesting to teach and learn about.

It should be of importance to note that an active, proactive and participative teacher would easily find, at least, a simple item for improvising for effective teaching of any specific topic/aspect in Geography anywhere, any time in Ogun state, (Nigeria).

Conclusion
Geography is a subject that teaches the interaction of man with his physical environment. It is useful as a school subject that a potential student of tertiary institution can combine with other school subjects to pursue professional and academic disciplines. A number of professional fields and professionals emerge from the discipline of Geography. There is no
aspect of the subject, at the SSS level of education in Ogun state (Nigeria) that materials (animate and inanimate, tangible and intangible) for effective teaching and learning cannot be improvised. It requires active participation and pro-activeness of the teachers and learners. A school van/bus is imperative for movement of students and teachers for Field Work/ Field Study/ Field Visits and others. Otherwise, school can hire bus for that purpose. Again, as many as ten objectives can be targeted to be met within an outing. The first two years may be traumatic and cumbersome but subsequent years will be building on the existing materials and experiences.

References and Further Readings


**APPENDIX**

The West African Examination Council (2004) Regulations, Syllabuses and Improvisation of Teaching Aid

<table>
<thead>
<tr>
<th>S/N</th>
<th>CONTENTS</th>
<th>WAEC NOTES</th>
<th>Teaching Aid Improvisation</th>
</tr>
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</table>
| 1   | ELEMENTS OF PRACTICAL AND PHYSICAL GEOGRAPHY  
Map Work | Map reading and interpretation based on a survey map of part of West Africa: scale, measurement, distances, direction and bearing, map reduction and enlargement, identification of physical features such as spurs, valleys etc and cultural features such as city, walls, settlements, communication routes etc, measurement of gradients, drawing of cross profiles, inter-visibility, description and explanation of drainage patterns of communication settlement and land use. | Materials: Prototype topographical maps, Drawing as many as possible of topographical maps and photocopying same for each student to practice. Such topo maps can easily show contour lines, drainage patterns, contour lines, spur, cliff, knoll, hills, plateaux, escarpments, falls, promontory, coastal features, valleys, lakes, settlements and their patterns communication lines and others. Functions of the settlements and human activities in the settlements could be derived; and vegetation type could be read. Distances could be measured, and gradients, intervisibility of points and others could be determined. |
|     | Elementary Survey | Chain and Prismatic compass, open and closed traverse avoiding obstacles in the field. | Materials: Common table (square) tape rule, ruler, twine, note book, set square, angle, common straight pegs (short and tall), a group of five students. A common ruler can be used to replace alidade. (It is a modified ruler). Common tape rule can be used in place of chain after a graphical example of chain might have been shown on the chalk board. Using either tape rule or common twine, with the supervision of the teacher, |
Elements of Physical Geography

The earth as a planet in relation to the sun. Latitude, longitude and time. Structure of the earth (internal and external).

Materials: Water, clay, mortal and water colour/paint. Clay is well mashed and then moulded to spherical shapes of various sizes (of the sun and the planets). This is painted with various colors of water bodies, low lands, higher land etc. Political and vegetational boundaries could be shown. On another spherical mould there can be lines of longitude and latitude. Equitoria line, artic and antartic lines shown. Still another one can be cut into two equal halves and differently coloured to show internal structure. Paper cuttings could equally show all these with

Statistical Maps and Diagrams

Graphical representation of statistical data: Bar graphs, Line graphs, flow charts, pie charts, dot maps, proportional circles, density maps, isopleths maps.

students can traverse avoiding obstacles in a school compound using a classroom as obstacle. Traverse legs and offsets are measured using tape rule. Individual students can form a straight line, or with the use of long pegs. One alines with the other at the next end and one in between. One measuring the angles and the other takes the reading and do the pegging. Angles of set square could be used to measure angle. Roles can be interchanged. A school Foot Ball Field is an example of a close traverse and a path in the school compound is an open traverse. When a school foot ball field is used, some desks could be placed along the route as obstacle.

Materials: A group of raw data on rainfall, temperature, trade volume, volume of traffic and others, sketch map. The data can be processed and put into a graph, chart, map and others. Such data can be obtained from any text and or generated. To draw a map of a set of data for a particular place, there will be a sketch map of such place too. Other information about density, for example, will determine how the data will be scattered on the map. Where data are omitted or none existing, common interpolation is done.

Materials: Water, clay, mortal and water colour/paint. Clay is well mashed and then moulded to spherical shapes of various sizes (of the sun and the planets). This is painted with various colors of water bodies, low lands, higher land etc. Political and vegetational boundaries could be shown. On another spherical mould there can be lines of longitude and latitude. Equitoria line, artic and antartic lines shown. Still another one can be cut into two equal halves and differently coloured to show internal structure. Paper cuttings could equally show all these with
<table>
<thead>
<tr>
<th>(i) Rocks</th>
<th>Types, characteristics, formation and uses. Mountains, plateaux, plains, karst and coastal landforms.</th>
<th>little explanation. Various sizes of moulded clay can be made to represent different planet. The sizes will represent relative sizes of each planet to the other including the sun. All can be arranged in space with the aid of string and the sun to form the planetary system – in a Geography Laboratory.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(ii) Major Landforms</td>
<td>Agencies modify landforms such as weathering, running water, underground water, wind and waves. Fieldwork covering local landforms such as coastal features, drainage features, gullies, etc.</td>
<td>Materials: Cement mixtures, clay, samples of different rocks types, geographical garden. Efforts of the teacher to arrange various types of rock samples, sedimentary, igneous, metamorphic etc. at the Geography Laboratory and or geographical garden or geography corner in Geography class will do the magic. Examples of resources derivable from each can be similarly arranged. Dormant and active volcanic erupted mountain, mountain, plateaux, plains, karst and coastal landforms are best improvised with casts in geographical garden. Use of cement cast with little artistic work each will be distinct and excellent. Clay mould can be used to depict these in Geography Laboratory and or class room. Pictures and drawings from internet could be used.</td>
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</table>

Materials: Cement mixture, clay, geographical garden, strings and others. Again various land forms are best presented in geography garden with casts. Valleys, braided river, tributaries, distributaries (delta) and others. How each came about could also be demonstrated with some water made to run from various slopes through pre-modified loose soil or mere mould of sand with obstacles along the slope. Erosion, along erosion passage, casting different structures/landforms on the way, can be good example of running water and its work. Again, as suggested by WAEC, NECO and UTME, Fieldwork covering local
(iii) Oceans

Ocean basins, salinity, ocean currents (causes, types and effects on the climates of coastlands), water as an environmental resource.

Landforms such as coastal features, drainage features etc. should suffice. Within and at the immediate surroundings of the student, if not anything biological weathering could be seen and explained.

Materials: Salt, water, drinking glass, transparent bowl, hand fan or standing fan or ceiling fan. A sketch of ocean floor on chalk board and water in transparent bowl of water can show ocean basin. Some moulds of clay and sand may be made to settle at the bottom of the basin to show certain terrain/configuration below the water ocean floor. A little salt in a cup of water will turn saline. Dirts in ocean water make it become cloudy.

— In a large bowl of water, blow winds with the aid of a hand fan or standing/ceiling fan, waves (currents) are created. Relate this to large body of water and circulating wind on water; circulating wind through the hot and cold regions.

— Ocean Resource - sea foods, water, sand, salt, transportation routes – A chart showing canoe being paddled or a ship sailing on sea. Students can be made to enumerate what are obtained from sea and ocean waters (that are known to them).

Materials: Matches and some pieces of paper, dusty ground, sticks and flowing gown; plastic funnel of 6-8cm diameter, calibrated bottle, a concrete cast of about 0.5m high, teak wood/stem of 3.4m long/high, 2 pieces of sticks of 1.2m long each, plates made into letters N, E, S and W, an arrow head with tail, a five inches nail, 4 two-inches nails, and a thick plastic ball. Outside the classroom, make a small fire with the matches. The flame and the smoke will follow direction of wind. Also use sticks to hit the dusty ground, you will see the

(iv) Weather and climate

Simple weather study based on local observation description of the Stevenson’s screen and uses of basic weather instruments e.g. rain gauge, thermometer, barometer and wind vane etc.
(v) Elements of climate

Temperature, pressure, wind and precipitation and the factors affecting them e.g. altitude, latitude, ocean currents, land-and-sea breezes, continentality, aspect. Interpretation of climatic charts and data. Classification of climate (Greek and Koppen’s). Major types of climate (Hot climate – equatorial, tropical and desert, temperate climate – warm and cool). The atmosphere as an environmental resource.

direction of wind – where it is coming from and where it is going. Using cement concrete, a rain gauge stand can be constructed. The graduated bottle is placed inside the already prepared space for it and the funnel put in place – all at a height of under 1 meter from the surface of the ground. Rain water could be collected in graduated bottle in this way and measured. Using the 2 pieces of wood of 1.2m length stick, and the letters N, E, S and W, attached to each end of the stick, one on each end; arrow head with tail, all made of metal plates a four cardinal point is constructed. This is mounted on the 3.4m length teak wood with the aid of hard/tough plastic ball to allow it rotate. It is erected perfectly perpendicular to the ground. It is without interference from any building or trees that will disturb wind flowing freely to it. Prevailing weather may be described. Photographs and diagrams could be used.

Materials: Sunny, hot days; rainy, cold days, hamattan period/day, hamattan haze, large bowl of water, standing fan; a swimming pool around the school or better still, a large pool of water.

A sunny day is bright and beautiful and it is hot. Heat is felt when it is hot. The shower of rain is visible. A rainy day is when the rain spans through considerable period of time of the day. It will be cold. Students use cardigans. During hamattan, it is dry, hazy and dusty. Visibility is greatly reduced too. Students should be reminded and or made to have a feel of it in its season. With a pool of water or in a large bowl of water, as the wind blows over it, a ripple of water is noticed. This is breeze. The breeze on water is a miniature form of ocean breeze/current. Compare this with large body of water. The ocean body and great winds over
<p>| <strong>(vi) Soil</strong> | Definition, local types and characteristics. Factors and processes of soil formation and soil profile. Tropical soil types. Importance to man and the effects of human activities on soil. |
| <strong>(vii) Vegetation</strong> | Major types (tropical rainforest, cool temperate, woodland, tropical grassland and temperate grassland); characteristics, distribution, factors affecting their distribution, plant communities. Vegetation as an environmental resource. | Go further to explain/relate it to ocean bodies, great winds blowing across the world cold to hot region, and vis-va-sar (continent). Material Resources: Different soil samples from around the school compound e.g sand, clay, humus etc. Cutlass and hoes, rock samples etc. Mixture of weathering of rocks and degradable organic materials turn to humus soil, sand and sandy soil. Cutlass, shovel and hoes can be used to cut out a soil perfectly to some depth to show soil profile. The hoe and the shovel are used to cut the soil and the cutlass is used to dress the cut surface. This can be observed at fresh road cuttings - from particles, through humus soil to basement rock. Drawings could be used too. Material Resources: Timber at saw mills, fire wood, chewing sticks, leaves for bean cake, local sponge, planks with which school furniture are made, grasses around the school, trees around and within school compound. The type of trees and flowers (shrubs) show the type of plants (vegetation) that thrives in the environment. They are also selected resources from the forest. Where trees/forests/grasses have been cleared for roads; agricultural purposes, urban land use etc. are deforested areas. The school compound is another one. Use of photographs and diagrams is imperative. Relate climate and vegetation. Material Resources: The school compound, the rats in the bush around, plants and other animals in the bush, water, trees and other landforms around it, bear grounds, school field, school farm etc. These could be used to explain the concept of niche, habitat and ecosystem. Simple food chain could be explained with |</p>
<table>
<thead>
<tr>
<th>(viii)</th>
<th>Aspects of Environmental Interaction</th>
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<tbody>
<tr>
<td></td>
<td>Land ecosystem, environmental balance and intervention within the natural environment.</td>
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<tr>
<th>(ix)</th>
<th>Environmental Hazards</th>
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<tbody>
<tr>
<td></td>
<td>Soil erosion, drought, desert encroachment, deforestation and pollution, causes, effects and prevention of each.</td>
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<th>2</th>
<th>HUMAN GEOGRAPHY</th>
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</thead>
<tbody>
<tr>
<td>(i)</td>
<td>World population</td>
</tr>
<tr>
<td></td>
<td>Factors and patterns of growth, distribution and movement; growth rate problems (e.g. Amazon as in, N.E. of USA, India, Japan, West coast of South Africa)</td>
</tr>
</tbody>
</table>

Materials: Erosion passages, running water during or after rains, cultivation against slope on school farms and on the farms around, gutter and erosion passages. Imagination of extremities of dry and wet seasons with many attributes of dryness and wetness; and the hamattan haze. A look at gutter during and after rain will show corrosive work of running water. Dry season is next to drought and desert conditions. Any waste dump is polluted land; unclean gutter are polluted; stagnant water with refuse is polluted; air smelling and dusty is polluted and so forth.

Materials: Two large settlements like Abeokuta and Ijebu-ode; and two small towns like Imaweje and Iju Okoto; government establishments, industries, water works known, hospitals, schools and colleges, transportation and commercial activities, stories of selected towns and villages known to the students. History helped or determined the growth and development of cities and towns. Employment opportunities, Government facilities and amenities etc. help settlement to grow and develop. Other things being equal, the more the number of amenities and facilities, the more the opportunities for employment. Bigger settlements have more amenities/facilities.

Materials: Drawing/ sketches of rural and urbanized settlements showing features of built-up areas –mosques, churches, schools, hospitals, roads, rails,
| (ii) Settlement | post office and the sizes to scale relatively. Given known examples, what is rural may lack all or most of the above and vice-versa. Lack or scarcity of these and small size of the settlement tent to rurality. Visit to rural and urban communities and studying the attributes of both will suffice. Photographs and diagrams should be applied. |
| (iii) Transport | Materials: Roads/paths that lead to school, railway around the school and or that might have been seen, Water in large rivers and sea (and ocean); the air above the school – up to 25,000 feet above sea level. People, animals, articles of trade, goods and others in vehicles on roads that lead to schools and colleges are similarly those carried by rail, water and air transport except relative cost and bulkiness – between cities, towns, regions and nations. How waters dry up in most rivers is a challenge to water transportation; hamattan is a challenge to air travels since visibility is always reduced; and poor roads (some wash away) are predicaments to road transportation. What is lacking in one region (town or nation) is transported to another basis of trade. There is no Kolanut growing in northern Nigeria. Thus, it has to be transported there the market is there and vice-versa with tomatoes, tatase and pepper. There is little or no fish inland of the state thus it is taken inland from the south. Photographs and diagrams should be applied. |

<p>| Types (rural and urban); patterns and factors affecting location; growth and size; functions of rural and urban settlements (e.g. Western Europe, the Middle East and West Africa). | Materials: For small/light industries: amala restaurant, carpentry workshop, blacksmith shop, motorcycle repairer’s shop, mechanic village, bean cake kiosk, plantain and corn roaster kiosk and other. Heavy industry – cement factory at Ewekoro, cement factory at shagamu, 33 Brewery at Ijebu – Ode, Ceramic Industry at |</p>
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<tr>
<td>(iv) Manufacturing Industry</td>
<td>Types (heavy and light industry); Factors of industrial location; contributions to Gross National Product (GNP) and problems.</td>
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<tr>
<td>(v) World Trades</td>
<td>Factors, major commodities (agricultural, manufactured goods and mineral products, trade routes, with special emphasis on trade between candidate’s home country and the outside world.</td>
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**REGIONAL GEOGRAPHY OF NIGERIA**

Nigeria on broad outlines (location, position, political divisions, physical setting, population distribution of mineral and power resources, industry and commerce, transportation).  

Geographic Regions of Nigeria (Eastern Highlands, Eastern Scarp, etc.).  

Abeokuta and others. Field visits to the locations of all (both categories) will explain some factors of location – accessibility, raw materials, labour, market etc. Photographs and diagrams should be applied.  

Materials: Two known location in the world. United Kingdom and Nigeria. Goods produced in United Kingdom (electronics, tin foods, automobiles and others) and those in Nigeria (cashew nut, crude oil, cocoa, hides and skin). The goods of the two nations are required in exchange. Sketch maps can depict the trade routes by air and by water.  

Materials: Atlas maps, sketch maps of Nigeria and others. Students should be made to study, trace/ draw map of Nigeria and locate political boundaries, physical settings, population distribution, major transport network, airports, sea ports and others; location of mineral resources, agricultural produce and others.  

Materials: Atlas maps, sketch maps, physical settings, Hausa/ Fulani man/woman, Yoruba man/ woman, Tiv/Benue man/woman, Igbo man/woman, Ijaw man/woman, Ibibio man/woman, Edo man/woman; common crops and others in the region. Trace/colour on sketch map where they could be found. Those found around the school and known somewhere else may be described. Student should be made to know where they came from, their food, mode of dressing, main religion etc. as distinct from others. Photographs and diagrams should be applied.  

Materials: Sketch maps, school vans and others. With the guidance of the teacher, the student are made to study/observe, jot, sketch and
### Fieldwork

Field work on any one of the following should be based on local geography of candidate’s home country. (This aspect of the syllabus should be examined in schools as part of the continuous assessment and should account for 25% of the total mark of continuous assessment):

1. **Physical settings**
2. **Peoples and population**
3. **Resources and economic activities**
4. **Transportation**
5. **Problems of development**

### Geography of Africa

Africa on broad outlines – location, size, position, political divisions and associated islands, physical setting (relief, drainage, climate and vegetation); distribution of major minerals.

<table>
<thead>
<tr>
<th>Lands, North-central Highlands, Sokoto Plains, Chad Basin, Niger Trough, Cross River Basin and Southern Coast. Each of these geographical regions should be under the following sub-headings:</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i) Physical settings;</td>
</tr>
<tr>
<td>(ii) Peoples and population;</td>
</tr>
<tr>
<td>(iii) Resources and economic activities;</td>
</tr>
<tr>
<td>(iv) Transportation;</td>
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<tr>
<td>(v) Problems of development.</td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th>Fieldwork materials: Atlas maps of Africa, sketch map of Africa showing outline, location and position, times of longitude and latitudes, the great circles - equator and others, political division, associated hills and mountains, climate, vegetation and distribution of major mineral resources. Students should endeavor to sketch and locate places and features on sketch maps as Home Works and during class lessons.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i) Land use (rural or urban): Rural – crop farming (e.g. rice, cocoa etc), mining (e.g. coal, tin, petroleum etc), fishing. Urban – commercial activities, ports, factories, recreational etc.</td>
</tr>
<tr>
<td>(ii) Market survey – rural or urban</td>
</tr>
<tr>
<td>(iii) Traffic flow – rural or urban</td>
</tr>
<tr>
<td>(iv) Patterns of journey to work – rural or urban</td>
</tr>
<tr>
<td>(v) Rate of erosion in the locality etc</td>
</tr>
</tbody>
</table>

| Materials: Any local mining or agricultural plantation; known economic activities, known location for lumbering and saw-milling activities and others. Let the students know favourable conditions for the existence of the practice where it exists; the draw specifics, e.g. Rural land use such as agricultural land use (and what are planted), mining (and minerals mined) fishing; Urban land use such as market survey, traffic flow, pattern of journeys etc. Articles of trade, volume of sales, modes and forms of traffic, patterns of journey and others could be observed/recorded and described. From immediately around school compound or short distance away. Erosion – watching moving water in erosion passages, abrasive, transportation and deposition works observed, and recorded. Visit to any local market will show predominant articles of trade, how the stalls are arranged, times and intervals of marketing, major marketers, challenges and otherwise of the market. |

| Materials: Atlas maps, sketch maps. Students will be made to study, sketch map of Africa and locate position of features and places and regions for example, lumbering, irrigation agriculture, mineral mining, population distribution; regions of Africa – North, West Central, East and South Africa; and geography of each region. |

| Materials: Any local mining or agricultural plantation; known economic activities, known location for lumbering and saw-milling activities and others. Let the students know favourable conditions for the existence of the practice where it exists; the draw specifics, e.g. Rural land use such as agricultural land use (and what are planted), mining (and minerals mined) fishing; Urban land use such as market survey, traffic flow, pattern of journeys etc. Articles of trade, volume of sales, modes and forms of traffic, patterns of journey and others could be observed/recorded and described. From immediately around school compound or short distance away. Erosion – watching moving water in erosion passages, abrasive, transportation and deposition works observed, and recorded. Visit to any local market will show predominant articles of trade, how the stalls are arranged, times and intervals of marketing, major marketers, challenges and otherwise of the market. |

| Materials: Atlas maps of Africa, sketch map of Africa showing outline, location and position, times of longitude and latitudes, the great circles - equator and others, political division, associated hills and mountains, climate, vegetation and distribution of major mineral resources. Students should endeavor to sketch and locate places and features on sketch maps as Home Works and during class lessons. |

| Materials: Atlas maps, sketch maps. Students will be made to study, sketch map of Africa and locate position of features and places and regions for example, lumbering, irrigation agriculture, mineral mining, population distribution; regions of Africa – North, West Central, East and South Africa; and geography of each region. |
## SELECTED TOPICS

- (a) Lumbering in equatorial Africa (with particular reference to Cote d'Ivoire and Zaire).
- (b) Irrigation agriculture in the Nile Basin and the Niger Basin.
- (c) Plantation agriculture in West and East Africa.
- (d) Fruit farming in the Mediterranean Regions of Africa.
- (e) Gold mining in South Africa.
- (f) Copper mining in Zaire and Zambia.
- (g) Oil production in Nigeria, Algeria and Libya.
- (h) Population distribution in West Africa.
- (i) International Economic Cooperation in West Africa (e.g. ECOWAS).

Significance of each to where it exists. Example oil production in Nigeria, Algeria and Libya; gold mining in South Africa and others. Visit to any local example will give the students an imagination of whatever is in other parts. The teacher should relate and give the conditions that favour it in such locations. Photographs and diagrams should be applied. Let the students know why we must/can refer to Nigeria, West Africa or Africa as a whole, a "region of contrast". Variability and contrasting physical environment, economic, social, political, people, culture and others.

WATER EDUCATION: AN ANTIDOTE TO WATER BORNE DISEASES

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Imo State, Nigeria.

ABSTRACT
This paper was designed to address the significance of water education. This is aimed at increasing public awareness on the importance of taking clean and safe water and keeping our bodies clean in order not to be contaminated with water borne-diseases. This paper therefore focuses on concept of water, water education, reasons for water education, water-borne diseases, transmission of water borne diseases, effects of water borne-diseases and the prevention of water borne diseases. When people’s behaviour is changed towards water issues as a result of proper information on water, it will go a long way to reduce the wide spread of water-borne diseases which kill over two billions of people annually. It was therefore recommended that comprehensive legislative programs should be enacted to protect and improve water quality and protect communities from water pollution thereby preventing water-borne diseases.

INTRODUCTION
The essentiality of water cannot be over emphasized. It is required in every sphere of human, plant and animal life. It is one of the most abundant liquid in the body and forms over 60% of our body fluids. It aids in metabolic activities which helps in sustaining our body system, an individual can survive without food for some weeks but cannot survive without water for one week. Water is of paramount importance as we use it in our home for drinking, washing, bathing, cooking, extinguishing fire and so on. It is also used for recreational activities, transportation and also acts as a solvent which helps in dissolving some polar molecules.

Water benefits are enormous that we need to acquire so that we can value taking safe and clean water and keep our water-bodies clean thereby preventing water-borne diseases which can be contacted by drinking water contaminated by human or animal faeces which contain pathogenic micro-organisms such as protozoa, bacteria, virus and so on, and it can be transmitted due to flood water, water runoffs from landfills, septic fields and sewer pipes through the faecal-oral routes of disease transmission. These diseases have tremendous effects on our health as well as the economy, locally and internationally people infected with water-borne diseases and faced with a huge financial burden in order to receive proper treatment. This can be prevented if we acquire a positive attitude towards water as a result of water education which will help us drink clean water devoid of pathogenic micro-organisms and keep our water bodies clean.

CONCEPT OF WATER
Deltawerken (2004) states that water is a colourless, tasteless and odourless substance that is essential to all forms of life that we know of.

Also the Merriam-Webster Unabridged Dictionary (2011) says that, water is the liquid that descends from the clouds as rain, forms streams, lakes and seas, and it is a major constituent of all living matter and that when pure is an odourless, tasteless, very slightly
compressible liquid oxide of hydrogen $\text{H}_2\text{O}$ which appears bluish in thick layers, freezes at $0^\circ\text{C}$ and boils at $100^\circ\text{C}$ has a maximum density of $4^\circ\text{C}$ a high specific heat, is freely ionized to hydrogen and hydroxyl ions and is a poor conductor of electricity and a good solvent.

Water is also a chemical substance that has the chemical formula $\text{H}_2\text{O}$, a water molecule contains one oxygen and two hydrogen atoms connected by covalent bonds, Dihydrogen monoxide is the scientific name of water. Though it is almost never used (Wikipedia free encyclopedia 2012).

**THE RELATIONSHIP BETWEEN WATER AND EDUCATION**

The World Water Council (2010) says that, the intimate relationship between water and education is based on the need for information. We need to be educated about water in order to know how to deal with all kinds of water-related problems or diseases. In developing countries, communities also need to know how best to manage their water sources and eradicate all pathogenic organisms that are likely to contaminate our water.

Therefore, water education is the process of acquiring adequate knowledge of where water comes from, it’s uses and the proper way of managing water so that it will be safe for human consumption. It is aimed at helping people to understand that water is essential to life, in food, energy, transportation, nature, leisure, culture, social norms and virtually all products used on daily basis.

**REASONS FOR WATER EDUCATION**

The Alliance for Water Education (2012) stipulated the following reasons for water education:

- Billions of people live without clean water and their children are dying.
- We buy food grown in different places, wear cloths grown in different countries and use computers and cell phones made in China, foods and products flown around the world like never before and with them goes the water that went into making them.
- To have energy systems, you must have water system; water and energy are the basic building blocks of modern civilization and both are challenged in the 21st century. Energy supplies depend on abundant fresh water and electricity from dams.
- To teach our children water literacy so as to be able to control the emerging water crisis.
- Also to create water awareness among individuals.
- To encourage improvement in water purification.
- To encourage citizens to be better informed about their drinking water supplies in order to prevent water-borne diseases.
- To educate people on the effect of polluted water.

**WATER-BORNE DISEASES**

According to Lennttech (2011), water-borne diseases are any illness caused by drinking water contaminated by human or animal faeces which contain pathogenic microorganisms.

Also, Webmaster (2009) states that water-borne diseases are caused by pathogenic micro-organisms that are most commonly transmitted in contaminated fresh water. Infections commonly result during bathing, washing, drinking, preparation of food or the consumption of food thus infected. Various forms of water-borne diseases affect mainly children in developing countries according to World Health Organization (W.H.O) such diseases accounts for an estimated 4.1% of the total daily global burden diseases and cause about 1.8 million human deaths annually. The World Health estimated that 88% of the burden is attributed to unsafe water supply, sanitation and hygiene.
Lenntech (2011) opines that the full picture of water-associated diseases is complex for a number of reasons. Over the past decades, the picture of water-related human health issues have become increasingly comprehensive with the emergence of new water-related infectious diseases and the re-emergence of ones already known, such as salmonellosis, cholera, shigellosis, schistosomiasis or the most modern infections such as legionellosis or SARS, the analysis remain to be done. The water related diseases according to the Lenntech (2011) includes; Anaemia, Arsenicosis, Ascariasis, Bolulism, Campylobacteriosis, Cholera, Crptosporiodiosis, Cynabacterial toxins, Dengue, Diarrhoea, Hookworm infection, Japanese encephalitis,lead poisoning, Legionellosis, Laptopsirosis, Lymphatic filariasis, methaemoglobinemia, Onchocerciasis, Ringworm or Tinea, Scabies, Schistosomiasis, Trachoma, Trichuriasis, Typhoid and so on.

TRANSMISSION OF WATER-BORNE DISEASES

Lenntech (2011), says that, water-borne diseases spread by contamination of drinking water system with the urine and faeces of infected animal or people. This is likely to occur where public and private drinking water systems get their water from surface water (rain, creeks, rivers, lakes, and so on) which can be contaminated by infected animal or people. Runoffs from landfills, septic fields, and sewer pipes, residential or industrial development can also sometimes contaminate surface water. This has been the cause of many dramatic outbreaks of faecial-oral diseases such as typhoid and cholera. However, there are many other ways in which faecal materials can reach the mouth; for instance, on the hands or on contaminated food. In general, contaminated food and water are the single most common way in which people become infected. These germs in the faeces can cause the diseases by even slight contact and transfer. This contamination may occur due to flood waters, water runoffs from landfills, septic fields and sewer pipes.

The United Nations World Water Development Report (2012) shows the following diagram as the faecal-oral routes of disease transmission

![Diagram of faecal-oral routes of disease transmission]

EFFECTS OF WATER-BORNE DISEASES

The IWA water wiki (2012) states that, in developing countries, four fifth of all the illnesses are caused by water borne diseases with diarrhea being the leading cause of childhood death.

The global picture of water and health has a strong local dimension with some 1.1 billion people still lacking access to improved drinking water sources and some 2.4 billion to adequate sanitation and education on water issues. Today, we have strong evidence that water
sanitation and hygiene related diseases account for some 2,213,000 death annually and an annual loss of 82,196,000 disability adjusted life years (Dalys, BOS, Dec. 2004).

The World Health Organization (2000) stipulated that water borne diseases can have a significant impact on the economy, locally as well as internationally. People who are infected by water-borne diseases are usually confronted with related costs and not with a huge financial burden.

This is especially the case in less developed countries. The financial losses are mostly caused by example, costs for medical treatment and medication, costs for transport, special food and by the lost of manpower. On average, a family spends about 10% of the monthly household’s income per person infected.

The World Health Organization (W.H.O) (2012) estimates indicates that the world wide over 2 billion people are infected with schistosomes and soil transmitted helminthes and 300 million of these suffer serious illness as a result. Also an estimated 246.7 million people worldwide are infected by schistosomiasis and these 20 million suffer severe consequences of the infection, while 120 million suffer milder symptoms. Also, estimated 80% of transmission takes place in Africa South of the Sahara (World Health Organization, 2012)

Diarrhea occurs worldwide and causes 4% of all deaths and 5% of the health loss to disability. Also after the Tsunami attack in Asia on Sunday 26th of December 2004, people faced the threat of water-borne diseases link to flooding like shigellosis, cholera, hepatitis A, leptospirosis, typhoid fever and dengue fever (W.H.O. 2012).

PREVENTION OF WATER-BORNE DISEASES

The United Nations World Water Development Report (2012) states that, the only way to break the continued transmission of water-borne diseases is to improve the people’s hygiene behaviour through education. And to provide them with certain basic needs such as drinking water, washing and bathing facilities and sanitation.

However, Lenntech (2011) opines that blackflies, bilharzian snails and other vectors that can cause water-borne diseases can be controlled with efficient drainage because they all depend on water to complete their life cycle.

More so, clean water is a pre-requisite for reducing the spread of water-borne diseases. It is well recognized that the prevalence of water-borne diseases can be greatly reduced by providing clean drinking water and safe disposal of faeces, (World Health Organization, 2012).

Water is disinfected to kill any pathogens that may be present in the water supply and to prevent them from growing again in the distribution system. Disinfectants are then used to prevent the growth of pathogenic organisms and to protect public health. The choice of disinfectant depends on the individual water quality and water supply system which can be improved by having adequate knowledge of water.

We should use water purifiers like kent for making the water clean so that we can keep the water-borne diseases away. It is also our responsibility to keep the water sources clean (Medindia 2012).

More so, drugs for water borne diseases include Albendazole, Ampicilin, Chloramphenicol, Ciproflaxacin, Doxycycline, Erythromycin, Furazolidone, Metronidazole, Nitazoxanide, Ornidazole, Tetracycline, Tinidazole and so on but all these drugs should be taken only according to Doctors’ prescription (Medindia 2012).

Also, the two common methods to kill micro-organisms in the water supply are oxidation with chemicals such as chlorine dioxide or Ozone and irradiation with Ultra-violet (UV) radiation (Lenntech 2011).
RECOMMENDATION

More water supplies, water quality, environmental restoration, climate change, flood management and a long list of other water-related issues should be explored.

Water education should be inculcated in the curriculum of different schools so that students at different levels should learn it from tender stage.

Water education should be encouraged so that people will learn how to keep their water safe for drinking.

Policies that prevent people from throwing dirt’s and waste products in our streams and rivers should be implemented.

National Agency for Food and Drug Administration and Control (NAFDAC) and other Organization that ensures that quality water are consumed and sold should be encouraged. Also there is need to invest in the water plan’s strategies and actions according to Guivetch.

Comprehensive Legislative Programs should be enacted to protect and improve water quality, protect fish and wild life and protect communities from water pollution.

There should be creation of water finance plan for integrated water management on a state wide and regional basis.

CONCLUSION

Water is one of the basic necessities of life that enhances metabolic activities of the body. It is vital in every sphere of human life and for the sustenance; it gives to our environment the economic health, social, cultural and recreational benefits we get from it.

The acquisition of knowledge that will enable people to have positive attitude towards water is necessary so as to enable people value keeping their water bodies clean and drink clean and safe water devoid of pathogenic organisms such as bacteria, protozoa, virus and parasitic infections thereby reducing and preventing the wide spread of water-borne diseases.

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INFORMATION COMMUNICATION TECHNOLOGY (ICT) IN SCHOOL EDUCATION AND MARGINALISED: AN EMPIRICAL ANALYSIS

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Abstract

Since independence, the Government of India has been taking initiatives new innovative programs to improve the basic education facility in the country. Many efforts have been made to universalize education at the elementary level. In this regard, programs like DPEP and SSA have made landmark achievements to have slight increase the enrolment and retention rate of children and bring back out-of-school children to school again. Despite the ongoing program, there is a newness and innovativeness in these programs to attract children to get quality education and for joyful learning in classroom settings through the use of technology i.e. ICT. In this regard, it becomes utmost inevitable to study how far these agencies have integrated themselves into the present structure of schooling system to help both marginalised children and teachers to facilitate collaborative teaching learning process. And, it helped to create interest level of the students and teachers belongs to tribal region in the country. Finally, paper aims to glimpse the effect on overall increase of students’ enrolment, retention and achievement level in school education. Experimental research through questionnaire and observation reveals that the student’s performance has increased among the general students rather than marginalised students due to adoption of ICT. It has well integrated and makes the classroom interesting for teachers and students since it has been helpful and captured the classroom more interesting. The study is accorded high priority in terms of effectiveness of ICT for educational development of marginalised.

Keywords: ICT, School Education, Marginalised and Student’s Performance

INTRODUCTION

Information and Communications Technology (ICT) plays a major role in all aspects of national life: in politics, in economic life, as well as in social, educational and cultural development. It is rapidly transforming our lives, vis-à-vis the way children do learn at school, access information, communicate with each other, and entertain ourselves. Since the Indian Constitution and the Directive Principles of the State Policy is committed to the equality of citizens and promote the educational and economic interests with special care of the weaker sections of the people, and, in particular, of the SC/STs and Minorities. Thus, Quality and equitable learning through application of technology are required to be ensured for the children in general, marginalised in particular. State hold responsible and require to provides quality and ensure equity in the teaching learning process in school education.

Application of technology not only helps a lot in bridging the rural urban divide in the education sector but also improving the quality of life as a whole (Mohanty & Vohra 2006) and it transforms the mode of imparting education which it leads to capacity development of both teachers and students. After independence, the Government of India has been taking initiatives to improve the basic education facility in the country. Many efforts have been

This paper is the part of empirical work during the M.Phil in Education in 2010 and it was presented and submitted to National University of Educational Planning and Administration, New Delhi-110016.
made to universalize education at the elementary level. In this regard, there is lots of newness and innovativeness to attract children in ensuring the participation in school education. The Computer Aided Education (CAE) in the form of ICT is one among them which have been implemented in selected districts and schools across the country under SSA.

The present study carries tremendous importance and it becomes utmost inevitable to study how far these agencies (ICT) have integrated themselves into the present structure, systems and arrangements of the government mechanisms for school education and become successful in running the program. Besides, to understand their coordination with the government structures and systems with regard to implementation of the CAE program becomes highly essential. More so, the CAE is meant to increase the interest level of the students and teachers and overall to increase students’ enrolment, retention and achievement level and thus the study is accorded high priority in terms of their effectiveness.

Keeping on the above view, the national mandate for the use of ICT in education in India has been anchored in various policy documents and programmes and it’s with proper implementation. Keeping in view of equality and ensuring equitable learning, the educational policy documents like NPE-1986 & POA, 1992, NCF-2005 and MDG-2 have given importance to use the ICT in the form of computer aided learning to achieve UEE in India. It was found that computers are useful tools in assisting the process of learning and acquisition of the academic competencies. This not only makes learning interesting and joyful but also provides scope for creativity and innovativeness in thinking and approach of the children along with the teachers to enhance their potential to learn.

Under this backdrop, this paper explores whether there is any strong relation between adoption of technology in school education with the enrolment, attendance and teacher performance, if so, then in what way ICT program helped in improving the student performance in terms of enrolment, attendance and achievement?

METHODOLOGY

The empirical investigation through experimental study and observation was conducted in Bhadrak (Non-Tribal) and “Mayurbhanj (Tribal & Marginalised) in two districts of Odisha State. The researcher selected 10 schools each from two districts because 50% of schools are considered as Low literacy in Odisha (Census, 2001) mostly geographically disrupted, hilly and tribal belt. Other 50% of schools fall in the coastal area which is coming under high literacy and non-tribal category. For a scientific and logical representation of the samples for experimental and control group, it was planned to cover 50% of the schools having ICT and another 50% of the schools having no use of ICT in both marginalised and non marginalised district. It was ensured that proper representation of sample size i.e 10 students and 3 teachers each from 10 CAL & 10 Non-CAL schools.

DISCUSSION AND ANALYSIS

Status of ICT in School Education

Like other programme, computer aided learning programme (CAL) in the form of ICT have been a key innovative programme under SSA in school education to provide quality education and to facilitate better teaching learning process. To ensure this, the availability of infrastructure i.e. availability of computer/Laptop, regular electricity, connection of internet along with regular check up is very much essential. It was observed in all sample schools possessing the required infrastructures to facilitate the class on technology based. But few schools in marginalised area did not occupy all the instruments, but no hamper/obstacles are observed in teaching learning process. Even after, the policy document emphasized the
regular check up, repairing of computer parts and appointment of special teachers, no monitoring work has been done regularly. Teacher who are trained to teach are involved in using the computers on the class room. No single computers have been appointed under the CAL programme rather than trained teacher which has hampered to facilitate the teaching learning process through computer.

Capacity building of teacher is the most important area of ICT under SSA which enhances the teacher performances in teaching through computers. Henceforth, training is very much essential to update the knowledge of teachers and which encourages the teachers to teach in innovative way. Status of ICT in terms of availability of computers, chairs, electricity, trained teacher, computer teacher, availability of content CD, regular visit for proper by staffs monitoring and provision of training programme for teachers are considered due importance.

Utilization of ICT in Education

Technology in classroom setting have been used by school teachers to facilitate their teaching learning process whose primary aim is to make the teaching learning process easy, interesting, understand, joyful and learning oriented.

Since ICT is primarily introduced for class V to VII students, the utilisation part was observed in primary and upper primary schools only. Few content designed in the form of CDs are developed for class IV students only. It was found more interesting for learning purposes. Teachers are also taking extra initiatives to give at least exposure to these students on computer education. In those schools one or more of the following measures have been taken i.e extra classes, multi-class coaching through computers, innovation teaching through extra effort etc. Most probably, computers are properly used in class room settings both in Bhadrak (non-tribal) and Mayurbhanj (tribal) district in state of Odisha.

Effect of Students Accessibility and Teacher performance

After studying the overall program execution in different schools, it becomes equally important to find out the kind and degree of impact that the ICT has on different components of students’ performance in education since there is strong relation between technology and technology based learning. Information was elicited to measure and know the effect of ICT over a period of time i.e 2003-04 to 2008-09. Objective was to compare the rate of attendance and achievement of children two years prior to the program execution and two years after the program implementation so that it was much easier to assess whether there had been an increase or decrease or no change. Attempt was made to collect required data from the school registers to justify the effect.

Student’s Enrolment

Annual growth rate of enrolment has shown that there is an increase in both tribal and non tribal district after technology is introduced in the year 2005-06. But there was a marginal difference observed in terms of enhancement of enrolment rate which is found in Bhadrak district (non-tribal). Apart from that after intersection between experimental (ICT schools) and Control (Non-ICT) schools in non tribal district in terms of enrolment rate, it was seen that there is overall increment in enrolment rate of experimental schools than
control reason of course of influence for the enrolment, if a child, in a particular school, has access to the nearest availability of that school from their house. But the most important factor which has captured student’s attention towards computer education. As evident from the interview, 44% students opined that due to computer education, they got interested to come regularly to school since it is interesting to learn through various games and practical examples. Even tribal students have also expressed their views is that computer education has been more attractive them which makes easier to learn in mathematics and science. But they find it difficult to understand the language of English and critical examples. Henceforth, ICT programme have been the motivational factor for the increase of enrolments at elementary level in Odisha.

4.4.2.0 Student’s Attendance

Regular attendance gives better performance (Sinha, 2005) among the students. Attendance also makes student more thoughtful and provoked. Many studies found that regularity of students ensures better result that is due to effective teaching learning process. To keep a major objective in the mind, ICT was implemented to ensure the 100% attendance in the classroom both in tribal and non-tribal areas. It has been found that during interaction, majorities of teachers realized that there has been an increase in attendance rate of children in their schools after the implementation of computer aided education program. But very few teachers agree that tribal student have not shown interest much on computers. Mainstream language has become an issue for them.

It is still clearly shown (Fig.3) that the rate of attendance of Mayurbhanj district has been low than Bhadrak district in both ICT and non-ICT schools in subsequent years. But in non ICT schools of both districts, the attendance is not consistently increasing over a period of time. At last, if we compare to the both district in terms of the attendance rate of students in different class, then, it is found that the rate of attendance of Bhadrak district is significantly high than the both ICT and Non-ICT schools of Mayurbhanj district.
From the above table, it clearly shows that there is a positive impact on ICT programme on student’s enrolment at elementary stage. Students has expressed that they have found interest in managing computers and learn through computers. They are interested to come to school regularly due to computer education and learning through computers. There are other factors which influenced them, but most of respondents agreed that they are finding easy to understand through computers even without interference of teachers. Tribal students have got less interest than non-tribal students. Though teachers have not created interest so much amongst them, they found to be less attracted towards computers. Really, in-depth reasons to be really sort out for the better understanding among teacher in the tribal district.

Few of them agreed that most of the time, they don’t take interest to come to schools. Student, particularly in Bhadrak district responded that due to absence of teachers in the school, they took less interest to come regularly. In tribal (Mayurbhanj) district, students are looking after their siblings, help their parents in family occupation and work outside to earn for an income which hampered to attend class regularly.

Similarly, evidence reveals that students take more interest to learn new things and loves to learn through computer. It can be said that only for this reason; student’s attendance rate is consistently increased. But relatively, there is no increase, in case of students in Mayurbhanj district as compare to Bhadrak district. Home pressure, taking care siblings has been the cause for non-regularity. Rather than this, neither local/tribal language is used in the teaching learning process, nor the most of the teacher know the tribal language. Transfer of teacher from non-tribal areas has remained as an issue of concern.

**Impact on Students Achievement**

It has not only provided them opportunites to widen their outlook and scope of learning. Use of this new tool has also given rise to enthusiasm and creativty among children. It was vouched by many teachers during interaction that many students who were poor
performer earlier are doing far better in computer operation and this also brought improvement in their performance in the subject matter.

**Achievement in the Subject Matter:** To know the impact of ICT on achievement scores of students, average % marks secured by the sample students in the subject like English, Mathematics and Science from the school register was collected from both experimental schools (ICT) and control Schools (Non-ICT). Data was collected from the both tribal and non-tribal district to know whether is there any difference between the tribal students and non-tribal students, which was followed by both ICT and non-ICT schools in the year 2006-07, 2007-08 after the implementation of ICT programme in the year 2005.

![Figure 4. Average Result of sample students in Science, Mathematics and English in both ICT & Non-ICT School for the year 2006 & 2007](image)

As it revealed from the above table no. 4, it is clearly visible that the difference between of ICT and non-ICT school result in terms of the student’s achievement score. Average score of the Bhadrak district in the subject of Science, English and Math is better than Mayurbhanj district. Similarly average score of all three subjects of ICT students are also performed better than the non-ICT students only in Bhadrak district. But, that does not took place in Mayurbhanj district. If we look at the above figure for the ICT and Non-ICT result of Mayurbhanj district, then it is found that there was similar achievement score of Math (55,55) and English(40,40) only. Still there is a difference between both ICT and Non-ICT in terms Science (58, 48) of Mayurbhanj district. In overall, it may be concluded that there is a significant difference in terms of achievement score of both ICT and non-ICT schools in the non-tribal (Bhadak) district only.

Independent sample T-test result signifies that there was a significant difference between the achievement score of both experimental schools and control schools in the both tribal and non-tribal district. Separate average result of 50 students from each district for the subject of Science, Mathematics, and English for the classes-V, VI, VII in the year 2006-07, 2007-08 was taken for the consideration. Systematic random sampling was adopted while individual score were collected from the register itself. Like one student from each 10 student was selected from both districts so that there was made sure that students from all category like good, average and bad were taken for the study.
### Table No. 1 Independent Sample t-Test of for the year 2006

<table>
<thead>
<tr>
<th>Bhadrak</th>
<th>Mayurbhanj</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>calculated T-Value</strong></td>
<td><strong>calculated T-Value</strong></td>
</tr>
<tr>
<td>Science Result of Class-V</td>
<td>4.99*</td>
</tr>
<tr>
<td>Science Result of Class-VI</td>
<td>5.20*</td>
</tr>
<tr>
<td>Science Result of Class-VII</td>
<td>7.91*</td>
</tr>
<tr>
<td>English Result of Class-V</td>
<td>6.06*</td>
</tr>
<tr>
<td>English Result of Class-VI</td>
<td>4.83*</td>
</tr>
<tr>
<td>English Result of Class-VII</td>
<td>6.43*</td>
</tr>
<tr>
<td>Mathematics Result of Class-V</td>
<td>4.22*</td>
</tr>
<tr>
<td>Mathematics Result of Class-VI</td>
<td>5.44*</td>
</tr>
<tr>
<td>Mathematics Result of Class-VII</td>
<td>4.66*</td>
</tr>
</tbody>
</table>

*Significance at 5% level (calculated Value > T-Value)*

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### Table No. 2 Independent Sample t-Test of for the year 2007

<table>
<thead>
<tr>
<th>Bhadrak</th>
<th>Mayurbhanj</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>calculated T-Value</strong></td>
<td><strong>calculated T-Value</strong></td>
</tr>
<tr>
<td>Science Result of Class-V</td>
<td>4.95*</td>
</tr>
<tr>
<td>Science Result of Class-VI</td>
<td>7.22*</td>
</tr>
<tr>
<td>Science Result of Class-VII</td>
<td>9.97*</td>
</tr>
<tr>
<td>English Result</td>
<td>9.06*</td>
</tr>
</tbody>
</table>
of Class-V  of Class-VI  of Class-VII  of Class-V  of Class-VI  of Class-VII
English Result  7.83*  2.01  English Result  1.83  2.01
of Class-VI  9.20*  2.01  English Result  1.52  2.01
Mathematics  6.52*  2.01  Mathematics  1.52  2.01
Result of Class-V  7.49*  2.01  Mathematics  1.56  2.01
Mathematics  6.51*  2.01  Mathematics  1.05  2.01
Result of Class-VI  7.49*  2.01  Result of Class-VII  1.05  2.01

*Significance at 5% level (calculated Value > T-Value)

This independent sample t-test (above both table no.1 and table no.2) analysis indicates that there has been a significant difference in the average achievement scores of students in the Class-V, VI, VII between ICT and Non-ICT schools in the Bhadrak district only. It is found that the calculated value of t-test is greater than t-value (2.01) which indicates there is significant different difference between ICT and non-ICT. Calculated value of Science, English and Math for the both year of Bhadrak district is greater than t-value. Similarly, calculated value of only Science (2.36*, 4.50*, 5.06*), which is indicated above, for the both year in Mayurbhanj district is greater than t-value (2.01). But in case of result of English and Mathematics for the both year, the calculated value is less than the t-value so that there has not been any significant difference in the Mayurbhanj (Tribal) district. Only Science result has made a difference between ICT and non-ICT in the Mayurbhanj district.

Evidence reveal that Computer Aided learning has a positive impact on student’s achievement in the areas of costal belt (Non-tribal district), where as ICT has been completely failure in the marginalized tribal district. However, there may be the other factors like provision and facilities available both at school and home, better education facility, parent’s education & occupation, local environment, quality of teacher, extra coaching also have a direct impact on student’s education. But it is proved that keeping all other factors remaining constant, ICT program has a positive impact in Bhadrak district only. As it was observed that shared with teachers, students and academic administrator, it was found that the given CD under ICT programme has not been designed to take care the socio-cultural context of tribal student. Games, examples and languages used are too difficult to understand to the tribal students which resulted that under achievement. In both district, it seems that under achiever started securing good marks only because of ICT program due to interesting examples and game etc. designed in the CD.

Impact on Teacher Performance

The computer aided learning is not only new to the students but is also a recent development for the teachers in the state of Odisha. So, it becomes equally important to know the teaching performance of teachers at elementary level. Capacity development of teachers was focused under ICT programme. It was felt that teacher training will enhance the student’s performances. Keeping in view of this, there was a need to be felt that development of teachers in terms of method of teaching. Teachers were interviewed about the interest, perception and utilisation of computer in the classroom to know how far they are aware and
really performing well in the classroom situation. It was also observed in the classroom before the computer whether they know how to run the computers and teach through computers.

It is evident that, ICT has made the task of the teachers easier while taught through computers. It was taking time to explain a subject through elaboration, which visualisation has made easier to understand for the children and also to explain for the teachers. Thus it has been able to minimize the task out 60% teachers. In case of 45% teachers from Bhadrak district has felt that their task is minimised, only 15% teachers from Mayurbhanj district has felt the same. Though tribal teacher in Mayurbhanj has not got long 1-12 days training about the computer program, they are having less interest, less knowledge about the computers how to function it. So that their interest for utilisation of computer is minimised which leads to maximise their task as it was explained earlier. Their absence and lack of desirable may be one the reason for less-utilisation the computer properly.

Teacher’s performance depends upon their perception and attitude about the using of computers. There is a positive relation between the teacher’s perception and performance of teacher’s. Unless the teacher perceives the positive attitude about the computer, they won’t initiate and think about the proper use of computers in the teaching learning process. Hence forth, it has to be understood that how the teachers have perceived about the ICT program and use of computer in the classroom.

Table-3 Teachers’ Perception on CAE

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Perception of teacher’s</th>
<th>Bhadrak</th>
<th>Mayurbhanj</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>1.</td>
<td>ICT is one important program to increase the enrolment/retention of children in school</td>
<td>2.82</td>
<td>0.48</td>
<td>2.96</td>
</tr>
<tr>
<td>2.</td>
<td>Computers is good only for playing and not for study</td>
<td>2.73</td>
<td>0.51</td>
<td>2.83</td>
</tr>
<tr>
<td>3.</td>
<td>ICT program of Govt. Of Odisha is nothing but a wastage of time and money</td>
<td>2.87</td>
<td>0.44</td>
<td>2.88</td>
</tr>
<tr>
<td>4.</td>
<td>My students are doing better in subjects like Math, Science and English after introduction of ICT</td>
<td>2.69</td>
<td>0.54</td>
<td>2.85</td>
</tr>
<tr>
<td>5.</td>
<td>Teaching through computer is a matter of pride for me</td>
<td>2.82</td>
<td>0.50</td>
<td>2.92</td>
</tr>
<tr>
<td>6.</td>
<td>Children are more interested towards the story, game etc. rather than the subjects matter</td>
<td>1.51</td>
<td>0.72</td>
<td>1.77</td>
</tr>
<tr>
<td>Statement</td>
<td>Description</td>
<td>Mean Value</td>
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<td>-----------</td>
<td>-----------------------------------------------------------------------------</td>
<td>------------</td>
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<tr>
<td>7.</td>
<td>ICT has only increased the workload of teacher</td>
<td>1.80</td>
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<td></td>
<td></td>
<td>0.90</td>
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<td>2.38</td>
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<td>0.85</td>
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<td>2.10</td>
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<td>8.</td>
<td>Oriya medium schools, which fail to provide basic minimum facilities to</td>
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<td></td>
<td>students/teachers, must not introduction ICT</td>
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<td>9.</td>
<td>I am not comfortable to teach through computers</td>
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<td>10.</td>
<td>CAE takes more time to teach a topic in comparison to the traditional method</td>
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<td>11.</td>
<td>ICT has increased my curiosity and I feel like creating something new through</td>
<td>2.82</td>
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<td></td>
<td>computers to teach my students</td>
<td>0.44</td>
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<td>12.</td>
<td>Use of computers has increased my confidence level</td>
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In order to study the attitude and perception of the teachers towards ICT, they were asked to respond to a set of 12 statements. The responses were measured using Likert Scale. Some of the statements (Statement no. 1, 4, 5, 11 and 12) having mean value of more than 1.5 shows a favourableness of the respondents towards that statement. Similarly statement having less than 1.5 value indicates unfavourableness. For the other set of statements (statement no. 2, 3, 6, 7, 8, 9 and 10) it is interpreted in the opposite way, i.e. such statements having a mean value of more than 1.5 indicates unfavourableness and statements having mean value of less than 1.5 shows favourableness towards that statement.

It is evident that positive attitude of the teachers towards the CAE program. However, responses to statements like children are more interested for game; story etc. gives mostly a neutral response. The CAE has not only been able to create interest among children, but has also brought enthusiasm and creativity among the teachers. As from the interaction with teachers, they have bought computers for use at home. According to some of them it will also help their own children to learn computer in the way it will help them to upgrade their own skill and create newness in teaching. Some of them learned it earlier, but majorities of them learned it out of their own interest after introduction of CAE in their school, as one/two training provided to them under this program are not sufficient to increase their proficiency in computer.
CONCLUSION

Enrolment trends, attendance rate and students’ achievement have significantly been progressed due to ICT program. Teacher performance indirectly shows that there is greatly improvement in the teaching learning process. Rather than this, favourable perception has made teachers to have positive attitude and thinking towards use of computer. As evidenced from above table and discussion, it is clear that teachers have not considerably performed well basically in the tribal district. Their low qualification has not motivated to make them learn. Their socio-cultural habits have restricted them to accept new modern technology and forced them to keep in their traditional settings. Regular local alcoholic drinking made them out of interest in using the computers in the class room situation. In this way, socio-cultural milieu has affected to accept that new learning environment.

To realize and fill the gap of teaching learning process in tribal areas for marginalised students, use of technology properly in teaching learning process can be felt to be a major decision both by the state. Tribal/marginalised students would be able to understand the teachings very easy through technology. If there would have been a felt need of frequent using computers in the teaching learning process and use of local language in the content itself, so that both teachers and students in tribal areas will be benefited. Role of technology could be felt a widely necessary element in education industry.

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REVIVING THE AFRICAN ART AND CULTURE THROUGH EXPLORATION OF INDIGENOUS CONCEPTS IN PAINTING

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ABSTRACT

There is this impression made by the white (colonial masters) that the art and culture of the African man is fetish and primitive. This has culminated into driving the focus of the African artist towards the white man’s art, idea, concept, theme and vision in a bid not to earn primitivity and be accepted all over the world thereby throwing the artist into colonial expressionistic bondage and as well relegating the African art and culture; making it unexhibitable and unacceptable outside our domain. This paper therefore, is focusing on adopting indigenous themes, ideas, vision, structure and mission in paintings to revive and promote the rich African art and culture particularly Nigeria that has sometime been relegated and lost in our pockets due to crave for colonial acceptance.

INTRODUCTION

African art has gone a long way in terms of style, theme, aesthetic and structure like the art of other continent. Creative analysis in art is an everyday event as new styles, forms; media, procedure and idea are emerging alongside contemporary artists. African art is known beyond Africa due to its dynamism and uniqueness. Art is life, and the way of life of a people is embedded in the culture. The African art and culture must be reawakened, promoted, exhibited and revived through the exploration and rendition of indigenous forms, themes, styles, ideas and aesthetic on the painters’ canvas or support.

The exploration of indigenous concepts in painting has since been an engaging issue in the mind of many contemporary artist. Although available art works (paintings) made by contemporary artists in Nigeria reveal such experimental trend for the sustenance of the rich artistic and cultural heritage of African especially Nigeria. Art is a living tradition in Africa. Contemporary African art derives its inspiration from traditional models but employs new techniques and materials (Shorter 1998).

ART AND CULTURE DEFINED

Art and culture are crucial and inevitable terms. Although they have their different meaning but closely related and accompany each other. Art as a term is an activity of diverse definitions. Simply defined, art is an expression of the adversities and feelings of the people in relation to their environment. According to Banjoko (2000), art is the visual and non-visual arts representation of human though. The visual arts are the symbols of expressed language, the tools with which culture is analyzed.

Thus, it is the expressed non-verbal symbols of the cultural environment. The meaning of art is applicable to African art. That is, African art refers to art works produced by Africans reflecting African(indigenous) life, theme, style, form and ideas.
Culture, like art, it also wide in scope and content, culture is more elastic because it embraces every aspect of human life. Generally, culture is seen as a sum total of people’s way of life, socially, religiously, politically, economically and morally.

Nkom (1992) posits, the identity of people, it provides the group that particular stamp that distinguishes them from other people, it expresses their uniqueness and existence. Taking a look at our society leads us realize that culture, for the African, is an indispensable tool. Cultural exposition and identification is manifested in the daily life of the people in the society. This is evident through the numerous art activities available in every Africa society. A society devoid of indigenous art practices cannot maintain its culture due to the presence of modernity where some things are disregarded and tagged “old fashion” or “primitive”.

PAINTING AND EXPLORATION DEFINED

Painting as a two dimensional art form is highly expressive. It consists of the organization of ideas in terms of lines and colour upon any surface (Ngumah 2006). He further defines painting as the application or spreading of colours on any given surface to create an effect with the aid of brushes and painting or palette knife. The art of painting developed from the primitive cave decorations of prehistoric times to the highly sophisticated and varied processes used today.

Exploration on the other hand simply means experimentation. Experimentation of something or ideas, styles, themes and so on. Oxford Advanced Learners’ Dictionary defines exploration as an examination of something in order to find out about it. It also means analyses-to analyze something.

WHY REVIVING THE AFRICAN ART AND CULTURE

Currently, lack of complete documented rich and cherished art and cultural heritage – values, norms, attitude, aesthetics and tradition handed to us from our fore-fathers is what our society is faced with. We all know that cultural properties are good elements that nourish the growth of the society especially the Nigerian society. But it is unfortunate to know that the so called colonialism is Africa had adversely infected our people socially, economically, politically, religious, and culturally. No doubt, this same colonial infection was extended to the art of Africa - the concepts, ideas, styles forms of African art.

However, the white man’s culture has interwoven and interrupted and relegated our art and culture. Prior to this time, the Africans had and were satisfied with their creative urges and abilities in terms of theme, idea, style, form and concepts. Therefore, the revival of the African art and culture can be possible and achievable through constant and further exploration of indigenous concepts, idea, style, form, theme and so on in paintings.

EXPLORATION OF INDIGENOUS CONCEPTS IN ART STARTED IN NIGERIA.

What exploration of indigenous concepts calls to mind is the experimentation on African (indigenous) ideas, styles, theme, life (culture), structure in painting to portray certain messages from within based on African background generally and Nigeria in particular. Before the advent of colonialism with its related tools, the Africans generally and Nigerians in particular had her novel way of executing paintings. This form of painting were done on the walls – murals, posts and on the body “Uri”. Such paintings are characterized by African themes and styles,(Ngumah 2006).
During the colonial era, a new form of painting emerged in terms of styles, support and media. This new way of painting expression formalized in Nigeria in the early 1920s with the effort of Aina Onabolu who made art form an important aspect of the school curriculum. This new art experience was mainly focused on landscape and portraiture. This is why most of the foremost Nigerian artists – Aina Onabolu (pioneer) Akinola Lasekan, Ben Enwonwu, Ugorji among others were realistic or representational painters (Ngumah 2004).

The post-colonial era witnessed and produced notable painters with radicalization of African concepts, full of experimental zeal. Painting reflect the socio-cultural matrix of the people rather than singing in praise the canon of the white man. This explosive urge gave rise for the “Nsukka school” whose focus is on “Uri” with Uche Okeke as the exponent. Bruce Onobrakpeya, Yusuf Grillo and a host of others were not out of the race for cultural experimentation and radicalization in painting (Ngumah 2004). The Awakening (Anyanwu) although sculpture by Ben Enwonwu has an indigenous background, the market scene by Akinola Lasekan, Agemo festival by Kolade Oshinowo and Ahware and Enemu by Bruce Onobrakpeya among others typified exploration and radicalization on African indigenous themes, ideas, styles and life.

BENEFITS IN EXPLORING INDIGENOUS CONCEPTS IN PAINTING

Exploring indigenous concepts in painting has no limitation on the artist horizon and vision, rather in opens the painters’ insight on the cultural practices of his people or the environment he finds himself in. exploring on indigenous concepts like – Ezeship (Coronation), Aladima, Ikenga, marriage ceremony, fishing ponds, cultural dances, wrestling festivals, farming season, politics, religion, burnt shrine and others, definitely push us very close to our way of life and happening around our society. It will interest us (the artist) to know that paintings with indigenous concepts are prone to patronage, more especially – if idea is clear and unique.

In like manner, Ochigbo (2011) posits that the creation of cultural artistic designs and works in staggering proportion by our creative genii, both in the academia and cultural institutions have been able to open vistas to Nigeria’s culture and traditional indigenous values. There is no doubt saying that African art had been in global market, museums, galleries and other art and cultural institutions – clothed with indigenous style, form, beauty, idea and life thereby raising interest, awareness, attention and hope for the African art and culture. Ayaka (2004) posits that cultural survival can only be possible if sufficient interest is shown in the study of sources of our cultural heritage, which is implanted in arts and culture.

CONCLUSION

In concluding this paper, we should have observed from the beginning of this paper that African art and culture are widely known but was relegated and discarded during colonial embrace. The vision, quest and cultural urge of our founding fathers, there came a rebellious mission which led to the systematic liberation from the so called colonial expressionistic bondage.

REFERENCES


STRATEGIES FOR DEVELOPING LEARNING SKILLS IN PRIMARY SCIENCE IN NIGERIA SCHOOLS

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Abstract
This paper examined the 21st century learners characteristic, the learning skills and the importance of developing learning skills in Primary Science teaching. The use of conventional methods of teaching was discouraged as it merely reproduced learners without thought processes who focus on mere regurgitation of facts without necessarily utilizing the left brain and the right brain activities in learning science. The paper also identified some of the strategies for developing learning skills among learners of primary science and the educational implications involved, were discussion.

Keywords: 21st Century Learners Characteristics, Learning skills, Teaching skills, Learning Styles, Constructivism.

Introduction
The reformation in science curricular led to innovations in the teaching and learning of Primary Science and also in professional development teacher, where teachers are re-trained for effective challenges of the 21st century Primary Science education. In Nigeria, the Millennium Development Goals Project (MDG) in collaboration with National Teachers’ Institute (NTI), organized a workshop in 2006 for retaining of Primary School teachers and among the subject teachers involved were primary science teachers. According to the NTI manual (2006), the general objectives of primary science education is to enable children observe and explore the environment using their senses. In pursuance of these objectives, the primary science curriculum content were centered on Physics, Chemistry, Biology, Health, Agricultural science and presented in an integrated manner.

These themes would expose the learners to acquire knowledge that would help to lay strong and sound foundation needed for further studies in science and also for scientific and technological advancement in future. Unfortunately, the teaching methods in the primary schools have been proved to be na"ive, unproductive and passive thereby leaving the primary science learners to be ill-equipped for further pursuance of science and science related studies at higher level. Ogunleye in Uzoechi (2006), identified among others, lack of qualified science teachers, poor teaching methods, lack of adequate instructional materials, gender problems, poor learning environment as the problems of the rudiments of nature study into the curriculum that was introduced ever before independence.

Studies even after independence and even recently, identified the same problems. Ifegbo (2005) found out that both human and material resources in the teaching of science were neither available nor adequate in primary school in Imo state. Legghara and Okafor (2006) observed that
many of our primary school lacked adequate number of science teachers and even where they were present, materials were lacking.

To Uzoechi (2004,2006), Teaching and learning of science were predominantly by memorization and regurgitation of facts with inappropriate teacher/pupils ratio. These were in line with former findings by Okpalla (1981) and Okebukola (1996) cited by Ezeliora (2005), Okalla posited that teacher clung to verbal symbolism while Okebukola indicated that teachers read from the science textbook, interspersed with a few explanation. While pupils copy as the teacher dubs textbook or an old note. Maduabum in Ifegbo (2009) maintained that due to poor teaching methods exhibited by teachers, pupils failed to have interest in learning and doing science instead, most of them left the primary schools into the secondary with misconceived ideas about concepts and process skills of science. In affirmative, Ezeliora pointed out that in secondary schools, science teachers faced challenging tasks in an attempt to bring these pupils to the expected standard for onward move towards achieving functional science education of the required scientific skills and attitudes due to lack of pupil-pupil interaction, pupil-teacher interaction and pupil-learning material interaction during the teaching and learning process in their primary schools.

Obiefuna (2000) postulated that primary science teachers shied among from activity oriented teaching methods which are effective and relied on teaching methods which are easy but most times inadequate and inappropriate.

Obioha (1987) Njoku (1993) cited in Ifegbo (2009) opined that such inappropriate and ineffective methods of teaching primary science have affected performance of pupils in primary science. Virtually, Ifegbo argues that teaching was the focus before the 21st century and agitates for ‘learning’ as the focus and the need for a paradigm shift in the teaching learning methods employ by teachers of primary science for purposeful and meaningful learning to take place in the 21st century.

**The 21st Century Learner and the Nigerian Classroom:** Virtually the discourse from the introduction depicted a ‘gap’ between ‘what is’ and ‘what is expected’ in the teaching learning process in the Nigerian primary school classrooms. Learner –centeredness approaches to teaching and learning have been introduced into the system though, yet to be fully implemented. Lecturing / talk- chalk teacher dominated discussion methods, verbalism and whole class teaching are yet in practice.

The 21st century requires competency from both the teacher and the learner and this could be achieved through pedagogic and andragogic effectiveness where the teacher and the learners are actively involved in all that concerns human learning. “What is” in the school system includes the following: Teacher dominated learning environment, the teacher reads and dictates notes to the learner, the teacher reads the textbooks to the learners, the teacher writes voluminous notes on the chalkboard for the learners to copy. Use of teaching aids rather than instructional materials. Teacher is still regarded as the custodian of knowledge and information flows from the teacher. Frontal teaching that exposes the learner to rote learning, memorization and regurgitation of facts are practiced.

Further more the learning environment is not stimulating enough to develop learning skills. Whole classroom teaching is practiced to the fullest in the Nigerian primary schools and teaching is the focus other than learning. Teachers due to proactive inhibition and technophobia still embark on the conventional teaching methods and the environment is devoid of technology – driven. Assessment is one way and the learner most times, hardly realizes why he/she failed in
a particular subject Emphasis is placed on objectivist theory of learning where the learner is forced to learn from what the teacher’s interests are.

Admittedly, scientific and technological development has influenced the instructional system components of the 21st century and the learning theory has shifted from objectivism into another branch of cognitive learning theory – constructivism. Obanya (2002) supports that something drastic has to be done urgently to remedy the situation the Nigerian educational system found itself at the beginning of the 21st century. The constructivist according to Senapathy (2009) functions under four major assumptions.

- Knowledge depends on past construction and the world is made known to learners through mental framework and new information is transformed or interpreted through this mental framework.
- Assimilation and accommodation aid constructions in the existing mental framework.
- Learning is not mechanical rather, it is an organic process of invention where learning happens in a natural way without anyone forcing such an occurrence to take place.
- Meaningful learning occurs through reflection and scaffolding of new knowledge.

In a nutshell, the constructivists believe that learning is an individual event where the learner constructs knowledge through the organic process of invention utilizing the mental framework, information is accepted and processed to fit the personal framework and based on the prior knowledge, new knowledge is formed and understood. The 21st century learner requires to be equipped fully and involved actively for the information processing to be positively influenced. This takes place through effective interaction with the environment that is enriching and stimulating. The 21st century teaching learning process requires a paradigm shift from ‘what is’ to ‘what is expected”. ‘What is expected’ includes.

- Learner –centered /dominated approaches.
- Facilitative teaching /learner.
- Knowledge construction by the learner, as the teacher coaches, guides and facilitates.
- Active learner and use of activity oriented instructions.
- Learner exposures to critical and analytic thinking through the use of real-life experiences / environment and Hands –on /minds – on experiences.
- Learner controlled instructional system.
- Collaborative learning.
- Technology –driven learning environment.
- Use of learner – friendly instructional strategies.
- Learning environment full of instructional materials and learners effective interaction with materials, fellow learners and teachers.
- Flexible sitting arrangement.
- Two way assessment technique.
- Assessment dominated learning process; at the beginning of instruction, during lesson delivery.
- Instructional system with practical oriented instruction and examination.
- Linking and matching theory with practice during teaching / learning.
- Use of ICT technologies and ICT complaint teachers.
- Learning with, about and especially from technologies.
Above all emphasizing on process of learning rather than product of learning through effective implementation of constructivists learning theory and principles. It is a truism that there are gaps and the gaps affect learning especially, in science and technology subjects. There is need therefore to expose both the teachers and the learners especially in primary science to acquire appropriate teaching and learning skills for the learners of the 21st century to face the challenges of the 21st century science and technology and for sustainable development.

Concept of Learning Skills and the 21st Century Learning Skills

Ifegbo, (2012) defines teaching skills as those teacher behaviours the teacher employs during teaching and learning process for the teaching and learning to be active, effective, purposeful and meaningful. Ifegbo further explains that teaching skill are different from teaching methods, the teacher exhibit teaching skill for the effective use of the teaching method and for a worth while learning overcome to be achieved. Learning styles and learning skills in the same vein differ. Learning styles according to Keefe in Ezekoka (2005) are characteristic cognitive, affective and physiological behaviours that serve as relatively stable indicators of how learners perceive, interact with and respond to the learning environment. Ezekoka posits that understanding brain functioning is an important factor in understanding the concept, learning style. The left-brain users learn in a step-by-step approach while the right-brain users learn holistically, generalizing concepts before going into specifics. Left brain is specifically for critical thinking while left brain for creative thinking. In learning styles, learning skills are exhibited. Learning skills are knowledge, abilities and experiences a learner exhibits in utilizing a particular learning style.

Learners are categorized differently by different researchers. Ezekoka identifies these categories from different researchers. Thus: conservative focusers and gambling focusers, sharpeners and levelers, divergent and convergent producers, freedom oriented learners and control oriented learners, impulsive and reflective learners, field dependent and field independent, holists and serialists sensory or intuitive learners and visual or verbal learners, inductive or deductive learners, activists, reflectors, theorist and pragmatists.

Admittedly, these categories emerged from learners behaviour during learning which according to Kolb (1999) is determined from the way a particular learner perceive information and how the information perceived is processed. An individual learner may either perceive information by concrete experience or through abstract conceptualization. In processing information also, a learner either does that by reflective observation or active experimentation (Ezekoka 2005:39). Boyatzis and Kolb (1995) identified four phases from the experiential learning theory thus: concrete experience, reflective observation, abstract conceptualization and active experimentation. Kolb (1999) from the above assumption identified four different learning styles of accommodator, diverger, assimilator and converger.

Ezekoka describes accommodator as a person who favours concrete experiencing and active experimentation learning dimensions. Information is perceived by feeling and the processing is by doing. Diverger favours concrete experiencing and reflective observation learning dimensions. Information from diverger are got through listening and watching. They engage more on paring and sharing where ideas are discussed in groups. Convergers learn through conceptualization and active experimentation dimensions. Information is perceived by critical thinking and learning by doing they process information by involving objects or materials rather than people. Assimilators are abstract conceptualizers and reflective observers learners.
They perceive information through thinking, watching and listening and process information preferably, alone though very cautious and always exhibit thoroughness in understanding concepts before they can act.

Virtually as the learners employ the learning styles discussed above, learning skills are exhibited. Partnership for the 21st century skills observed that a profound gap exist between the knowledge and skills students learn in school and the knowledge and skills they need in typical 21st century communities and workplaces. This emerged what is referred to as the 21st century learning skills (4c’s) Thus: critical thinking and problem solving, creative thinking and innovations, communication and collaborating. Learning skills according Bayatzis and Kolb is defined as a generic heuristic that enables mastery of a specific domain. They further identify the two components of a skills to be a domain –specific and knowledge rich; A skill describes an integrated transaction between the person and environment and finally, skills are developed by practice. Tracing, back to the ‘what is’ in the Nigerian school system especially in the primary school, learning skills are absolutely missing and the need of the hour is to close the gap so as to help learners meet up with the challenges in the community and work place in this 21st century.

The 21st Century Learning Skills and the Strategies for Developing the Skills in the Primary Science Classroom.

Ani (2004) posits that ‘Reasoning’ is the missing ’ R’ in the 3R’s of reading, writing and arithmetic that formed the basics for teaching and learning process. Ani opines that pedagogical method of teaching and andragogical method of facilitating learning are two dominant methods of leading learners through the winding road of learning. Andragogy according to Ani, is the learning approach that uses systematic and synergetic thinking approaches to learning and in this systems thinking, the facilitator leads the learner to be critical and creative in thought. This approach probably exposes the learners to the 21st century learning skills of critical thinking, creative thinking, communication and collaboration. The Nigerian classroom especially, the primary science classroom requires this type of learning environment to enable the learners meet up with the challenges in the scientific word because modern science according to Okeke (2005) depends on relative paradigms for its growth.

Below Are The 21st Century Learning Skills And The Type Of Activities That Will Help Foster Such Skill In The Primary Science

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<tr>
<th>Learning skills</th>
<th>Abilities</th>
<th>Strategies techniques</th>
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<tbody>
<tr>
<td>Creative thinking</td>
<td>Brainstorming ideas, creating something, designing, entertaining, imaging improvising a solution, innovating, overturning, problem solving, active questioning</td>
<td>Experience based learning, case teaching method, simulations, The imagine elaborate predict and confirm strategy (IEPC).</td>
</tr>
<tr>
<td>Communicating</td>
<td>Analyzing, choosing a medium,</td>
<td>Gallery walk activities, game-</td>
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</table>
Admittedly, a paradigm shift is required for the primary science learners to be equipped and empowered effectively and efficiently to face the scientific literacy and technological development of the 21st century. It is agreed that with the use of those activities/techniques, the “need” that is the gaps between the expected and the observed will be attended to, for science and technology related courses to be appreciated and learnt with interest and understanding at other levels outside the primary school and at the same time, develop lifelong learning and enable primary school learners to acquire learning skills and even integrate the skills into learning other subjects.

**Educational Implications of Developing Learning Skills in Primary Science Teaching and Learning.**

Contemporary view of Nature of Science (NOS) accepts that science is conducted in a social context providing opportunities for personal bias and public adoption or rejection of ideas, unlike the traditional view that is so naïve about NOS, seeing science an objective enterprise. Teachers of science education in the 21st century should accept the contemporary view of NOS to ensure successful inculcation of the 21st century learning skills to the primary science learner and to enable them face the scientific and technological challenges for sustainable development.

Omífo (2006) carried out a study on the assessment of teachers views of the nature of science. It was found out that in general, teachers have mixed views of the NOS and less than 50% of the teachers studied have contemporary view. The implication of the findings showed that teachers communicate science in schools as a body of knowledge that is value-free and teachers are likely to teach science without reference to the ways in which science ideas were developed; they are not likely to teach an authentic view of science. Onu (2004) opines that teachers need to challenge children to think creatively, analyze, apply and evaluate information and not to end at developing the knowledge level of the cognitive domain only, as these skills are needed to achieve real success in life situation and in the world of work –(learning skills). The educational implications therefore are:

- That professional primary science teachers should be given appropriate training so as to exhibit the responsibility of the primary science teacher in teaching and developing the appropriate and meaningful learning skills among primary science learners which
involves; critical and creative thinking, collaborative learning and effective communication.

- Teaching methods and the theory of learning should shift purely from teacher – centeredness to learner – centered and from objective theory to cognitive/constructivism theory where learning should be seen as a process that is not mechanical in nature but rather as an organic process of invention where primary science teaching and learning happens in a natural way and science becomes a way of life and not just a body of knowledge that is emphasized upon accumulation of data, its classification and description and by an emphasis upon mechanistic mode of interpretation (Okeke 2005).

- Curriculum developers should go back to the drawing board and ensure effective curriculum planning, development, implementation and evaluation in primary science because primary science education is regarded as a foundation of science education at the post primary and tertiary institutions. Where the learning skills are developed based on the implemented curriculum, the primary science learners can withstand with ease science and other science related subjects in secondary and tertiary institutions. This will go a longer way to improve on the number of students that enter for science and science related courses and will in turn, lead to modernization and improvement of living standards of individuals and the society at large.

Conclusion
The 21st century teaching and learning process has been revolutionized, learning is being emphasized rather than teaching and the 21st learning skills focus wholly on the constructivists learning theory whereby learning is seen as an organic process of invention and knowledge is constructed through the system of assimilation and accommodation into the existing mental framework. The already existing framework of knowledge promotes transformation and interpretation of new information. The primary science learner should be trained and taught utilizing strategies/techniques that will equip and empower them to think critically and creatively work collaboratively and to communicate effectively for sustainable science and technology development in this country, Nigeria if this country is ready to realize scientific and technological breakthrough in future.

References


DYNAMIC SELF PROGRAMMING ARCHITECTURE FOR CONCURRENT FAULT DETECTION

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Abstract

Online concurrent testing of VLSI circuits continues to be a challenge because of the need to test circuits during their normal operation. As offline test schemes and online non-concurrent Built-in-Self-Tests (BIST) do not suffice, new techniques like input vector monitoring concurrent BIST schemes were introduced. But the best of the techniques suffer from major limitations like extremely high concurrent test latency, exponential area overhead, limited fault models and therefore are not a viable solution, especially for pipelined circuits. In this paper a dynamic self programming architecture is presented. The proposed scheme includes a self programming ability of a concurrent online test architecture based on the type of instruction being executed. And this programming happens dynamically, that is during the normal working of the design under test (DUT). The concurrent test latency is reduced significantly and all at-speed fault models are included naturally. The fault coverage increases because of dynamic rule sets. It uses a scalable BIST architecture without a noticeable increase in area overhead. The applicability is being validated by implementing the scheme for Cortex M0 ARM core.

Key words: Online testing, concurrent test, offline testing, built-in-self-test, dynamic programming

1. Introduction

There is an increasing necessity to work on reliable methodologies to test integrated circuits (IC) especially System on Chips (SoC) both offline and online because of the increasing unreliability in the nature of defects. Some faults that arise later in the lifetime because of electro-migration, stress migration, time-dependant dielectric breakdown, and thermal cycling (Srinivasan et al, 2005) make estimation of mean-time-to-failure (MTTF) very difficult at design time and consequently failure detection at runtime. The faults that occur during the lifetime of the IC can be classified as follows (Al-Asaad and Shringi, 2000):

**Permanent faults** are those which remain indefinitely in the system. Most of these are manufacturing faults or design errors. Few of these are caused by major environmental changes or physical damage of the chip whose effect might remain for the rest of their lifetime.

**Intermittent faults** may appear for a brief period of time and then disappear and reappear after a relatively longer period. Since there are no fixed parameters that cause the fault, predicting them seems to be an impossible task. Two major reasons they might occur are because of marginal dimensions in manufacturing and tight constraints during design. Since the system works well for most of the time and for most of the conditions, testing and diagnosing them is a major concern.

**Transient faults** mostly appear for a much shorter period and disappear quickly. Their appearances are rare and are mainly caused due to environmental variations.
One common method of testing circuits after they are placed in the field is using Built-in-Self-Tests (BIST). They are both effective and practical for most offline tests. The advantages of BIST include the capability of performing at-speed testing, high fault coverage, elimination of test generation effort, and less reliance on expensive external testing equipment for applying and monitoring test patterns as in Abramovici et al (1990). Because of these advantages, BIST offers a very cost effective test package. These BIST methods are further divided into offline and online BISTs. The one where the system is shutdown completely or the circuit is detached from the field and the I/Os are captured by the BIST circuitry are called offline BIST. Online BIST is where the operation of the circuit might be temporarily suspended to change the mode into test mode and run a BIST. Here a test generator (TG) applies the test vectors either in a random or in a deterministic way to the circuit and a response verifier (RV) verifies the captured output. The compiled response is finally analysed to determine if a fault is present. There were several proposals to tackle both online and offline BIST.

2. Challenges for concurrent online test
Online testing addresses the detection of faults that emerge during the operation of the system, mainly the intermittent and transient faults. Online testing is especially important for critical applications. These systems are not expected to fail without warning. Online testing gives us the option to avoid catastrophe if a system fails. Once the test detects an error, the system does one or few of the following to adjust to the error: It either saves critical data or issues a warning or switches to a different module or steps down the performance of the system or starts a repair sequence or starts a reconfiguration mechanism or shuts down the system.

Online test can be done either with a setup outside the system either with the help of software or with hardware alone. But external setup doesn’t have sufficient external pins to monitor the entire complex hardware within, also that all the internal faults do not show up on the pins and external monitoring is expensive. Internal online testing is the alternative method to test ICs on the system. Testing is internal if it takes place on the same substrate as the design under test, in most case within the SoC.

Online testing can be further divided into concurrent and non-concurrent testing. Non-concurrent testing is testing the DUT while the normal operation of the circuit is temporarily suspended or during the shutdown/boot sequence. For critical applications where the operation of the circuit cannot be suspended, testing has to be carried out during the normal functioning of the circuit. This kind of testing is called concurrent testing. Normal online testing methods do not work for concurrent testing; neither does the external online testing schemes. The major parameters to be considered while designing an online test scheme are:

**Concurrent test latency (CTL):** It is defined as the number of normal functional inputs that must be applied to the CUT inputs while the CUT operates normally in order to complete the concurrent test process (Voyiatzis et al, 2008).

**Fault Latency (FL):** It is defined as the time taken for the concurrent test to detect the fault from the time it actually appeared.

**Fault Coverage (FC):** It is defined as the fraction of the targeted faults for a particular CUT that are detected by a specific test or a test set. Circuits that are critical require very high fault coverage in each of the fault categories.

**Area Overhead (AO):** It is defined as the number of gates that are needed to complete online testing over and above the gate count of the original design. Even though area overhead is not a major factor, it affects scalability.
Concurrent testing was initially carried out by using watchdog timers Mahmood and McCluskey (1998). Watchdog timers alone proved to be inefficient, because they only confirm if control flow is traversing properly. Later redundancy was introduced. In one case, duplication with comparison (DWC), Johnson (1989), where the outputs of the two copies of the same circuit which operate in tandem is compared.

The initial work on vector monitoring concurrent BIST was done out by Saluja (1988) (C-BIST). The test generator of C-BIST is a Linear Feedback Shift Register (LFSR) and the active test set consists of exactly one active test vector (the current value of the LFSR). To drive down the CTL, four techniques have been proposed so far, namely, the Multiple Hardware Signature Analysis Technique (MHSAT, Saluja (1987)), the Order Independent Signature Analysis Technique (OISAT, Saluja (1986)), windowed-Comparative Concurrent BIST (w-CBIST, Voyiatzis and Halatsis (2005)), and RAM-based Concurrent BIST (R-CBIST Voyiatzis et al (2005)), which decrease the CTL by increasing the number of active test vectors.

The above mentioned techniques target either exhaustive or pseudorandom testing, so the size of the active test set is large, imposing high CTL. In order to resolve this problem, Built-In Concurrent Self-Test (BICST, Sharma and Saluja (1993)) was proposed by Sharma and Saluja; when BICST is applied to an n-input m-output combinational CUT that can be tested with T vectors, it utilizes a T-line X (n+m)-column PLA; when a vector that belongs to the T-vector test set reaches the CUT inputs, the AND plane of the PLA is activated and the response of the CUT is compared to the output of the m response columns of the PLA. BICST cannot be utilized in offline mode in order to impose the test vectors required to test the CUT during manufacturing testing or periodic offline testing. In Voyiatzis et al (2008), an input vector monitoring concurrent BIST technique for Monitoring Input vectors for concurrent testing based on a preComputed test SET (MICSET) is given; the presented scheme is based on a test set stored in a mapping logic module which can be implemented with either random logic or a ROM whose address inputs are driven by a subset of the input bits of the CUT. This scheme again suffers from a very high CTL. And since the hardware overhead scales along with the size of the CUT, this scheme is not scalable.

For systems where its continuous functioning is of utmost importance, online concurrent testing is the only solution.

3. Dynamic Self Programming Concurrent Online Scheme

The architecture of Dynamic Self Programming Concurrent Online Scheme (DSPCOS) is presented in Figure 1. The idea is to start the embedded system cycle from a known starting point; monitor the outputs continuously after passing them through multiple pseudo random scramblers; the monitoring is done by a collection of rule sets. The rule sets are set dynamically according to the current instruction that is being executed. The architecture can be used for both online and offline testing and is fully programmable and customizable according to the CUT’s test requirements. Online testing will be completed fully while the CUT is performing its normal operation. In many of the embedded systems and systems with critical applications there are two facts, which are exploited in this architecture. One is that there is a specific program cycle that gets executed repeatedly. The other is that the program is loaded once in the system and is not changed unless the normal operation of the system is suspended. All the faults in the false paths, i.e. the non-functional paths need not be tested. So it is a safe assumption that during the normal operation of a circuit, it is sufficient if the system works fine for the current program that is loaded in the system. When the program is reloaded, the test can be performed again for that
particular program. So this architecture exploits both the program cycle concept and the limited fault coverage necessary for the program to work without issues. The DSPCOS architecture was built and is being tested on the ARM CortexM0 core.

To start or restart concurrent testing, a reset signal (R) is provided. The reset signal can be multiplexed with any other input. The DSPCOS can be programmed either to start whenever the reset R is given or when the program counter (PC) reads the start of any of the intended program loops. The outputs go through a set of scramblers and an Accumulator Based Compactor (ABC) & Multiple Input Signature Register (MISR). For example, two stage scramblers are chosen. The function of a scrambler is to shuffle the outputs in a predetermined manner. There are several ways to do it. One of the easiest and effective methods is to tap the opcode bits which change almost every cycle. The selected opcode bits are XOR-ed and its output is fed as the select line to stacks of multiplexers. A simple scrambler is shown in Figure 2. The 4-bit input named as A, B, C & D are shuffled based on the parity generated (Y) by the two opcode bits OPCODE(0) and OPCODE(2). If Y=0, the outputs of this scrambler A’, B’, C’ & D’ will be A, C, B & D and if Y=1, the outputs will be B, D, C & A. The scrambler was expanded to shuffle 8-bit word. In order to shuffle the bits well, multi stage scramblers are used. We have
chosen to use two stages of 8-bit scramblers which would be sufficient to randomize the bits to a maximum extent. This randomization is required to maximize the probability to capture the fault effect and almost eliminate error leakage.

After the two stages of the scramblers, the output word is given to both the ABC and the MISR. ABC is proven to have negligible aliasing, provides extremely high fault coverage, has very little hardware overhead and can work effectively for a very large number of cycles with little or no error cancellation. The ABC used is shown in Figure 3. Each output word of the scrambler (n-bits) is added to the contents of the accumulator’s register (m-bits; m>n) and the result is in turn added to the next word of the output and so on. The final content of the ABC is the signature which can be shifted out for comparison. But since the objective here is for concurrent test, the signatures are monitored by a dynamic rule set.

Simple examples of functional rule sets for the instruction decoder in ARM CortexM0 are:

- $o_{multiply\_function} \&\& o_{interrupt\_vector\_sel} = 0$
  - If next funct. is multiply, it cannot be interrupt
- $o_{user\_mode\_regs\_load} \&\& o_{user\_mode\_regs\_store\_nxt} = 0$
  - If next funct. is load, it cannot be store
- $o_{pc\_wen} \&\& o_{reg\_bank\_wen} = 0$
  - If next funct. is pc_write, it cannot be register bank write

These conditions cannot occur. A long list of such assertions can be listed by the designer during verification. These rule sets change for each instruction. Generic rule sets yield less coverage. So a dynamic self programmable rule set architecture is used which is based on the current instruction being executed.

At the end of the test, if there is no error from both the rule sets, then pass signal will be asserted. If there is a rule set violation at any point of time during the execution cycle, then the fail signal would be asserted indicating an error immediately within a few cycles after the fault first
occurred in the hardware. Figure 4 shows that multiple rule set outputs can be combined together to detect a fault. The dynamic programmability comes from the instructions in the instruction decoder.

4. Design Validation

<table>
<thead>
<tr>
<th>Block</th>
<th>Hardware overhead</th>
<th>Gates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scramblers</td>
<td>$2 \times {(n \times \text{Mux}) + 1 \ \text{XOR gate}}$</td>
<td>$2 \times (3n+1)$</td>
</tr>
<tr>
<td>ABC</td>
<td>$&lt; (5 \times m) \text{ gates} + m \times \text{DFF}$</td>
<td>$m \times 13$</td>
</tr>
<tr>
<td>MISR</td>
<td>$&lt; n-\text{XOR gates} + n \times \text{DFF}$</td>
<td>$n \times 9$</td>
</tr>
<tr>
<td>Rule-set</td>
<td>$c \times \text{gates}$</td>
<td>$C$</td>
</tr>
<tr>
<td>Total</td>
<td>$(6n+2) + mx13 + nx9 + c$</td>
<td></td>
</tr>
</tbody>
</table>

Table 1. Area overhead calculation

The hardware overhead calculation for the scheme is shown in Table 1. As is shown in the table the hardware is generic in monitoring any block outputs. The hardware overhead does not scale proportional to the block under test rather DSPCOS is proportional to the number of outputs available for monitoring.

5. Conclusions

In this paper, a dynamic output vector monitoring concurrent BIST scheme was presented. The practical effectiveness of the method is being implemented for the control blocks of Cortex M0 of ARM. DSPCOS is better in many aspects. Its scalability and low CTL, especially for pipelined controllers are notable advantages.

Acknowledgements

The authors acknowledge with gratitude the technical and financial support from DIT, Ministry of Communications & Information Technology, Govt. of India, New Delhi, through SMDP-II project at NIT Hamirpur HP, India.

References


VOCALATIONAL AND TECHNICAL EDUCATION IN NIGERIA: ISSUES, PROBLEMS AND PROSPECTS’ DIMENSIONS (IPP)

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Abstract:
Vocational education deals with the training or retraining designed to prepare individuals to enter into a paid employment in any recognized occupation. On the other hand technical education deals with the training of technical personnel for the purposes of initiating, facilitating and implementing the technological development of a nation and create the basic awareness of technological literacy to our youths. In Nigeria, the training of technical personnel has witnessed formidable challenges ranging from poor funding to inadequate facilities, brain drain, poor staff training and defective curricular. This paper intends to critically examine the issues, problems and prospects of vocational and technical education in Nigeria and suggest ways to improve the teaching and learning of vocational/technical education with enhanced enthusiasm and vibrancy.

Key words: Vocational, Technical, Education, Issues, Problems and Prospects.

INTRODUCTION
Vocational education is defined as any form of education whose primary purpose is to prepare persons for employment in recognized occupations (Okoro, 1993). It is obvious therefore that vocational education is a term that is more all-embracing than technical education which O. M. Okoro defines as post-secondary vocational training programme whose major purpose is the production of technicians. The Nigerian National Policy on Education defines technical and vocational education as a comprehensive term referring to those aspects of the educational process involving, in addition to general education, the study of technologies and related sciences and the acquisition of practical skills, attitudes, understanding and knowledge relating to occupations in various sectors of economic and social life. Technical education can therefore be seen as the formal training of persons to become technicians in different occupations. Thus any education that is geared towards teaching technical skills and attitudes suitable to such skills can be regarded as technical education.

In his own views, Uwaifo (2009) posited that technical education is the training of technically oriented personnel who are to be the initiators, facilitators and implementers of technological development of a nation. He opined that this training of its citizenry on the need to be technologically literate, would lead to self-reliance and sustainability. He stressed that technical education more than any other profession has direct impact on national welfare.

Furthermore, technical education contributions are widespread and visible ranging from metal work technology, mechanical/automobile technology, electrical and electronic technology, building and woodwork technology etc. Consequently, technical education can serve as change agents not only for technical systems but also for many other societal changes. The practical
nature of technical education makes it unique in content and approach thereby requiring special care and attention. The inputs of technical education are, so visible to the extent that even an illiterate could see when failures occur.

Under critical examination, vocational and technical education have been an integral part of national development strategies in many societies because of the impact on human resource development, productivity and economic growth. Despite their proven contributions does Nigeria seem to give vocational and technical education the attention they deserve? Does that appear to be one of the reasons for the rising unemployment and poverty in the society?

This paper therefore seeks to explore the issues, problems and prospects of vocational/technical education in Nigeria.

Issues: It has been noted that vocational education is designed to offer training to improve individual’s general proficiency, especially in relation to their present or future occupation. The provision of vocational and technical schools has a long history. Before the industrial revolution (between 1750 & 1830) the home and the “apprenticeship system were the principal sources of vocational education. Societies were however forced by the decline of handwork and specialization of occupational functions to develop institutions of vocational education. As the Columbia Encyclopedia of 2001 noted manual training, involving general instruction in the use of hand tools was said to have developed initially in Scandinavia (C. 1866).

However, vocational education became popular in the elementary schools in the United States after 1880 and developed into courses in industrial training, book keeping, stenography and allied commercial work in both public and private institutions. Some of the early private trade schools in the US include Cooper Union (1859) and Pratt Institute (1887). The number of public and private vocational schools has greatly increased since 1900.

However, vocational and technical education have continued to thrive in many societies. Unfortunately, Nigeria is not taking the issues of vocational and technical education seriously. Although vocational and technical education seem deficient in citizenship or leadership training (Friedman, 1982), they could provide student the skills to become productive entrepreneurs and engender creative and innovative ideas that would enlarge the nation’s economic pie, and increase personal freedom.

Thus the neglect of vocational and technical education is socially injurious as it rubs the nation of contribution the graduates would make on national development. More importantly, the Nigerian society needs competent auto mechanics and truck drivers, carpenters, plumbers, electricians (to maintain the NEPA plants), computer database technicians and web/network technicians, medical technicians and vocational nurses to function well. The half-baked road-side mechanics in the society often cause more damages to vehicles when they are contracted to service them, and because of poor training some of the commercial drivers on the road and nurses assistants in the hospitals have sent many people to their early death.

Without gainsaying, the current preoccupation with university education in Nigeria reduces economic opportunities of those who are more oriented toward work than academics. Not every one needs a university education. But who would employ them if everyone became a university graduate? As mentioned earlier, graduates of vocational and technical institutions are highly skilled entrepreneurs. Many of the so-called “expatriate engineers: who are being paid huge sum of money in dollars to build the roads and bridges in Nigeria are graduates of vocational colleges, yet, Nigeria is not taking the sector seriously.
The issue of youth unemployment appears to be shooting up the sky because many of them lack “employability” skills that are often acquired from vocational schools. The nation’s poverty level was put at 70% and more than 91 million Nigerians are said to live on less than one dollar per day. Also it has been well documented that Nigeria’s higher institutions lack the tools to give students the skill employers need. It is evident that Nigeria has teething problems in vocational and technical education. Let us examine some of these major problems.

Problems:
The challenges or problems mitigating the training of technical education or vocational education are:

1) **Funding**: Universities in Nigeria are owned and funded by the Federal Government, state government and private individuals. Over the years, government subventions to universities have never been adequate but at the same time governments maintain the policy that universities should not charge fees it deemed adequate to complement the financial effort of the government. In Nigeria, the allocation to education as a share of the GDP is quite minimal. Till date, government funding of vocational and technical education programmes have not been impressive.

2) **Facilities**: Most technical education departments in Nigerian universities do not have laboratories or workshops space let alone usable equipment and facilities and where they exist, they are grossly inadequate, as the laboratories only have the items or equipment that were provided when the departments were established. It is however most surprising to know that most technical education departments still depends on engineering workshop and lecturers to teach technical education concepts in this 21st century. The available facilities, programme as at today are inadequate quantitatively and qualitatively and besides they are obsolete. Oryem Oriya (2005) indicated that only 40% of institutions of Higher Education in Nigeria have laboratory or workshop space for technical education programmes. The others, 60% do not have laboratory or workshop space and that this reflects the low quality of technology programmes in higher institutions. He further noted that these few universities that have laboratories, experience acute shortage of laboratory equipment and supplies. He concluded that this situation is partly responsible for the reason why it has been increasingly difficult to run experiments effectively for students and made the teaching and research in science and technology difficult and therefore the country was producing insufficient and ill-prepared technical education graduates necessary for driving the technological and socio-economic development of Nigeria as a nation.

The inadequacy in teaching, laboratory and workshop facilities has contributed to the diminution of the quality of technical education graduates in Nigeria. Reyes – Guerra (1989) categorized students into three, namely: verbalizers, visualizers and doers. The verbalizers are those who learn easily if information is in written or spoken form. They benefit from lectures, tutorials and hand-outs. Visualizers learn easily when information is presented in pictorial or diagrammatic form while the Doers learn more easily when information is presented by practical demonstration by the lecturers. The inadequacy of facilities both qualitatively and quantitatively has put the visualizers and the Doers at a disadvantage. The verbalizers may also have problem in a class with large students population. The implication of this scenario is that only a small proportion of the students benefit from the current pedagogical system.
3. **Brain Drain:** In the context of this paper, brain drain refers to the movement of lecturers of technical education which are needed for the socio-economic and technological advancement of Nigeria from one university to other universities or to other professionals (including politics) calling for better conditions of service. Akintunde (1989) identified five different components of brain drain:

   a) Experts in academics who moved to the industry where they get better pay for their services.
   b) Lecturers and students who leave the country to acquire more knowledge and skill but later refused to return.
   c) Lecturers who move from one country for other conditions of service.
   d) Skill professionals who abandon the practice of technical education in favour of other more lucrative economic activities and political appointments which are not related to their training.
   e) Skilled professionals, although in their field of training who do not devote their full attention to their job because of their effort to supplement their earnings through other unrelated economic activities.

Bassi (2004) reported that:

   (i) About 45% of all Nigerian professionals including technical educators have left the Nigerian shores over the decades since colonization.
   (ii) Between 1997 and 2007 alone, Nigeria lost over 10,000 middle level and high-level managers to the western economies.
   (iii) About 500 lecturers from Nigerian universities continue to emigrate each year, particularly to Europe, America and other African countries where the condition of service is relatively better. These Nigerians in Diaspora contribute 35 times more wealth to Europe, America and other African economy.

4. **Staff training and retention:** The training of academic staff is ordinarily a continuous exercise to ensure consistent improvement in the quality of their outputs. The training is two-fold: training to acquire minimum qualification (Ph.D) to teach and continued professional training. Both types of training can be acquired either locally or overseas. Usually, local training within the nation is cheaper than overseas training but more strenuous because of inadequate facilities, literature and distractions arising from the need to meet the necessary demands. Overseas training requires a lot of foreign exchange but the enabling environment exists to achieve success in a record time. However, over time it has always been difficult to get the trainees back to their respective countries after the completion of their study.

   Invariably, the salary and service benefits paid to technical education teachers in Nigeria is about the lowest in the world. This leads them to migrate to other countries especially the United States of America or local industry for better pay. Academics from within and outside Nigeria also migrate to Botswana and South Africa because of high wages that they pay to the academics and the relatively better equipped laboratories.

5. **Staff situation:** Many universities across the country are inadequately staffed both qualitatively and quantitatively. In most departments especially in technical education programme, the proportion of staff without Ph.D out numbers those with Ph.D. Uwaifo (2005) asserted that it is difficult to get people trained to the level of Ph.D because academic is not as attractive and commensurate to the effort, commitment and finances
put in to acquire it; whereas a first degree graduate can function well in the industry and politics etc and earn good money.

Table 2: Shows the relative percentage of academic staff with Ph.D in technical education across the southern universities in Nigeria as at 2010.

<table>
<thead>
<tr>
<th>S/N</th>
<th>Names of university</th>
<th>Course areas</th>
<th>No. of Ph.D holders</th>
<th>Percentage %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Nnamdi Azikiwe University, Awka</td>
<td>Building/wood work</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>2.</td>
<td>University of Benin, Benin City</td>
<td>Electrical/electronics</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>3.</td>
<td>University of Nigeria, Nsukka</td>
<td>Metal/auto mechanic</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>University of Uyo, Akwa Ibom State</td>
<td>Building/wood work</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>5.</td>
<td>Ambrose Ali University, Ekpoma</td>
<td>Electrical/electronics</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>6.</td>
<td>Delta State University, Abraka</td>
<td>Metal/auto mechanic</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>7.</td>
<td>Enugu State Uni. of Sc. &amp; Tech, Enugu</td>
<td>Building/wood work</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>8.</td>
<td>Rivers State Uni. of Sci &amp; Tech, P.H</td>
<td>Electrical/electronics</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>9.</td>
<td>Ebonyi State University, Abakaliki</td>
<td>Metal/auto mechanic</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>10.</td>
<td>Rivers State University of Education, PH</td>
<td>Building/wood work</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td>52</td>
<td>24</td>
</tr>
</tbody>
</table>

Author’s input:

It could be seen from table 1 that no department offering technical education in Nigerian universities have adequate Ph.D lecturers, as the university with the highest Ph.D lecturers is the university of Nigeria, Nsukka; established in 1960. Of the 15 lecturers in the department, only 5 of them have their Ph.D, while others are yet to acquire it. Most lecturers in technical education department in these schools who have obtained their Ph.D, have been drained away from these schools because of the unattractive nature of the lecturing profession in Nigeria.

In order to spur locally needed science and technology activities, it is imperative that Nigeria governments should seriously consider proper retention schemes for their best talents by providing special working conditions including income supplements and adequate research supports to stem this problem of brain drain.

6. The curriculum of technical education: The curriculum of a subject with practical content is generally organized into an average of 67% for the theoretical classes and 33% for laboratory. Students also use the laboratory to develop case examples on their own time. Olunloyo (2002) noted that one of the issues confronting the design of appropriate curriculum for technical education is preparing students for the shift from the fordist to ICT paradigm in technology practice.

The low pace of industrialization and technological growth in Nigeria can be attributed to the widening gap between science and technology as a result of the inability of technical education to adequately utilize the scientific ideas to promote technology. This suggests the need to overhaul technical education curricula in Nigeria.

However, the overhauling of the curricula may not necessarily translate to the production of highly literate technical education experts of ready-made graduates for the industry which
may result in rapid industrialization or growth in the economy of a nation unless solutions are proffered to some constraints that may militate against positive outcomes, but will adequately equip our youths with the relevant skills needed for their day to day living. The problems associated with the current curricula are:

(i) They are based on a foreign model which has evolved under ideal conditions (staff, equipment, infrastructure, training opportunities etc) that are not easily duplicated in developing countries.

(ii) There is a basic lack of textbooks in this area and most of the available textbooks are often illustrated with examples from outside the local environment and which are irrelevant to the particular country.

(iii) There is usually a shortage of highly competent indigenous teaching and support staff with sufficiently wide practical experience of technology.

(iv) The curricular are adjudged to be too academic and overloaded with intellectual content in pure science and mathematics at the expense of basic engineering and technology.

(v) Inadequate provision for humanities, social sciences, business management concepts and entrepreneurial skills development. Because of the inadequate preparation of the students for the industry some employers retrain the graduate to make them productive in their organizations.

(vi) The teaching approach follows the conventional method of transferring knowledge across through the lecturer reading out to students, who would then take down notes. The educational system continues to place considerable value on this method of teaching.

7. The apathy of political office holders/law makers: Education generally, including technical education programmes has been grossly neglected in Nigeria. Technical educators have the greatest challenge of convincing the law makers on why they should give priority to the programme in allocating resources. Many options of getting positive results have been advocated at different fora, namely, lobbying, participation of technical educators in governance, wooing etc. Yet the government is playing a lopsided attitude to the proper development of the programme in Nigeria. Thus, Nigeria will ever remain a technologically backward and dependent nation if this attitude and trend is not reversed.

Prospects:
It is evident that Nigeria lags behind in preparing her workforce for the challenges of the rapidly changing global economy. For that, the nation must invest copiously in education with particular attention given to vocational and technical education. No nation would make any meaningful socio-economic stride without viable educational institutions. The National Board for Technical Education (NBTE) and teachers in this area should take up the campaign for more funds for vocational education and to launder its image in the society, it has been this way in many societies.

The United Nations Educational, Scientific and Cultural Organization (UNESCO) has noted that revitalizing this sector is among the ways to improve economic opportunities for the youths. The Nigerian Labour Congress (NLC) and the affiliated unions could also help in this regard by setting up vocational training centres in local government areas from where the people could acquire some job skills. Upgrading the workers’ skills would improve their productivity and advance their values (wages/salaries and benefits) and voices on the job; calling out the workers for strike actions is not the only way to fight for their welfare.
The NEEDS and SEEDS programmes should include vocational education and job training program in their economic growth and development strategies as part of poverty alleviation and assist the unemployed for job search. This is the way things are set up in many societies, and Nigeria should adopt and adapt the system if she wants to move forward. Furthermore, political rhetoric without action will not solve Nigeria’s problems. The progress of Nigeria lies in the productivity of its citizens and quality education and genuine vocational programs hold the key.

Furthermore, the 1991 policy of the World Bank harped on the development of a skilled labour force which makes an important contribution to development. The challenges are to use employer, private and public training capacities effectively to train workers for jobs that use their skills and to do so efficiently in developing economies increasingly influenced by technological change and open to international competition. Training in the private sector by private employers and in private training institutions can be the most effective and efficient way to develop the skills of the work force.

Harping on the above prospects, it is pertinent to note that government at all levels must be pressured to devote the recommended 26% of their budgets to education. Out of this we should demand that at least about 50% should be allocated to technical vocational education representing roughly 10% of the total budgets. Rather than spend tax payers’ money establishing General studies universities in all the local government areas, and claiming that as an achievement the existing ones should be well funded so that both staff and students will be motivated to make their contributions to the development of the country.

Furthermore, one of the greatest problems of our education is that every government wants to give an impression that it is doing something. Thus policies that are not well thought out are introduced and changed arbitrarily and whimsically. There should be an end to policy somersaults. We should build an architecture of technical schools with the universities of technology at the apex. Those who choose the technical career path should be able to proceed from the senior secondary schools to doctorate degrees without feeling inferior in the least to graduates of the general studies institutions.

Technicians and all who pass through our technical-oriented schools ought to be adequately and equitably remunerated. The dichotomy in the civil service between holders of ‘General Studies’ certificates and technical certificates must not only be abolished as a matter of policy but in the thinking and attitude of government officials. The truth of the matter is that technicians or technologists are not inferior to their counterparts. It is a matter of career choice and we should make this very clear to our children right from the primary schools.

Conclusion:
Jimm gang (2004) posited that there is need for a total overhauling of the educational system and that in many fields, course work available only lead to rising unemployment, poverty and misery. He concluded that the situation could only be curbed if syllabuses were innovated, re-engineered or re-designed to include disciplines that build up the fighter – spirit needed for today’s intellectual battles of life. For progress to be made in Nigeria the challenges confronting technical education must be recognized and fought vigorously. Adequate resources should be allocated to the programmes in order to achieve positive outcomes. A comprehensive reform towards technical and vocational education and a deliberate attempt to uplift the programme is the only panacea to a technological enderado in this country.
REFERENCES


DROUGHT STRESS EFFECTS ON SOME BIOCHEMICAL PROCESSES OF WHEAT

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Abstract

The experiment carried out in 2007-2008 on the Dryland Agriculture Research sub- Institute Sararood, Kermanshah, Iran in order to study the effects of drought stress on yield, proline content and chlorophyll content of wheat cultivars under field conditions. The experiments were base on split plot in a randomized complete block design with three replications. The main plots included drought stress treatments at 4 levels: I1- drought stress at the start of stem elongation stage; I2 - drought stress at the start of boot stage; I3- drought stress at the start of grain filling stage and I4- full irrigation. The Subplots included cultivars treatments at 3 levels: Chamran (C1), Marvdasht (C2), and Shahriar (C3). A significant difference (p<0.01) was observed between the drought stress treatments. The results showed that with an increase in the Intensity of drought stress on wheat cultivars, there was a decrease in total chlorophyll content and increased proline content. The Chamran cultivar (C1) on drought stress treatment (I1) had the lowest decrease in total chlorophyll content than with control treatment (I4). Also this cultivar had the highest drought tolerance.

Introduction

Almost 32 percent of wheat culture face up to various types of drought stress during growth season in development Countries [5]. Drought stress is the most important limited factor of filed crops in Iran. The most part of Iran's subcultivation land have placed in arid and semi-arid regions, that because of water resource deficit and plant stress appearing, wheat performance reduce in these regions severly. Ashraf et al.,[1] also reported that drought stress will reduce concentration of chlorophyll b more than chlorophyll a , that increase the chlorophyll a/b ratio. However they reported that this ratio was more in sensitive cultivars under the drought stress. The results of experiment have showed that accumulation of proline and soluble carbohydrates will happen for osmotic regulation while water potential reduce more than one mg pa ,[6]. However it is reported that proline content in resistant wheat cultivar was more than sensitive cultivar under the drought and salinity stress [4]. In general, the purpose of this research was the study of drought stress effect on some biochemical processes of bread wheat cultivars, so that responses of these cultivars evaluate in resistance to drought stress.

Material and methods:

This research was done, in 2007-2008 on the Dryland Agriculture Research sub- Institute Sararood. Main plots consisted of four drought stress treatments, i.e.: impose drought stress at initiation of stem elongation stage (I1), at booting stage (I2), at initiation of grain filling stage (I3), and full irrigation (I4). Subplots included three cultivars, i.e.: Chamran(C1),
Marvdasht (C2), and Shahriar (C3). Seeding operations were carried out on November 2007. Based on soil analysis, required fertilizers were used as follows: 100 kg P2O5/ha-1 and 60 kg N/ha-1 prior to planting and 60kg N/ ha-1 were used as topdressing in tillering stage. Each plot included 8 rows 20 cm apart, 4 meter long, 1 and 2 meter distances were taken between test plots and replicates, respectively. Density was taken at 400 seeds per square meter.

**Chlorophyll determinations**
Chlorophyll content was determined by froze and Archioze method [2].

**Proline determination**
Proline was determined in flag leaves according to Pesci and Beffagna [7].

**Grain yield**
At the end of growth period, plants from rows 4 and 5 of each plot, 3 meter long, were harvested from each plot center, and grain yield were determined.

**Statistical Analysis**
MSTATC and SPSS software were used to anlyze obtained data.

**Result and discussion:**
In this research increasing of drought stress represent significant upward process in proline amount, so that the gained results of data analysing represented that changes of flagleaf proline amount were under the effect of cultivar, drought stress and their interaction and from a statistical point of view was so significant (p<0.01). The mean comparison of flag leaf proline amount in different wheat cultivars represented that Chamran cultivar (C1) had the most amount of proline in flagleaf and Shahryar cultivar (C3) had the lowest amount. Also, the mean comparison of flagleaf proline amount in various treatments of drought stress represented that the treatment of drought stress (I1) had the most amount that from a statistical point of view had a significant difference with another levels. It should be mentioned that the reports have suggested about relation between proline and carbohydrates [8]. Drought stress had a significant effect on the content of chlorophyll a and b, and total of chlorophyll (p<0.01) and had a significant effect on the rate chlorophyll a to b (p<0.05). Content of chlorophyll a decreased because of drought stress and decrease of chlorophyll a, was lowest in Chamran cultivar (C1) and highest in Shahryar cultivar (C3). Various cultivars were different significantly in different levels of drought stress so that the lowest decrease of chlorophyll a concern to Chamran cultivar (C1) and control treatment (I4) and the highest decrease related to Shahryar cultivar (C3) and treatment (I1). As the same of chlorophyll a, content of chlorophyll b decreased under effect of drought stress. In the light of chlorophyll b rate, various cultivars had a different reaction to drought stress, so that, the highest decrease of chlorophyll b was in Shahryar cultivar (C3) and the lowest decrease of chlorophyll b was in chamran cultivar (C1). Drought stress decreased the total rate of chlorophyll (the sum of chlorophyll a and b), too. The highest decrease of the total of chlorophyll, ratio to control treatment (I4), belonged to treatment (I1). In this case, various cultivars had different reactions, so that the highest rate of decrease of the total of chlorophyll (the sum of chlorophyll a and b) was in shahryar cultivar (C3) and the lowest rate of decrease belonged to chamran Cultivar (C1).

In various cultivars the mean comparison of grain yield showed Chomran cultivar (C1) had highest grain yield (5118 kg.h⁻¹) and Shahryar cultivar had lowest (4536 kg.h⁻¹). Also, mean comparison of grain yield in different treatment of drought stress showed drought stress treatment (I1) with 3663 kg.h⁻¹ had highest decrease of grain yield than control treatment (I4) with 6793 kg.h⁻¹. The results of this research specified those cultivars are under effect of drought stress and reduction of their chlorophyll content and proline are less, their yield is more to stability.
Also, rate of chlorophyll a to b placed under effect of drought stress, so drought stress caused to increase rate of chlorophyll a to b.

**Conclusion**

According to results, generally, can be concluded that plants in drought stress time, make changes in some of their biochemical features that respond to different stresses. the results of this investigation represented, in drought stress conditions the cultivars that have more proline and chlorophyll content, are more resistant to drought stress and their yield is filmer.

**Acknowledgments:**

Special thanks to the Islamic Azad university kermanshah Branch, Iran

**References:**


Abstract

A survey of natural vegetation of Tehsil Takht-e-Nasrati, District Karak was undertaken in winter 2010-2011. The study was conducted with in four distinct stands further divided into 22 sites for clear communities’ segregation. Hierarchical Cluster Analysis (HCA), and Detrended Correspondence Analysis (DCA) were used for the plant community analysis. Four plant association i.e. *Cenchrus-Saccharum-Prosopis* association, *Cenchrus-Zizyphus-Saccharum* association, *Cenchrus-Zizyphus-Cymbopogon* association and *Aerua-Zizyphus-Acacia* association were recognized. Classification and ordination techniques provided very similar results based on the floristic composition and communities similarity. The results produced the source for the mapping partition of vegetation communities.

Key words: DCA, HCA, plant community association, winter season, Tehsil Takht-e-Nasrati

Introduction

Ordination techniques are commonly used in phytosociology. This may be done either by arranging the points along the axis or by forming the scatter diagram with two or more axis. Detrended Correspondence Analysis (DCA), an indirect gradient analysis technique in which the distribution of species is not controlled by environmental variables rather, it focuses to analyze the pattern of species distribution. Environmental data for DCA is not required and species data is used to assume the gradients (Sagers & Lyon, 1997). Ordination techniques are widely used by the ecologists to study the relationship between vegetation and environment. Khaznadar et al., (2009) conducted a study in Chott El Beida wetland, a RAMSAR site in Setif, Algeria to study distribution of plants community and environmental factors. The collection was done from sixty vegetation plots. TWINSPAN and Detrended Correspondence Analysis (DCA) were used as the analysis techniques. A similar study was conducted by Ahmad et al., (2010) along motorway (M-2), Pakistan using multivariate techniques i.e., DECORANA. Results showed two major and sixteen sub-communities from 397 quadrats. The study was helpful for implementation and conservation planning and for the improvement of road sides. To study the relationship between vegetation and environment, a study was conducted by He et al., (2007) in the Alxa Plateau of Inner Mongolia, China which resulted in the detection of six characteristics vegetation groups by using the Detrended correspondence analysis (DCA). Ahmad (2009) studied the herbaceous vegetation in Margalla Hills National Park, Islamabad, Pakistan. Four vegetation groups were recognized by TWINSPAN. El-Bana et al., (2009) studied *Juniperus phoenicea* L. and associated vegetation at three mountains in Egypt, resulted in the recognition of four vegetation types along with juniper by TWINSPAN and DCA analysis techniques. Jabeen and Ahmad (2009) conducted a study to analyze the vegetation and environment data of Ayub National Park, Rawalpindi. PCOrd 5 and CANOCO 4.5 were used and data was recorded by quadrat method. 44 plants species from 30 quadrats were recorded. Many researchers (Dasti & Malik, 1998; Malik &
Hussain, 2008; Saima et al., 2009; Ahmad, 2009; Ali & Malik, 2010; Ahmad et al., 2010) have studied different aspects of vegetation structure and classification and ordination distribution patterns in different parts of Pakistan. Classification and ordination is an invaluable method for vegetation survey and assessment involving investigation of characteristics of plant communities using simple and rapidly employing field techniques (El-Ghanim et al., 2010). In the present study, an effort has been made to investigate and analyse correlation of communities with key environmental factors. The Tehsil Takht-e-Nasrati comprises one of the richest and most interested ecosystems on earth. The community structure and distribution patterns of research area have not been given due attention till the date by the plant ecologists, and hence poorly understood (Khan, 2012). The particular objectives of present study include quantifying the vegetation in spring season of Tehsil Takht-e-Nasrati, District Karak using ordination techniques for upcoming conservation and providing base line data of ecological important area.

Research area

The Tehsil Takhti Nasratti is situated at 32.47° to 33.28° North and 70.30° to 71.30° East. The Tehsil is bounded by Tehsil Banda Dawood Shah on the North West, Tehsil Karak on the North East, District Mianwali and District Lakki Marwat on the South East, and Tribal area Adjoining District Bannu on the South West (Fig. 1). The total area of Tehsil is about 613.66 Sq. kilometer. Majority of the area consists of rigged dry hills and rough fields areas i.e. 323.97 Sq. kilometers and agriculture land is about 289.7 Sq. kilometer. The major income source of the people is Agriculture, which is rain depended. The area is situated at 340 m above the sea level. In the year 2001 - 2010, 121.6 mm of average rainfall per 10 year was recorded on district level. The mean maximum temperature was 39.5 C° in the month of the June and the mean minimum temperature was as low as 4.26 C° during January. The wind velocity is slightly above 5 km/h in summer and in winter it lies below 2.9 to 3.5 Km/h. Most of the winter season is calm, when February approaches, high velocity winds blow in the area. In winter season breeze blows from Banda Daud Shah’s side for weeks making the winter colder. The average humidity and average soil temperature is low in winter (Table 1).
Fig 1. Map of Tehsil Takht-e- Nasrati, District Karak showing research spots.

Table 1. Meteorological data of Tehsil Takht -e –Nasrati, District Karak for the year 2001-2010

<table>
<thead>
<tr>
<th>Months</th>
<th>Temperature (°C)</th>
<th>Humidity (%)</th>
<th>Rainfall (mm)</th>
<th>Soil temperature (°C) Average</th>
<th>Wind speed (Km Per Hour)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Max</td>
<td>Min</td>
<td>Max</td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td>January</td>
<td>19.18</td>
<td>4.26</td>
<td>75.80</td>
<td>35.24</td>
<td>27.43</td>
</tr>
<tr>
<td>February</td>
<td>21.69</td>
<td>7.29</td>
<td>77.39</td>
<td>42.23</td>
<td>37.72</td>
</tr>
<tr>
<td>March</td>
<td>28.20</td>
<td>12.06</td>
<td>75.38</td>
<td>35.23</td>
<td>37.17</td>
</tr>
<tr>
<td>April</td>
<td>34.74</td>
<td>17.94</td>
<td>66.12</td>
<td>29.42</td>
<td>36.54</td>
</tr>
<tr>
<td>May</td>
<td>38.32</td>
<td>22.33</td>
<td>59.66</td>
<td>30.73</td>
<td>31.6</td>
</tr>
<tr>
<td>June</td>
<td>39.50</td>
<td>25.9</td>
<td>59.96</td>
<td>32.89</td>
<td>74.24</td>
</tr>
<tr>
<td>July</td>
<td>38.44</td>
<td>25.76</td>
<td>73.33</td>
<td>38.76</td>
<td>121.6</td>
</tr>
<tr>
<td>August</td>
<td>36.66</td>
<td>25.29</td>
<td>75.68</td>
<td>42.61</td>
<td>108.3</td>
</tr>
<tr>
<td>September</td>
<td>35.47</td>
<td>21.95</td>
<td>77.21</td>
<td>39.29</td>
<td>61.58</td>
</tr>
<tr>
<td>October</td>
<td>32.33</td>
<td>16.79</td>
<td>71.55</td>
<td>35.51</td>
<td>15.13</td>
</tr>
<tr>
<td>November</td>
<td>26.71</td>
<td>10.01</td>
<td>71.56</td>
<td>36.66</td>
<td>5.80</td>
</tr>
<tr>
<td>December</td>
<td>21.93</td>
<td>5.67</td>
<td>75.20</td>
<td>35.90</td>
<td>15.38</td>
</tr>
<tr>
<td>Mean</td>
<td>31.1</td>
<td>16.27</td>
<td>71.57</td>
<td>36.21</td>
<td>47.71</td>
</tr>
</tbody>
</table>

Source: Agricultural Research Farm Ahmad Wala Karak.

Materials and Methods

Field data collection:

Floristic data were collected from 22 randomly selected sites from 4 stand selected on the basis of altitude. Quadrat method was used for the collection of vegetation data. Each field site comprised of 10 Quadrats for each plant layer i.e. tree (10X10m), shrubs (5X5m) and herbs (1X1m). Sampling was completed in winter season. Collected samples were pressed, dried and transported to herbarium, Department of Botany, University of Peshawar, Khyber Pakhtunkhawa, Pakistan, where they were identified and classified following Stewart (1972) and Nasir and Ali (1972) and a fraction of angiosperms of Tehsil Banda Daud Shah by Khan, (2004).

Data analysis:

Vegetation attributes including frequency, density and cover were recorded along with environmental coordinates like latitude, longitude, altitude and slope using GPS. The importance value of each species was compiled adding RD, RF and RC following Hussain (1989). On the basis of the highest importance values of the first three dominant species from each layer, the communities were established and named. All the species data, as well as the field sites communities, were used for the analysis. The data was classified using standard methods Hierarchical Cluster Analysis (HCA) and Detrended Correspondence Analysis (DCA) (Hill, 1979) to summarize biological records and position of communities in groups during winter. The plant life communities associations were named after the highest value of three dominant
species. DCA ordination offered two significant ordination axes on the basis of weight for communities. Detrended Correspondence Analysis (DCA) were performed to describe compositional gradients in the vegetation. All analysis was performed using the software PCORD ver. 4.16 (McCune & Mefford, 1999).
Results

The arrangement of plant life record is commonly vegetation orientation and main query disquiets the classification and explanation of the vegetation in addition to inconsistency of ecological arrangement. Distinctive multivariate techniques are generally fruitful and commonly used for plant life arrangement position. Though, distinctive multivariate analyses do not directly take into explanation relations in their computation and are not particularly designed to vegetation structures rationalization. The ordination may be defined as the position of communities designed to set apart group types, location, relative position, standing of communities in a season of particular area. In other words, the ordination is the sound or clear arrangement of split communities or species in a season of a particular area. In present work the ordination of communities in winter is given as follows:

1. Hierarchical Cluster Analysis

The Hierarchical Cluster Analysis shows that the relationship among 22 communities during winter were completed into 21 cluster’s cycling wherever in 1st cycle, it pointed up the relationship of 2 communities at 1.0792E-01 and in end cycle, 22 communities were related with one another at 6.5113E+00 by way of 2.63% chaining. In addition on the basis of relationship, it distinct out 4 diverse groups comprising at various level, cycling and similarity of communities. The description of each one group is as under:

1.1. Cenchrus-Saccharum-Prosopis association

Group 1 comprises Cenchrus-Calotropis-Prosopis community (CCP), Cenchrus-Periploca-Prosopis community (CPP), Cenchrus-Saccharum-Phoenix community (CSP) and Zizyphus-Peganum-Saccharum community (ZPS) and was arranged in cycle 10 at 1.7502E+00. It composed of 41 species with 7 tree, 6 shrubs and 28 herbs. The dominant plant species on the basis of important value were Cenchrus biflorus (IV = 88.3), Saccharum bengalense (IV = 30.4) and Prosopis farcta (IV = 13.9) (Table 2; Fig. 2).

1.2. Cenchrus-Zizyphus-Saccharum association

Cenchrus-Calligonum-Acacia community (CCA), Cenchrus-Zizyphus-Saccharum community (CZS), Cenchrus-Saccharum-Acacia community (CSA), Cenchrus-Saccharum-Zizyphus community (CSZ), Zizyphus-Cenchrus-Calligonum community (ZCC) and Zizyphus-Cenchrus-Saccharum community (ZCS) formed the association in the form of group 2 in cycle 14 at 2.7128E+00. It arranged 43 species having 4 trees, 5 shrubs and 34 herbs. Furthermore, the mean highest important value was presented by Cenchrus biflorus (IV = 73.4), Zizyphus mauritiana (IV = 41.8) and Saccharum bengalense (IV = 32.5) (Table 2; Fig. 2).

1.3. Cenchrus-Zizyphus-Cymbopogon association

The group 3 was originated in cycle 19 at 4.4519E+00 that linked the Saccharum-Cenchrus-Zizyphus community (SCZ), Cymbopogon-Rhazya-Zizyphus community (CRZ), Cassia-Zizyphus-Fagonia community (CZF), Phoenix-Fagonia-Capparis community (PFC), Fagonia-Zizyphus-Saccharum community (FZS), Zizyphus-Capparis-Phragmites community (ZCP), Astragalus-Aerua-Zizyphus community (AAZ) and Cenchrus-Rhazya-Zizyphus community (CRZ) together. This association composed of 48 species included 7 tree, 12 shrub and 29 herb species in which the mean highest important value was offered by Cenchrus biflorus.
(IV = 24.2), *Zizyphus mauritiana* (IV = 22.40) and *Cymbopogon jwarancusa* (IV = 20.72) (Table 2; Fig. 2).

1.4. *Aerua-Zizyphus-Acacia* association

*Aerua-Acacia-Capparis* community (AAC), *Zizyphus-Aerua-Capparis* community (ZAC), *Capparis-Aerua-Acacia* community (CAA) and *Aerua-Capparis-Zizyphus* community (ACZ) were arranged in cycle 12 at 2.2257E+00 and shaped group 4. It composed of 34 plant species covered 5 trees, 9 shrubs and 20 herbs in which the highest mean important value 46.3, 28.7 and 27.5 were represented by *Aerua persica*, *Zizyphus mauritiana* and *Acacia modesta* respectively (Table 2; Fig. 2).

2. Detrended Correspondence Analysis (DCA)

Ordination of the communities by DCA highlight 4 groups i.e. 1, 2, 3 and 4 which composed of 8, 3, 3 and 2 communities respectively. The community AAC with high weight (259) as low weight (0) of CCA was present on DCA Axis 1 and summarizes the group 1, 2, 3 and 4 with mean weight 27.75, 75, 161 and 229 at EIG (0.495) respectively. On DCA Axis 2, the high weight (235) was found in CRZ and low (0) in AAC and give shape to groups 1, 2, 3 and 4 with the mean weight as 120.62, 103.33, 107.67 and 56.5 at EIG (0.206) respectively. Other communities that did not appear in groups were CRZ, AAZ, CRZ, CZF, ZAC and AAC with DCA weight 247, 232, 143, 187, 215 and 259 on DCA Axis 1 respectively. These Groups show different vegetation types during winter seasons (Fig. 3).

Discussions

Cluster analysis isolates the communities of similar character into major groups of plant life. In winter, 4 groups were structured. Most factors that occur during winter in under investigated area were high grazing, cutting, non availability of water, soil erosion and uprooting of plant species. Ahmed & Yasmin (2011) analyzed natural vegetation of two zones along Hanna Lake, Baluchistan using DECORANA and classify the vegetation into plant communities. Major group is the objective to give structure to plant life. However, cluster analysis is a helpful preliminary position for competent judgment and adjoining neighbors of vegetation. Greater the homogeneity within communities and greater will be the similarity in the clustering. The cluster analysis was used to give clear picture of the plant life in an area in the form of tree - shape. In hierarchical clustering the principle is to structure a hierarchical chain of communities’ groups sorting from groups of community position at the bottom to a comprehensive group at the top. The graphically diagram which represents the hierarchy in the structure of upturned tree expresses a dendogram that clarifies the arrangement in which position were united (bottom-up outlook) or group were divide (top-down outlook).

Detrended Correspondence Analysis (DCA) was used to give the shape to the communities on the basis of weight. This method is also used to give cleared picture of plant life in specific area in different seasons. The present results conclude that the plant species composition was different in different seasons in the same area. However, DCA has limitations, making it best to remove extreme outliers and discontinuities prior to analysis. DCA consistently gives the most interpretable ordination results, but as always the interpretation of results remains a matter of ecological insight and is improved by field experience and by integration of supplementary environmental data for the plant life sample sites. Ali & Malik (2010) applied the Detrended Correspondence Analysis (DCA) to identify environmental gradients to define vegetation distribution in green belts, gardens and parks of Islamabad city and classified the flora into 4 major association groups.
Four association from winter were focused by the present study. El-Ghanim et al. (2010) studied the vegetation at Hail region north of central Saudi Arabia where multivariate techniques results showed 7 vegetation groups. Ahmad et al. (2010b) analyzed the vegetation along motorway (M-2), Pakistan by using multivariate techniques. In the investigated area, the foremost facts noticeably indicate that slope, edaphic factor, harsh erosion, crushing of herbs and supply of rain water were the key source of plant life discrepancy. These geomorphologic aspects restrict the limitations and composition of plant communities. Distant from the reality that the site changeable are definitely significant for explaining the major plant life nature the association between the results of cluster analysis and DCA planes allow a direct analysis of scores of position data in DCA plane in relation to area up-and-down. The DCA technique provided interpretable and dynamic results than other ordination techniques and the length of first axis was greater than 3.0 and in terms of communities or species turnover. Jongman et al. (1995) recommended that if plants species or communities turnover is larger than 1.9 standard deviation then DCA technique is advanced option of ordination. Detrended Correspondence Analysis (DCA) was carried out to express compositional ascents in the plant life. DCA was presented using a default value for rescaling and detrending. Rare species and divergent communities were down weighted in DCA ordination. 

The different association produced by cluster analyses in different seasons are designed a first two axes as a sprinkled diagram. The DCA ordination axes may signify in same way the main substrate weight that affect the community in these records and have been used by the community and area characteristic of the relationship to argue the dominant characteristics of the location and plant life association. Cluster and DCA analysis are very helpful in communities’ and species classification in addition to give structure to plant life. Such type of study was also carried out by Saima et al. (2009) who stated that tree density, pH and soil texture were the major determinant of vegetation pattern. There was thin vegetation in the investigated area and species was present in patches. The ecologists have tried to quantify the division of species beside the ecological gradients. There is an association between plant life sample and resources available (Ahmad et al., 2009b and Jabeen & Ahmad, 2009). 

The ordination by means of cluster analysis and DCA help us skillfully in evaluating the classification of plants and structure of entire habitat of plant life. Malik & Hussain (2008) conducted a study to work out the relationship between remote sensing data and vegetation communities of ecological importance using multivariate techniques and stated that the ordination methods proved effective in summarizing basic, general structure of the plant community types and to some extent indicated correspondence with their spectral signatures. This study pointed out that the climatic environment of region has restricted enlistment of area and the plant life was changed with the change of seasons and altitude. Our result agrees with Dasti & Malik (1998) who stated that altitude is an environmental factor which affecting plants association. Plant ecologists have commonly been aware that plant life shows an inconsistency over a wide range of particular scales and area that have built up methods for studying the classification of vegetation. The value of altitude as an ecological factor affecting plant species association is not considering, surprising its close correlation with precipitation and interruption of rain (Danin et al., 1975; Evenari et al.,1982).The area show less rainfall than 200 mm and consist of thorny trees like Zizyphus spp, A. nilotica, A. modesta. Trees are sprinkled, roots longs, leaves thick and small in most plant species therefore, the investigated area fall into tropical thorn forests.
Conclusion

A multivariate techniques method are used as a perfect way to study and helps skillfully in evaluating the biodiversity and conservation of intact habitat and plant life in specific area. This study pointed out that grouping of plant communities were taking place on the basis of similarities. Plant ecologists have commonly been conscious that vegetation shows an inconsistency over a large variety of particular scales and area. Therefore, it is needed that we apply the multivariate techniques methods for studying the degree of plant life division.

Acknowledgements

The authors wish to thanks the ASSR/AATL 2012 International Conference organizing committee for the invitation and permission to present the paper at the Conference.

References


Table 2. Mean relative importance value of species in different associations during winter distinguished through cluster analysis of Tehsil Takht-e-Nasrati, Karak.

<table>
<thead>
<tr>
<th>S. No</th>
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<th>Groups 1</th>
<th>Groups 2</th>
<th>Groups 3</th>
<th>Groups 4</th>
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<tr>
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<td>Dalbergia sissoo Roxb.</td>
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<td>5.01</td>
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<td>7</td>
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<td>Height (100)</td>
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**Fig. 2.** Dendrogram showing grouping of different communities into association during winter, Tehsil Takht-e-Nasrati, Karak.
Fig. 3. Detrended Correspondence Analysis (DCA) of communities during winter, Tehsil Takht-e-Nasrati, Karak.
EFFECT OF CONSUMER HEALTH EDUCATION PROGRAMME ON THE ATTITUDE OF SECONDARY SCHOOL STUDENTS IN SOUTHERN IJAW LOCAL GOVERNMENT AREA OF BAYELSA STATE

Ezebuiro, Veronica O.; Timighe, Gift. C. and Samuel, E. S.

Abstract
The study determined the effect of consumer health education programme (CHEP) on the attitude of secondary school students in Southern Ijaw local government area of Bayelsa State. Three specific objectives with corresponding research questions and one null hypothesis was postulated. The study utilized quasi-experimental research design. The instrument for data collection was a questionnaire. Data were collected from 408 students. Means were utilized to answer the research questions, while t-test was utilized in testing the hypothesis at .05 level of significance. The findings revealed that the students have positive attitude towards consumer health with the mean of 2.52; male students have a positive attitude; there was a difference in the consumer health attitude between students in experimental and control groups. Based on the findings, it was recommended among others that health science should be made compulsory in all secondary schools and for all the students.

Keywords: Health, Consumer health, Consumerism, Education, Programme.

INTRODUCTION
Everyday we make decisions involving health information, products and services that we buy and use to protect, improve and maintain our health. When we do this we are involved in health consumerism. Consumerism refers to the belief or idea that buying and selling of products or services is the most important or useful activity for an individual or society (Hornby, 2006). He further added that consumerism is an action taken to protect people from unfair prices and advertising that are not true. Consumerism that is related to health is called health consumerism.

Health consumerism is that branch of study that deals with consumption of health information, products and services. Buying and selling of health products and services and the use of health information are all aspects of health consumerism (Jaycee, 2008).

Consumer health information is concerned with obtaining health information that is related to our health. This involves learning about available products and services pertaining to health as well as health facts, principles, ideas, and feelings an individual has and can use to enhance optimal or sound health and practices for his or her well being. By so doing one becomes an informed consumer. An informed consumer is one who has knowledge about information, services and products that can influence health positively or negatively in order to be able to make wise choices or decisions (Payne & Hahn, 1990). They maintained that an informed consumer is important since practitioners, manufacturers, advertisers and sales personnel use a variety of approaches in an attempt to get individuals to buy their products or use their services. They further added that health is at stake when people buy products and services. Access or sources regarding a particular health information is many. Some are more accurate and
honest than others. These sources of health-related information are family and friends, advertisements, labels and direction, folklore, testimonial, mass media exposure, practitioners and medical reference books (Payne & Hahn, 1997).

Goods are products that are made and purchased to satisfy people’s wants (Bronson, 1990). When these products or goods are related to health they are termed health products. Health product or good is something that is made, purchased and used to protect, improve and maintain one’s health. To make health consumer decision, you need to know which of the choices are better for your health. People need to have adequate consumer health knowledge, skills, positive attitudes and sound consumer practices. This will help them live a healthy life. This can only be achieved effectively by objective planning, implementation, and periodic evaluation through workshop and seminars because consumer health education is based on preventive, promotive and curative treatment.

Consumer health education is the process of exposing people to the knowledge, skills and practices needed by individuals, families, and cooperate bodies to become competent in selecting health care products and services (Ukpore, 1996). Gordian (1980) opined that consumer education is the means of creating and achieving change in society so that instead of being misformed and manipulated by our society, we can adapt to our needs. International Organization of Consumer Union (2006) defined consumer education as critical awareness, social responsibilities and solidarity among consumers. Consumer education involves asking questions and subsequently making decisions, which are both political and personal, and it involves such specifics as defining their problem, determining their effects of values and standards, seeking information about alternatives, choosing, evaluating, reviewing and revising all major decisions. Consumer education as used in the present study refers to the acquisition of facts, skills, attitudes and practices capable of enabling an individual consumer to adapt to personal environmental and social changes with the aim of promoting health and healthy living.

The ultimate objective of consumer education is to equip the individual with knowledge and skills to become a competent or wise consumer (Ukpore, 1996). Ukpore (1996) defined competent consumer as an individual who is aware of the values, goals, standards of goods and services and is capable of establishing priorities by taking rational decisions and acting responsibly in the consumer society. This simply implies that the consumer is able to attach values to health information, products and services. Consumer education can be group into certain areas.

Ukpore (1996) identified three major areas of consumer education as knowledge contributing to satisfaction; skills and techniques contributing to household management; and developing capabilities on learning innovation and judgment. Regarding health consumerism, Payne and Hahn (1980) specified four areas which include health-related information, health services, health care products and health care quackery. Federal Ministry of Education (2006) categorized consumer health into four areas namely: consumer health protection, factors influencing choice of consumer products, evaluating consumer health services and quacks, quackery and nostrums. Following from the above classification or categorization, consumer health covers four main areas, which are consumer health – related information, consumer health products, consumer health services and health care quackery, non-consumer health products (NCHP) and non-consumer health services (NCHS). Individuals including secondary school student need correct knowledge desirable attitude and practices in there areas. This can be achieved the implementation of a will designed consumer health education programme.
Consumer health education programme as described by Samuel (2003) as that which focused on correct knowledge, acquisition of desirable attitude and practices for secondary students. Comforth (2004) stated that, knowledge is the sum of our perceptions (awareness), views and prepositions that have been established and tested as correct reflections as far as they are objective realities. He stressed that, the beginning of all knowledge lies in sense perception, the reliability of which is proved beyond mere acquisition of facts to establish testing and its consequent use in human endeavours. This definition implies that knowledge can be acquired and used. Therefore secondary schools students can acquire consumer health knowledge and can use it.

World Health Organization (1990) opined that knowledge is a prerequisite to any practice. The WHO further maintained that, many of the ailments suffered by people are to a large extent inflicted by anti-health practices because many people are not well-informed (knowledgeable). Okafor (1997) stated that knowledge is a precursor for behaviour, though not all knowledge is translated into behaviour.

Consumer health knowledge as used in the present study refers to the processes of acquiring information about all types of consumer products and services including beneficial and harmful ones. It involves being a wise or informed consumer, learning about services or products that influence health, approaches that practitioners, manufactures, advertisers and sales personnel use in an attempt to sway individuals to buy their products and use their services. It also involves knowing about consumer rights and how to handle consumer problems. It also implies knowing authentic sources of information regarding where to get the services and products, and learning about the activities of quacks. Acquisition of consumer health knowledge can positively or negatively influence a consumer’s attitude.

Attitude is a feeling tone directed towards a person, object or idea (Mudary, 1983). Maghaddam (1998) defined attitude as evaluation of other people, events, issues and material things with some degree of favour or disfavour. Ajezen (1999) believes that attitude is relatively enduring and consists of a series of beliefs organized in such a way that they predispose one to act or respond to some situations in a predictable manner. Apart from knowledge and attitude, consumers usually hold certain beliefs about the things they consume. Attitude that is related to the consumption of health information, products and services is called consumer health attitude.

Consumer health attitude as used in the context of this study refers to the degree to which a consumer favours or disfavours health information, personnel, product or service for solving his or her health problems.

Korzielb and Olivieri (1991) opined that belief is an opinion; it is something that is accepted as being true by a judgement of probability rather than actuality. Godsby (2002) defined belief as a feeling that something is definitely true or something exists even though it is difficult to say where the belief is got. Beliefs that are associated with consumer health are termed consumer health beliefs. Consumer health belief refers to consumer health knowledge, attitudes and beliefs are important prerequisite to everybody including secondary school students.

Secondary school students are young persons being in the early part of life, specifically between childhood and adulthood (Robinson, 2005). Consumer education is important for these students for some obvious reasons. There is universal agreement that consumer education should be life-long experience that no one can ignore (Williams, 1982). This is perhaps why Ukpore (1996) stated that consumer educators have the major role in imparting to parents and children sound consumer practices, and in demonstrating the relationship between consumer behaviours practice and management of resources such as money, time and energy. Consumer education will
help improve interpersonal relationship especially among family members. Consumer education will help people use resources wisely especially in the midst of limited ones. Williams (2008) further stated that a little knowledge is a sine qua non for every consumer including adolescents, as knowledge goes a long way in rationalizing the consumer behaviour of such individuals. Bachman (1983) opined that a rational consumer will carry out comparative shopping before purchasing goods and services. Such a consumer, he further stressed is likely to seek information and advice about products with high prices and or reduced health risks. A rational consumer, Ukpore (1996) further added, will examine skeptically the selling claims made in advertisements, and budget expenses wisely and save money for the future. Consumer health knowledge attitude, beliefs and practices can be influenced by some factors.

There are many demographic factors that influence consumption according to Eno-Obong (2001). Gender is a strong factor that influences consumption of health information, products and services. Studies have indicated that males and females have different ways of food consumption, and women have been seen to be more concerned about eating habits than men. O’Dea and Caputi (2001) confirmed that females are more concerned about their diet especially those who are overweight. Samuel (2003) observed sex did not make a significant difference in the effects of the treatment given to the experimental group. Furthermore, the researcher observed that there is a significant difference in the post-test mean achievement score of the experimental and control groups; that the post-test of experimental group (\( \bar{x} = 44.5 \)) was higher than that of the control group (\( \bar{x} = 29.30 \)).

Everyday people make decisions involving consumption of information, goods and services for themselves and for other people especially children. Some of these decisions are based on what they know about their daily wants or needs to maintain, protect and promote their health. Some of these needs or wants may be health products (HPS), health services (HSS), non-health products (NHP) or non-health services (NHS). The decisions or choice we make should be based on the correct information or knowledge of the values, goals, standards and priorities regarding our needs, including health knowledge of what we need or consume which can come from different source including such ones as members of our families, teachers in schools as well as other sources as books, friends, advertisements, commercials, labels, mass media to mention.

The study of Okafor (2006) shows that there is inadequate knowledge, attitude and beliefs of secondary school students on consumer health education, secondary schools lack of Health teachers, no qualified health personals to head the available ones in some schools. His study further showed deficits knowledge on consumer human rights, there is so much belief on traditional herbs and immediate gratification on services, wise consumerism is not practice. Thompson, Ribera Wingenback and Vastal (2006), conducted a study to assess family and consumer sciences, teachers changes in attitude and knowledge of high about food irradiation using a repeated measures designed to assess the effects of a professional development workshop on food safety and food irradiation. To determine changes in the food irradiation attitudes and knowledge of family and consumer sciences of high school teachers, the authors administered a pre-test 2.5 months before the professional workshop, a post-test immediately after, and a delayed post-test approximately 10 months after a workshop on food irradiation, using a previously validated instrument. Results revealed significant positive.

Secondary school students represent a group that is gullible, facing a lot of health problems, which need solutions. This situation can adequately be handled if they are armed with adequate knowledge of consumer health and positive attitude towards consumer health matters. Presently, knowledge of what constitutes consumerism attitudes of secondary school students in
Bayelsa appear not to be known or documented. Hence, to the best knowledge of the present researchers, no study has been conducted to determine the effect of Consumer Health Education Programme on consumer health attitude of the students in Southern Ijaw LGA of Bayelsa State.

**Purpose of the Study**

The purpose of the study is to determine the effect of a consumer health education programme (CHEP) on the knowledge, attitude and beliefs of secondary school students in Southern Ijaw Local Government area of Bayelsa State. Specifically, the study seeks to:

1. determine the consumer health attitudes of students;
2. determine the effect of CHEP on the consumer health attitude of male and female students of experimental and control schools.
3. determine the effect of CHEP on the consumer health attitude of male and female students of experimental and control schools.

**Research Questions**

1. What is the consumer health attitude of students?
2. What is the Consumer Health Attitude (CHA) of students in control and experimental schools using CHEAQ?
3. What is the effect of CHEP on CHA of the male and female students in experimental schools using CHEAQ?

**Hypothesis**

The null hypothesis was tested at 0.05 level of significance.

1. There will be no significant difference between experimental and control group in their attitude CHEP.

**METHODS AND PROCEDURES**

**Research Design**

In order to achieve the purpose of the study, the quasi-experimental research design was utilized for the study. Ali (1990) affirmed that one type of quasi-experimental design is the non-randomized pre-test design or non-equivalent design.

**Population for the Study**

The population for the study comprised all the students in all the fifteen secondary schools in Southern Ijaw Local Government Area of Bayelsa State. According to Bayelsa State Education Board (2009), there are 4,350 students (2,450) senior students. The boys are 1634 while girls are 816.

**Sample and Sampling Technique**

The sample for the study was 490 of senior secondary school students in Southern Ijaw Local Government Area of Bayelsa State. It is 20/100 x 2450 = 490 subjects. This sample is 10 per cent higher than Nwana (1982) rule of the thumb which states that “when a population runs into few thousands, ten per cent or a fewer percentage of the population could be used.
Purposive sampling was used. Nworgu (2003) stated that, in purposive sampling, specific elements which satisfy some predetermined criteria are selected. Thus the sample that was used possessed homogeneous characteristics as the parent population. The sample selected was grouped into two groups of 245 subjects per group comprising male and female students for both the experimental and control groups. The study experienced experimental mortality of 82 students reducing the sample size to 408 students.

**Instrument for Data Collection**

The Consumer Health Education Attitude Questionnaire (CHEAQ) was developed by the investigators. This instrument was used to collect the data for the study.

**Methods of Data Collection**

The students were given a pretest using the CHEAQ in the respective schools after the investigator had presented a letter of introduction to the principals to intimate them of the objectives of the study. The instrument was administered with the assistance of some health education teachers in the schools. The pretest scores formed the results of the both experimental and control groups.

Students assigned to experimental schools were taught consumer health education using the innovative Consumer Health Education Programme (CHEP) while those in the control schools were taught without the CHEP. Trained regular Health Science teachers in the experimental school did the teaching for about eight weeks. The CHEP which contained lesson plans was prepared by the investigator and validated by lecturers in Health Education. After the treatment, the CHEAQ was administered to the students in the control and experimental schools and their scores recoded.

**Method of Data Analysis**

The data generated for the study was analyzed using the Statistical Package for Social Science (SPSS) on the computer. The steps taken are as follows: Research question 1 and 2 was answered using mean scores and standard deviations. The criterion mean chosen for the study was 2.50. The hypothesis was tested using t-test. The hypothesis was tested at the p ≤ .05 level of significance.

**RESULTS**

The results of this present study are organized and presented in two parts thus: Data answering the research questions and data testing the null hypothesis.

**Research question one**

What is the attitude of students towards consumer health? Data answering students’ attitude towards consumer health are presented in Table 1.

Table 1

<table>
<thead>
<tr>
<th>S/N</th>
<th>Question</th>
<th>×</th>
<th>SD</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>I prefer patronizing qualified health providers.</td>
<td>3.84</td>
<td>.496</td>
<td>Positive</td>
</tr>
<tr>
<td>2.</td>
<td>Some ailments are better handled by</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
traditional health care providers.  
3. I need to know how to get the best value for my money  
4. I do not bother about choosing nutritious foods  
5. I like eating foods that are packaged in industries because all of them are hygienically prepared.  
6. I like patronizing quacks because they can cure certain diseases or ailments that qualified medical practitioners cannot cure.  
7. All trained health providers are qualified to give advice on all health matters.  
8. It is not only your doctor or nurse that can give your advice on what health goods or services you consume.  
9. It is a waste of time consulting consumer advocacy groups for solving my consumer health problems.  

Overall $\bar{X}$  

Table 1 shows an overall mean score of $\bar{X} = 2.52$ in the attitude of students towards consumer health education matters, which is greater than the criterion mean of 2.50. This implies that the overall attitude of students was positive. The table further indicates accept the items on "I do not bother about choosing nutritious food ($\bar{X} = 1.62$) and "I like patronizing quacks because they can cure certain diseases or ailments that qualify medical practitioners cannot cure ($\bar{X} = 1.59$), and it is waste of time consulting consumer advocacy groups for solving my problems ($\bar{X} =1.31$) all others had mean scores which were above the criterion mean of 2.50.

Research question two.  

What is the difference in the consumer health attitude of students in the control and experimental schools using CHEAQ? Data answering this research question are contained in Table 2.

<table>
<thead>
<tr>
<th>S/N</th>
<th>Attitudinal Items</th>
<th>Control $(n_1=202)$</th>
<th>Experimental $(n_2=206)$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>$\bar{x}_1$</td>
<td>$SD_1$</td>
</tr>
<tr>
<td>1.</td>
<td>I prefer patronizing qualified health providers.</td>
<td>3.96</td>
<td>.207</td>
</tr>
<tr>
<td>2.</td>
<td>Some ailments are better handled by traditional health care providers.</td>
<td>1.75</td>
<td>.811</td>
</tr>
<tr>
<td>3.</td>
<td>I need to know how to get the best value for my money</td>
<td>3.96</td>
<td>.261</td>
</tr>
</tbody>
</table>
Table 2 shows the posttest mean attitudinal scores of students in experimental and control schools. The table further shows that the overall posttest mean score of students in experimental schools ($\bar{X} = 2.63$) was slightly higher than of the students in the control schools ($\bar{X} = 2.30$). The mean score of students in both is experimental schools was greater than the criterion mean of 2.50, indicating that the attitude was positive for this group.

**Research question three.**
What is the effect of CHEP on CHA of male and female students? Data answering this research question are contained in Table 3.

Table 3
**Effect of CHEP on CHA of male and female students in experimental and control groups**

<table>
<thead>
<tr>
<th>Gender</th>
<th>Male ($n_1=202$)</th>
<th>Female ($n_2=206$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>Posttest</td>
<td></td>
</tr>
<tr>
<td>S/N</td>
<td>Attitudinal Items</td>
<td>$\bar{x}_1$</td>
</tr>
<tr>
<td>1. I prefer patronizing qualified health providers.</td>
<td>3.93</td>
<td>0.30</td>
</tr>
<tr>
<td>2. Some ailments are better handled by traditional health care providers.</td>
<td>2.26</td>
<td>0.851</td>
</tr>
<tr>
<td>3. I need to know how to get the best value for my money</td>
<td>3.79</td>
<td>0.533</td>
</tr>
<tr>
<td>4. I do not bother about choosing nutritious foods</td>
<td>1.24</td>
<td>0.763</td>
</tr>
<tr>
<td>5. I like eating foods that are packaged in industries because all of them are hygienically prepared.</td>
<td>1.57</td>
<td>1.052</td>
</tr>
</tbody>
</table>
6. I like patronizing quacks because they can cure certain diseases or ailments that qualified medical practitioners cannot cure.  
7. All trained health providers are qualified to give advice on all health matters.  
8. It is not only your doctor or nurse that can give your advice on what health goods or services you consume.  
9. It is a waste of time consulting consumer advocacy groups for solving my consumer health problems.

<table>
<thead>
<tr>
<th></th>
<th>Control (n = 172)</th>
<th>Experimental (n = 236)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( \bar{X} = 50.42 )</td>
<td>( \bar{X} = 65.30 )</td>
</tr>
<tr>
<td>SD</td>
<td>30.474</td>
<td>9.735</td>
</tr>
<tr>
<td>t-cal</td>
<td>9.735</td>
<td>406</td>
</tr>
<tr>
<td>df</td>
<td>.042</td>
<td>.042</td>
</tr>
<tr>
<td>p-value</td>
<td>Significant</td>
<td>Significant</td>
</tr>
</tbody>
</table>

Table 3 shows that the overall mean attitude score of male students (\( \bar{X} = 2.50 \)) was slightly higher than that of the female students (\( \bar{X} = 2.42 \)). Male attitude towards consumer health was positive while that of female was negative.

Hypothesis one.
There is no significant difference between control and experimental groups in their attitude. Data verifying this hypothesis are contained in Table 4.

Table 4
Summary of t-Test analysis in the CHA of students in experimental and control groups.

<table>
<thead>
<tr>
<th>Attitude</th>
<th>Control (n = 172)</th>
<th>Experimental (n = 236)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( \bar{X} = 50.42 )</td>
<td>( \bar{X} = 65.30 )</td>
</tr>
<tr>
<td>SD</td>
<td>30.474</td>
<td>9.735</td>
</tr>
<tr>
<td>t-cal</td>
<td>9.735</td>
<td>406</td>
</tr>
<tr>
<td>df</td>
<td>.042</td>
<td>.042</td>
</tr>
<tr>
<td>p-value</td>
<td>Significant</td>
<td>Significant</td>
</tr>
</tbody>
</table>

Table 4 shows a calculated grand t-calculated value of 9.735 with a p-value of .042 which is less than .05 level of significance at 406 degree of freedom. Following from this, the null hypothesis of no significance difference in the attitude of student in experimental and control groups is therefore rejected. Now we accept the alternative hypothesis that there is a difference in the consumer health attitude between students in experimental and control groups.

Summary of Major Findings
Based on the analysis of data, the major findings of the study are hereby summarized.

1. Student’s attitude regarding consumer health was positive (\( \bar{X} = 2.52 \)) positive. This answers research question One (Table 1).
2. Student’s attitude in both experimental and control groups was positive, though that of experimental group (\( \bar{X} = 2.63 \)) was slightly higher than that of control group (\( \bar{X} = 2.50 \)). This answers research question Two (Table 2).
3. Attitudinal attitude of male ($\bar{X} = 2.50$) was positive while that of female ($\bar{X} = 2.42$) was negative. This answers research question Three (Table 3).

4. There was significant difference in the consumer health attitude of students in experimental and control groups. This test. Hypothesis One (Table 4).

Discussion

The finding in Table 1 on attitude of the students revealed that the students have positive attitude towards consumer health. This finding is expected because secondary school students are adolescents who by their nature and characteristics are poised to knowledge and also are exploratory. This finding is in line with the finding of Briggs (2007) who observed that one can have a positive attitude towards consumer health if one should learn to be a wise consumer.

The finding in Table 2 showed that the students in the experimental group showed a slightly higher positive attitude to consumer health education programme than the students in the control group. This finding is expected and not surprising. This finding is similar to the finding of Thompson, Ribera Wingen back and Vastal (2006) which revealed significant positive effect after a post-test on professional workshop on food irradiation.

The finding in Table 3 revealed that the male students have positive attitude contrary to the females’ negative attitude. This finding is surprising. This is because the females are supposed to have higher attitude since they are the ones who are usually concerned with the purchase of consumer health especially food products from the market. The males who do not go to markets often to buy food products are less likely to be concerned with the purchase of consumer health products and are likely to show positive attitude to the consumer health education programme. The finding is contrary to the finding of Samuel (2003) who observed that sex did not make a significant difference in the effect of the treatment given to the experimental group.

Furthermore, the finding in Table 4 revealed that there was significant difference in the consumer health attitude of students in experimental and control groups. This finding is expected and not surprising because the finding is similar to the finding of Thompson et al (2006) which revealed a significant positive effect after exposing the subjects to professional workshop. The finding is also similar to the finding of Samuel (2003) who observed that there is a significant difference in the post-test mean achievement score of experimental and control groups; that the post-test of experimental group was higher than that of the control group.

Conclusions

Based on the analysis of data, the major findings of the study are hereby summarized.

1. Student’s attitude regarding consumer health was positive.
2. Student’s attitude in both experimental and control groups was positive, though that of experimental group was slightly higher than that of control group.
3. Consumer health attitude of male was positive while that of female was negative.
4. There was significant difference in the consumer health attitude of students in experimental and control groups.
Recommendations

Based on the findings of the present student, discussion and conclusions, the following recommendations were made:

1. Federal and state, non-governmental organizations and schools management board should sponsor CHEP not only in schools but also in the community. Both students and members of the community should be made to participate in the programme so may negative attitude can be altered.

2. After CHEP had been successfully concluded and positive consumer health attitudes acquired, there is need for health educators to always make follow-up to ascertain whether these behaviours are actually put into practice and sustained by the participants.

3. Above all, health science should be made compulsory in all secondary schools and for the students.


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QUALITY INSTRUCTION: A SIN QUO-NON TO EFFECTIVE TECHNOLOGICAL EDUCATION IN SOUTH EASTERN STATES

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Nigeria

Abstract
This study sought to find out ways of promoting quality instruction in secondary schools in South Eastern States. Quality instruction has no substitute to technological education and so it should be pursued with vigour. The study made use of 5 research questions and 1 null hypothesis. It was a survey research design. The population of the study comprised all the principals and teachers in all the Secondary Schools in South Eastern States numbering 1,337 principals and 21,605 teachers. Simple random sampling technique was used to select 500 principals and 5,000 teachers from three States of the five States in South Eastern States. Data was collected using 41 item questionnaires named (Quality Instruction and Effective Technological Education Instrument (QIETEI) with a reliability co-efficient of 0.87. Mean was used to answer the research questions while Z– test was used in testing the null hypothesis at 0.05 level of significance. The result of the study among others specified many roles of different stakeholders in education like principals should reduce teachers work load, teachers should prepare very well for their lesson etc. Based on the results, it was recommended among others that government should increase the funding of schools, parents should live up to their responsibilities as regards to giving their children quality education.

INTRODUCTION

Quality in education is synonymous with efficiency and effectiveness. It is a deserved and desired virtue. It is the attribute in our educational sector that can move our nation technological upwards. When the quality of a nation’s education is poor, invariably that nation’s technological development will not have any hope. The level of technological development of any nation depends on the quality of education in that nation.

Quality in education according to (UNESCO 1998) is a multidimensional entity which embraces all functions and activities, teaching and academics programmes, research and scholarship, staffing, students, building, facilities, equipment services to a community and academic environment. It is the extent of solid education programme introduced to learners under a conducive environment that will produce school leavers with desired attributes that will meet the technological challenges of any nation.

For Beeby (1966), quality instruction includes learners that are healthy, well nourished and ready to participate and learn the content that is reflected in relevant curricula and materials for the acquisition of basic skills needed for a changing society.
Technology according to Merian Webster dictionary is the making, modification, usage and knowledge of tools, machines, techniques, methods of organization in order to solve a problem, achieve a goal and perform a specific function. It is the practical application of knowledge especially in a particular area. This practical application can not really take effect without somebody gaining quality knowledge.

Quality instruction is a prerequisite to a quality knowledge that begets technological education. No wonder, one of the aims of National Educational Agenda according to FRN (2004) is the production of quality graduates. High quality in education is not just earning high grades in examination but the acquisition of high grade that is attributed to the desired skilled relevant to the societal technological development. Nwangwu (2000) also added that for education to be technological relevant, it should not only be learners passing examination but must include the acquisition of relevant cognitive, psychomotor and affective skills, full of positive values that will match the changing environment. Willm (2000) concluded that learning environment is made up of physical, psychological and service delivery elements. Learning can occur anywhere, but the positive learning outcome generally sought by educational system happens in a quality learning environment.

Dashe and Patsohot (2011) also added that quality is the ability of a product, service or structure of a phenomenon to conform to an agreed standard that is superior to others. It is not out of place to say that our product and services cannot conform to the agreed standard of the changing environment. Researches have shown that many graduates of all levels, despite the high grade obtained from external examination could not fit in properly into the technological age of the society. It is a worrisome situation to all the stakeholders in education because education is the bedrock upon which all other societal development rest and considering the huge amount of fund government invested in education sector yearly. The researcher wants to find out ways of improving quality instruction by all the stakeholders in education so that technological development will be ensured.

Problem of the study:
There is a general perception that the quality of instruction in our education system is seriously dwindling due to laxity on most of the stakeholders in education. This has even made some researchers like Akubuiro and Joshua (2004) to begin to complain about the fallen standard of education; fallen standard in terms of both quality input and output. Researchers like Ogbuagu (2004), and Ekemezie (2010) concluded that most Nigerian Secondary Schools are known by inadequate and over crowded classrooms, lack of equipment, furniture, learning materials and poorly motivated teachers etc. The researcher begins to wonder, despite the importance of quality instruction in the development of technological education in our nation, how these kinds of characterized school environment produce quality output. Education being the bedrock of any national development can not produce the desired output without thoroughly looking at the quality of input. It is based on this, that the researcher wants to find out ways of improving quality instruction in schools to enable our nation gain effective technological education needed in this 21st century.

Purpose of the study:
The main purpose of this study is to find out various ways in which quality instruction can be promoted in secondary schools in South Eastern States by different stakeholders in education.

**Scope of the study**
The study covers all government owned secondary schools in South Eastern States. It also covers the ways various stakeholders in education can promote quality instruction in schools.

**Research questions:**
The following research questions guided the study:

1. What are the ways government can promote quality instruction in schools?
2. What are the ways principals can promote quality instruction in schools?
3. How can teachers promote quality instruction in schools?
4. How can parents promote quality instruction in schools?
5. What are the ways students can promote quality instruction in schools?

**Hypothesis:**
This null hypothesis was tested at 0.05 level of significance.

H01. The mean rating of principals and teachers on how quality instruction can be promoted by different stakeholders is not significantly different.

**METHODOLOGY**

**Design:**
The study adopted a descriptive survey design aimed at finding ways of promoting quality instruction in secondary schools in South Eastern States.

**Population:**
The population consists of all principals and teachers in government owned secondary schools in South Eastern States. It consists of Abia State 198 principals and 3,286 teachers, Imo State 320 principals and 1200 teachers, Anambra State 357 principals and 4,474 teachers, Enugu State 271 principals and 4000 teachers, and Ebonyi State 191 principals and 2645 teachers totaling 1,337 principals and 21,605 teachers as the entire population.

**Sample and sampling technique:**
Simple random sampling technique was used to select a sample size of 500 principals and 5,000 teachers from three States in South Eastern Nigeria. The States are Abia, Ebonyi and Imo States.

**Instrumentation:**
The instrument was Nwogbo (2007) “Quality Promotion Instrument”. The researcher adapted it, reconstructed and added many things to suit her environment. It was re-named “Quality Instruction and Effective Technological Education Instrument (QIETEI). It consist of 41 items that was based on a 4 point likert type scale of Strongly Agree (SA) = 4, Agree (A) = 3, Disagree (D) = 2 and Strongly Disagree (SD) = 1 point respectively for research questions 1-5. Any response from 2.50 and above is regarded accepted while any response below 2.50 is regarded as rejected.

**Validation and reliability of the instrument:**
The face and content validity of the instrument was established by the help of three experts from the Department of Educational Administration and Measurement and Evaluation, of University of Nigeria, Nsukka. 30 principals and 60 teachers from Akwa-Ibom State were used to test the reliability of the instrument. It was re-tested after a period of two weeks and Pearson Product Moment Correlation Coefficient that yielded a value of 0.87 attested the reliability of the instrument.

Method of data administration:
5,500 copies of questionnaire instrument were distributed with the help of six research assistants, 2 in each State and 5,180 were collected on the spot and used for the study.

RESULTS
Research question 1: What are the ways government can promote quality instruction in schools?

Table 1: Mean rating of principals and teachers on ways government can promote quality instruction in schools.

<table>
<thead>
<tr>
<th>S/N</th>
<th>Items</th>
<th>Principals’ response</th>
<th>Teachers’ response</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>X</td>
<td>Dec</td>
</tr>
<tr>
<td>1.</td>
<td>Recruitment of qualified personnel</td>
<td>3.70</td>
<td>Dec</td>
</tr>
<tr>
<td>2.</td>
<td>Adequate provision of needed infrastructural facilities</td>
<td>3.51</td>
<td>Agreed</td>
</tr>
<tr>
<td>3.</td>
<td>Regular supervision of instruction</td>
<td>2.68</td>
<td>Agreed</td>
</tr>
<tr>
<td>4.</td>
<td>Use of qualified personnel in supervision of instruction</td>
<td>2.71</td>
<td>Agreed</td>
</tr>
<tr>
<td>5.</td>
<td>Adequate teachers’ development programme</td>
<td>3.71</td>
<td>Agreed</td>
</tr>
<tr>
<td>6.</td>
<td>Maintenance of all kinds of school plants</td>
<td>2.76</td>
<td>Agreed</td>
</tr>
<tr>
<td>7.</td>
<td>Disbursing enough money for the management of schools</td>
<td>3.05</td>
<td>Agreed</td>
</tr>
<tr>
<td>8.</td>
<td>Improved personnel welfare scheme</td>
<td>3.25</td>
<td>Agreed</td>
</tr>
<tr>
<td>9.</td>
<td>Prompt and regular payment of salaries and other benefit of staff</td>
<td>3.92</td>
<td>Agreed</td>
</tr>
<tr>
<td>10.</td>
<td>Insist on normal class size</td>
<td>2.60</td>
<td>Agreed</td>
</tr>
</tbody>
</table>

Pooled mean: 3.19

Results in Table 1 shows that both principals and teachers agreed that the items are ways government can promote quality instruction because their responses are above 2.50.

Research question II: What are ways principals can promote quality instruction in schools?

Table II: Mean rating of principals and teachers on ways principals can promote quality instruction in schools.
<table>
<thead>
<tr>
<th>S/N</th>
<th>Items</th>
<th>Principals’ response</th>
<th>Teachers’ response</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.</td>
<td>Adequate supervision of instruction</td>
<td>X 3.25 Dec Agreed</td>
<td>X 3.40 Dec Agreed</td>
</tr>
<tr>
<td>12.</td>
<td>Provision of needed instructional resources/facilities</td>
<td>2.72 Agreed</td>
<td>2.78 Agreed</td>
</tr>
<tr>
<td>13.</td>
<td>Delegate duties to teachers</td>
<td>2.50 Agreed</td>
<td>2.60 Agreed</td>
</tr>
<tr>
<td>14.</td>
<td>Reduce teachers work load</td>
<td>3.50 Agreed</td>
<td>3.25 Agreed</td>
</tr>
<tr>
<td>15.</td>
<td>Encourage personnel development programme</td>
<td>3.12 Agreed</td>
<td>3.30 Agreed</td>
</tr>
<tr>
<td>16.</td>
<td>Create good and enabling environment for staff</td>
<td>2.70 Agreed</td>
<td>3.20 Agreed</td>
</tr>
<tr>
<td>17.</td>
<td>Maintain school plant of all kinds</td>
<td>2.54 Agreed</td>
<td>2.65 Agreed</td>
</tr>
<tr>
<td>18.</td>
<td>Involve staff in management of the school</td>
<td>2.51 Agreed</td>
<td>2.70 Agreed</td>
</tr>
<tr>
<td>19.</td>
<td>Be democratic in dealing with staff and students</td>
<td>2.60 Agreed</td>
<td>3.02 Agreed</td>
</tr>
</tbody>
</table>

Pooled mean 2.78 2.99

Results in Table II shows that both principals and teachers agreed that the items are ways principals can promote quality instruction because their responses are above 2.50.

Research questions III: What are ways teachers can promote quality instruction in schools?

Table III: Mean rating of principals and teachers on how teachers can promote quality instruction in schools.

<table>
<thead>
<tr>
<th>S/N</th>
<th>Items</th>
<th>Principals’ response</th>
<th>Teachers’ response</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.</td>
<td>Proper lesson planning</td>
<td>3.85 Dec Agreed</td>
<td>3.21 Dec Agreed</td>
</tr>
<tr>
<td>21.</td>
<td>Use of well prepared lesson note</td>
<td>3.50 Dec Agreed</td>
<td>3.60 Dec Agreed</td>
</tr>
<tr>
<td>22.</td>
<td>Varying methods of teaching</td>
<td>3.20 Dec Agreed</td>
<td>3.51 Dec Agreed</td>
</tr>
<tr>
<td>23.</td>
<td>Active learners participation</td>
<td>3.90 Dec Agreed</td>
<td>3.85 Dec Agreed</td>
</tr>
<tr>
<td>24.</td>
<td>Adequate use of relevant instructional resources</td>
<td>3.52 Dec Agreed</td>
<td>3.60 Dec Agreed</td>
</tr>
<tr>
<td>25.</td>
<td>Proper knowledge of subject matter</td>
<td>3.11 Dec Agreed</td>
<td>3.01 Dec Agreed</td>
</tr>
<tr>
<td>26.</td>
<td>Proper knowledge of learners/individual differences</td>
<td>2.70 Dec Agreed</td>
<td>2.65 Dec Agreed</td>
</tr>
<tr>
<td>27.</td>
<td>Good personality trait</td>
<td>2.61 Dec Agreed</td>
<td>2.56 Dec Agreed</td>
</tr>
</tbody>
</table>
In table III, the responses of both principals and teachers scored above 2.50, which indicates that all the items are ways teachers promote quality instruction.

Research question IV: What are ways parents can promote quality instruction in schools?

Table IV: Mean rating of principals and teachers on how parents can promote quality instruction in schools.

<table>
<thead>
<tr>
<th>S/N</th>
<th>Items</th>
<th>Principal’s response</th>
<th>Teachers’ response</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>X</td>
<td>Dec</td>
</tr>
<tr>
<td>28</td>
<td>Provision of educational materials and facilities for children at home.</td>
<td>3.01</td>
<td>Agreed</td>
</tr>
<tr>
<td>29.</td>
<td>Regular attendance to PTA meetings.</td>
<td>2.60</td>
<td>Agreed</td>
</tr>
<tr>
<td>30.</td>
<td>Help children at home with their assignment</td>
<td>2.70</td>
<td>Agreed</td>
</tr>
<tr>
<td>31.</td>
<td>Provide proper nutrition to their children/ward through good feeding.</td>
<td>2.90</td>
<td>Agreed</td>
</tr>
<tr>
<td>32.</td>
<td>Pay their children/wards schools fees regularly</td>
<td>3.01</td>
<td>Agreed</td>
</tr>
<tr>
<td>33.</td>
<td>Give their children time to study/play at home.</td>
<td>2.86</td>
<td>Agreed</td>
</tr>
<tr>
<td>34.</td>
<td>Allow them to leave home for school on time.</td>
<td>2.91</td>
<td>Agreed</td>
</tr>
<tr>
<td>35.</td>
<td>Give their children proper orientation about school at home.</td>
<td>2.60</td>
<td>Agreed</td>
</tr>
</tbody>
</table>

Pooled mean 2.82 2.84

In table IV, the responses of both principals and teachers scored above 2.50 which, indicates that all the items are ways parents can promote quality instruction.

Research question V: What are ways students can promote quality instruction in schools?

Table V: Mean rating of principals and teachers on how students can promote quality instruction in schools.

<table>
<thead>
<tr>
<th>S/N</th>
<th>Items</th>
<th>Principal’s response</th>
<th>Teachers’ response</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>X</td>
<td>Dec</td>
</tr>
<tr>
<td>36</td>
<td>Attending school/classes regularly and on time.</td>
<td>3.01</td>
<td>Agreed</td>
</tr>
<tr>
<td>37</td>
<td>Being always attentive in the class.</td>
<td>2.91</td>
<td>Agreed</td>
</tr>
</tbody>
</table>
In table V, principals and teachers agreed that all the items on ways students can promote quality instruction are true. This was seen in all the mean scores that recorded above 2.50.

**Hypothesis 1:** The mean rating of principals and teachers on how quality instruction can be promoted by different stakeholders is not significantly different.

**Table VI:** Z-Test analysis of the mean rating of principals and teachers on how quality instruction can be promoted.

<table>
<thead>
<tr>
<th>Respondents</th>
<th>N</th>
<th>X</th>
<th>SD</th>
<th>DF</th>
<th>Z-cal</th>
<th>Z-Cri</th>
<th>Prob.</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Principals</td>
<td>480</td>
<td>2.77</td>
<td>0.48</td>
<td>5,178</td>
<td>1.42</td>
<td>1.99</td>
<td>P&gt;0.05</td>
<td>Accept</td>
</tr>
<tr>
<td>Teachers</td>
<td>4700</td>
<td>3.02</td>
<td>0.51</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In table VI, the Z-calculated value of 1.42 at 0.05 level of significance is less than the Z-critical value of 1.96 which indicates that the null hypothesis is upheld. It means that there is no significant difference between the mean rating of principals and teachers on how quality instruction can be promoted by different stakeholders.

**DISCUSSION OF RESULTS**

Quality instruction is definitely a special virtue which all the stakeholders in education should pursue. It is a stepping stone to effective technological development of any nation. In the findings of this study in table 1 for example on the perception of principals and teachers on ways government can promote quality instruction, all the items are what government should do to make sure that quality instruction is provided in our schools. These findings are in agreement with Willms (2000), Postle Waithe (1998) and Anukam (2001) who were of the opinion that teachers working condition affects the ability to promote quality education. In the same development, they agreed that class size has a lot of impact on the quality of instruction a child gets in the school. If the normal class size is not maintained, definitely, teachers will be frustrated and learners will be uneasy to get the best from the teachers. Many aspects of school life and educational policy go into teachers perceptions of their employment. The condition of infrastructure and availability of learning materials, all influence the teachers experience as an educator. Postle Waithe (1998) also added that low and late remuneration may lead teachers to take on another job which hurts students learning.

A study in 12 Latin American countries found that children in schools where many teachers work in other jobs in addition to teaching are 1:2 times more likely to have lower test scores.
(Willms 2000) concluded. The low test scores invariably attest to low quality instruction because of unsteadiness and unseriousness.

For teachers to be productive and produce the best result, they need supportive working condition to maintain these positive attitudes. The quality of administrative support and leadership is another critical element in school processes both for students and teachers as observed in research question I. This assertion was in line with Miske and Dowd (1998) who concluded that teachers need governments who are supportive in education system. Organizational support for teaching and learning that enhances quality takes many forms like measures as advocating for better conditions and professional development, respecting teacher’s autonomy and professionalism, financial support, maintenance of structures and development including decision making process. Such support by government has been seen to have positive effect on quality of teaching and learning.

In research question II, it was found out that despite the effort of government to promote quality instruction in schools, principals, parents, teachers and even students, have a more embracing role to play. This group of people is directly affected. From the findings of this study in table II, all the items were agreed by both principals and teachers as the roles parents should play in quality instruction in schools. These findings corroborate the findings of researchers like Dolan, Drake, Maier, Brooler and Jukes (2000). They concur that guidance and counseling services, the provision of extra-curricular activities and provision of school snacks are other examples of service provision that contribute to quality school environment. McCain and Mustard (1999) added that adequate instruction is critical for normal brain development in the early years of a child. Physical and psychological healthy children learn well. And also healthy development in early childhood plays an important role in providing the basis for a healthy life and successful formal school experience. They also agreed that parents should provide educational materials and pay their children’s school fees regularly to avoid being sent home from school and try as much as possible to visit their school to see what they are doing. Children should not be over labored at home to enable them rest and carry out their home works which parents as a necessity should help them. Quality instruction is a step by step stage that needs a gradual assistance to make it real.

In research question III, the findings of this study also revealed that all the items by both principals and teachers on what principals should do to promote quality instruction are in agreement with what researchers like Carron and Chau (1996), Miske and Dowd (1998). They were of the opinion that quality supervision of instruction, development of authority, respecting teacher’s autonomy and inclusive decision making process are all roles of school administrators to make sure that teachers are relaxed in their work environment.

Principals that are autocratic and do not involve teachers in decision making process stand a chance of loosing the unity of their workers in an organization and it has adverse effect on the quality of instruction. Willms (2000) also added that a great relationship occur between teachers work load and their sense of efficacy. This is to say that teachers work more efficiently and quality is assured when work load is less as supported by both principals and teachers.
In research question IV, both principals and teachers accepted all the items as ways teachers can promote quality instruction in schools. This is in support of what researchers like Darling-Hammond (1997) said about professional learning for teachers. Darling-Hammond concluded that the highest quality teachers are those most capable of helping their students learn, have deep mastery of both their subject matter and pedagogy. This is also to corroborate Ekemezie (2010) who was of the view that most of the professional qualities of a good teacher that can render quality instruction are, good knowledge of learners, adequate mastery of the subject matter, sound knowledge of teaching methods, good personality traits, adequate use of instructional resources etc. A teacher that must provide quality instruction must be able to prepare his lesson in advance and be a teacher indeed and not a cheater.

In research question V, both principals and teachers accepted all the items as ways students can promote quality instruction in schools. This is to say that, though students as the recipients of the instruction can contribute meaningfully to the provision of quality instruction in schools. Researchers like Miske and Dowd (1998) and Ekemezie (2010) demonstrated that to achieve academically, children must attend school/classes consistently and be attentive in the class. This is also in agreement with a study of village-based school in Malawi, who found that students with higher rates of attendance had greater learning gains and lower rates of repetition.

In table VI, the Z-test analysis of the rating of principals and teachers on how quality instruction can be promoted by different stakeholders indicates that the null hypothesis was accepted which means that the findings in all the research questions and the hypothesis were in agreement with what the above researchers found out as the expected roles of different stakeholders in education. Quality instruction is not made overnight, it demands dedication and commitment to duties and proper implementation of educational policies instead of mere lip service and policy formulation.

CONCLUSION
Quality instruction as an attribute has no substitute to technological development. It is only when the quality of input is ensured that the quality output can be dreamt of. So far, any nation to grow technologically all the stakeholders in education should embrace the challenges of quality instruction in order to reach the nation’s goal in this technological era.

RECOMMENDATIONS
Based on the findings of this study, the following recommendations are made:
1. Government should increase the finding of schools in order to provide all needed infrastructures.
2. Teachers’ salaries/allowances should be paid on times and conditions of service be improved.
3. Principals should be democratic in dealing with both teachers and students.
4. Teachers should live by the ethics of the noble profession and avoid being cheaters.
5. Parents should live up to their responsibilities as regards to giving their children quality education.
6. Government should employ qualified personnel to schools.
7. Students should always put their priority right in life; this will make them to be self motivated.
REFERENCES


STUDENT VARIABLES AND SENIOR SECONDARY STUDENTS’ ACHIEVEMENT IN MATHEMATICS IN RIVERS STATE, NIGERIA

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Department of Technical Education
Ignatius Ajuru University of Education,
Port Harcourt, Rivers State, Nigeria

Abstract
This research study focused on the relationship between the student variable and their achievement in mathematics at the senior secondary school level in Rivers State, Nigeria. The ex-post facto research design was adopted for this study, since already conducted mathematics test scores of the students were retrieved and used for the analysis. Furthermore, data were elicited through the student variable and students’ achievement in mathematics questionnaire (SVAMQ). This questionnaire consisted of five sections and was administered to the students. A population of 10,120 students were involved in the study out of which 4510 were chosen for the sample using the Yarrow Yamen’s formula. The data were analyzed using the Z-test statistic, means and simple percentage. The findings were that to a high extent students’ attitude towards mathematics, their perceptions of the importance of mathematics and their self-concept influenced their achievement in mathematics. Based on these findings, recommendations were made.

Keywords: Student variables, mathematics achievement, attitude, self-concept, perceptions

Introduction
This research study focused on the student factor and students’ achievement in mathematics at the senior secondary school level of Rivers State, Nigeria. There is a widespread interest in improving the levels of mathematics achievement in schools. Apart from the economic benefits that it is argued this would bring, by better preparing young people for the numeracy demands of modern workplaces and raising the overall skill levels of the workplace, there are also social benefits tied to improving access for larger numbers of young people to post-school education and training opportunities and laying stronger foundations to skills for life-long learning.

This interest in raising levels of achievement has led to a focus on identifying the range of factors that shape achievement as well as understanding how these factors operate to limit and enhance the achievement of different groups of students. Such major factor to be considered in this study is the student factor. In our research context, the student factor means the attitude, perceptions and self-concept of the students towards mathematics as a subject in the senior secondary school.

However, the Third International Mathematics and Science Study (TIMSS) represents the most comprehensive international comparism of students’ achievement, yet recorded. The TIMSS assessment was conducted to study the effects of different factors on students’ achievement, including instructional activities, classroom environment, home background and possessions, students confidence in mathematics and science ability, and students’ attitudes towards mathematics and science. Kiamanesh (2005) observed that the preliminary
investigations of the TIMSS data in Iran indicated that there is a positive relationship between students’ achievement in mathematics and science and home background variables such as parents level of education, number of books at home and possession of dictionary and study desk. Furthermore, the study showed that the science achievement score of Iranian students who benefited from high confidence in science ability was much higher than that of those who had medium or low confidence in science ability (Kiamanesh and Kherich, 2001).

Arguing further, Papanastasiou (2002) asserted that students’ attitude towards an academic subject is a crucial role not only in learning but in maintaining a continued interest in the subject. Stodalsky, Sack and Glasner (1991) had earlier mentioned that students develop ideas, feelings and attitudes about school subjects over time and from a variety of sources. They argued that positive attitude to school and education is a necessary component for high educational aspirations. Research evidence shows that if an important person encourages somebody to behave in a certain way, he or she will accept it. The influence of an important person is so strong that even the individual may change his or her attitude in agreement with that of the important person (Berkowitz, 1986). Does an aggregate of these views connote the fact that the student factor plays a centre-stage role in the achievement of students especially in mathematics? What is the problem of low achievement in mathematics at the senior secondary school level?

The Problem
Odubina (2001) posited that mathematics is the pivot around which the whole essence of living revolves and the basis for scientific and technological take-off. Yet, Ahiakwo (2006) found that the performance of various levels of students has decelerated over the years with that of Nigerian children quite remarkable. Furthermore, the chief Examiners Report of results of our public examinations (WAEC, 2001-2009) had shown markedly a decline in the percentage of passes in mathematics. There is a perceived risk that the percentage of failures in secondary schools and in universities is greater in scientific matters than in others. Earlier, Ibebuike (1986) noted that many students, even as far back as their primary school time, do not take interest in mathematics to a meaningful degree and this has led to a continuous general poor performance in the subject. Does that suggest a high or low likely relationship between the student factor and their achievement in mathematics at the senior secondary school II level in Rivers State, Nigeria?

Theoretical Background
The term student variable, in relation to this study is a concept demanding utmost attention. It includes students’ attitudes towards mathematics students’ perceptions of the importance of mathematics and students’ self-concept and achievement in mathematics. Psychologists define attitude as any strong belief or feeling or any approval or disapproval towards people and situations. We have favourable or unfavourable attitudes towards people, politics and academic subjects etc. We favour the things we think are good and helpful and oppose the things we think are bad and harmful (Kagan, 1984). The students’ attitude towards an academic subject is a crucial factor in learning and achievement in that subject. Whether a student views herself or himself as a strong or weak person in a specific subject may be an important factor in her or his academic achievement. Among the major findings of TIMSS 1999 was that students generally had positive attitudes towards mathematics and science, although less so in countries where science is taught as separate subjects at the eighth grade (Mullis et al, 2000).
Many studies have examined students’ thinking about school and their attitude towards mathematics (Vanayan, White and Tepper, 1977 cited in Papanastatiou, 2002). Instruction in school settings provides one important and regularly experienced context in which ideas and perceptions about subject matters as well as other cognitive and affective outcomes can be shaped.

The next concept in this framework is students’ perceptions of the importance of mathematics. By perceptions, we mean hard work, good luck and natural talent towards mathematics. Researchers recommend that students’ perceptions of themselves play an important role in their level of personal aspirations and in their self-expectations (Lynch, Campbell, 2001). Researchers (Frize, Francis and Hanus, 1983; Weiner, 1985) have shown that attributions influence students’ achievement and they often attribute their outcomes to variables like hard work, good luck and natural talent. Although students may attribute their failure or success to the afore-mentioned variables, the efforts that they make in order to learn science at school or do homework at home probably have an effect on their achievement.

Another concept involved in the student factor is the self-concept of the student. By self-concept, we mean what the student thinks mathematics is to him – whether mathematics is not one of his strength or thinks he would like mathematics if it were not difficult and his belief that mathematics is more difficult for him than for many of his classmates. Franken (1994) stated that there is a great deal of research which shows that self concept is perhaps the basis for all motivated behaviour. He argued that it is the self-concept that gives rise to possible selves, and it is possible selves that create the motivation for behaviour. Hamachek (1995) asserted that self-concept and school achievement are related. Research had shown a close relationship between academic self-concept and academic achievement (Russel-Bowie, Yeung and Mcleney, 1999). House (1993) had earlier observed that students; self-appraisals of their overall academic ability were significantly related to grade performance in their science courses. The major issue here is the direction of relationship i.e. does self-concept produce achievement or does achievement produce self-concept? However, Marsh (1988) found support for both self-concept affecting achievement and achievement affecting self-concept. Marsh (1990) further suggested that the effect of prior academic self-concept on subsequent achievement is likely to be substantial and it is interesting that findings may vary depending on how academic achievement is inferred. Many investigations recommend the improvement of a students’ academic self-concept as a basic educational outcome (Koutsouls and Campbell, 2001).

The next concept in this framework is students’ achievement in mathematics. The concept of achievement in mathematics denotes the performance in tests and examinations conducted by the mathematics teacher. However, the Third International Mathematics and Science Study (TIMSS, 2002) measured the achievement of students at different grade levels in various countries around the world. In conjunction with the achievement portion of the study, a video study of mathematics teachers in Germany, Japan and the United States of America was also conducted. Peterson (2005) found that by video taping many randomly selected eight grade teaching episodes in each of these countries, the researchers were able to capture and describe the type of teaching that typically took place in each of these countries.

Earlier empirical studies conducted included Fredman (1976) and Legette (1979). Fredman (1976), in his study on the relationship between self-concept and academic achievement used 190 fifth and sixth grade males enrolled within a white middle to upper middle class school district in Pennsylvania. Three research groups were formed consisting of 66 males classified as aggressive – disruptive, 53 males classified as withdrawn – inactive, and 71 males
classified as appropriate within the classroom. The Piers-Harris self-concept scale and the Fredman-Willowdale school concept scale were administered. He observed that there was a significant and positive relationship between IQ and school self-concept (p.05), but the relationship between IQ and generalized self-concept was not significant.

Similarly, Legette (1979) in an earlier study tried to find out if self-concept influences achievement. She used 3734 students in the seventh, ninth and eleventh grades. She used the Pearson Product Moment Correlation Coefficient to compute the correlation between subjects’ self-concept score and their achievement and came out with the result that there is a relationship between self-concept and achievement.

In the same vein, studies like Tymns (2001) and Benlow (2002) have found that attitude of students towards mathematics has impacted student achievement. Basic theories of learning encapsulated in this study include David Ausubel and Robert Gagne. An examination of the above literatures revealed that students’ attitude, perceptions and self-concept had relationships with achievement in mathematics.

However, these studies were conducted in foreign lands quite alienated from the Nigerian environment. This study intends to find out to what extent student attitudes, perceptions and self-concept influence their achievement in mathematics with a special focus in Nigeria and Rivers State in particular. Hence, this study is poised to investigate empirically the student factor and achievement in mathematics with a view to filling the gap in literature and contribute to requisite knowledge.

The Method
The ex-post facto research design was adopted for this study because it seeks to investigate an existing phenomenon regarding students’ achievement in mathematics. The population of the study consisted of 10,120 senior secondary II students in Rivers State, Nigeria. However, the sample size of 4510 for the study was selected by using the Yarrow Yamen’s formula. The research instrument is the student factor and students’ achievement in mathematics questionnaire (STAMQ), divided into five sections. To elicit data from the respondents, the instrument was constructed using the following scale:

1. Very High Extent (VHE) = 4
2. High Extent (HE) = 3
3. Low Extent (LE) = 2
4. Very Low Extent (VLE) = 1

The respondents were free to indicate (√) in the column against each of the items as it applied to them. A decision cut off point of 2.50 was adopted. Any item or component in which the respondents have a mean score of 2.50 and above was regarded as “a high extent” while a mean score below 2.50 was regarded as a low extent.

Descriptive and inferential statistics were adopted for this study. In the descriptive statistics, means (\(\bar{X}\)), variance (\(\delta^2\)) and standard deviations (\(\delta\)) were computed and tables constructed. Deductions made from results on these tables formed the answers to the research questions (1-3).

To test the hypothesis (1-3), the Z-test statistic was applied to compare the means of the various variables and those of achievement in mathematics. The 0.05 level of significance was adopted with the degree of freedom as \(df = N_1 + N_2 - 2\).

Table 1: Distribution of Population of 10,120 senior secondary II students in Rivers State, Nigeria

<table>
<thead>
<tr>
<th>S/N</th>
<th>Local Govt. Area</th>
<th>No. of</th>
<th>Population of students</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Schools (SS2) | students (SS2)
--- | ---
1 Abua/Odual | 11 | 440 | 209
2 Ahoada-East | 12 | 480 | 218
3 Ahoada-West | 13 | 520 | 226
4 Akuku-Toru | 8 | 320 | 177
5 Andoni | 10 | 400 | 200
6 Asari-Toru | 8 | 320 | 177
7 Bonny | 13 | 520 | 226
8 Degema | 12 | 480 | 218
9 Eleme | 6 | 240 | 150
10 Emohua | 19 | 760 | 262
11 Etche | 19 | 760 | 262
12 Gokana | 12 | 480 | 218
13 Ikwerre | 13 | 520 | 226
14 Khana | 22 | 880 | 275
15 Obio/Akpor | 16 | 640 | 246
16 Ogu/Bolo | 3 | 120 | 92
17 Okrika | 6 | 240 | 150
18 Omuma | 3 | 120 | 92
19 Ogb/Egbema/Ndoni | 15 | 600 | 240
20 Opobo/Nkoro | 3 | 120 | 92
21 Oyibgo | 4 | 160 | 114
22 Port Harcourt | 15 | 600 | 240
23 Tai | 10 | 400 | 200
Total | 253 | 10,120 | 4,510

Results and Discussion

Research Question 1:
To what extent do students’ attitude towards mathematics relate to their achievement in mathematics?

Table 2: Analysis of the opinions of students on their attitude towards mathematics and achievement in mathematics

<table>
<thead>
<tr>
<th>S/N</th>
<th>Question Items</th>
<th>VHE (4)</th>
<th>HE (3)</th>
<th>LE (2)</th>
<th>VLE (1)</th>
<th>Total</th>
<th>Mean ((\bar{X}))</th>
<th>Percentage rating (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>To what extent do you like studying mathematics?</td>
<td>958 (3832)</td>
<td>1184 (3552)</td>
<td>1533 (3066)</td>
<td>835 (835)</td>
<td>4510 (11,285)</td>
<td>2.50</td>
<td>62.56</td>
</tr>
<tr>
<td>2</td>
<td>To what extent do you hate mathematics?</td>
<td>992 (3968)</td>
<td>755 (2265)</td>
<td>1579 (3158)</td>
<td>1184 (1184)</td>
<td>4510 (10575)</td>
<td>2.35</td>
<td>58.75</td>
</tr>
<tr>
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<td>4510 (1581)</td>
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<td>5</td>
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<td>To what extent do you dislike mathematics because of the teacher?</td>
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<td>To what extent do you think mathematics is not necessary to life?</td>
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<td>10</td>
<td>To what extent do you dislike any subject with calculations and numbers?</td>
<td>1049</td>
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<tr>
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<td>To what extent do you fear mathematics?</td>
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<tr>
<td>12</td>
<td>To what extent do you appreciate</td>
<td>902</td>
<td>2.44</td>
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<td>1015</td>
<td>61.00</td>
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</tbody>
</table>
subjects with calculations and numbers?

Group Mean Rating ($\bar{X}$) = 2.52 63.00

Table 2 above, revealed that the summary result of the total opinion of students on the relationship between students’ attitude and their achievement in mathematics was 2.52 indicating a percentage of 63.0. However, the decision rule says that the mean of the scale used is 2.50, making any score above 2.50 to show “a high extent” students attitude towards mathematics is related to their achievement in mathematics. It also indicates that any score below 2.50 means to “a low extent” student’s attitude towards mathematics is related to their achievement in mathematics. Therefore the score 2.52 above shows that to “a high extent” students’ attitude towards mathematics is related to their achievement in mathematics.

**Research Question 2**

To what extent do students’ perceptions of the importance of mathematics relate to their achievement in mathematics?

**Table 3: Analysis of the opinions of students on the perceptions of the importance of mathematics and achievement in mathematics.**

<table>
<thead>
<tr>
<th>S/N</th>
<th>Question Items</th>
<th>VHE (4)</th>
<th>HE (3)</th>
<th>LE (2)</th>
<th>VLE (1)</th>
<th>Total</th>
<th>Mean ($\bar{X}$)</th>
<th>Percentage rating (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>To what extent do you perceive mathematics is worth studying?</td>
<td>973 (3892)</td>
<td>1180 (3540)</td>
<td>1540 (3080)</td>
<td>813 (813)</td>
<td>4510 (11,325)</td>
<td>2.51</td>
<td>62.75</td>
</tr>
<tr>
<td>2</td>
<td>To what extent do you perceive mathematics is not worth learning?</td>
<td>850 (3400)</td>
<td>680 (2040)</td>
<td>1683 (2366)</td>
<td>2297 (2297)</td>
<td>4510 (10103)</td>
<td>2.25</td>
<td>58.25</td>
</tr>
<tr>
<td>3</td>
<td>To what extent do you perceive mathematics is an easy subject?</td>
<td>830 (3320)</td>
<td>660 (1980)</td>
<td>1698 (3396)</td>
<td>1322 (1322)</td>
<td>4510 (10,018)</td>
<td>2.22</td>
<td>55.50</td>
</tr>
<tr>
<td>4</td>
<td>To what extent do you perceive mathematics is a difficult subject?</td>
<td>1990 (4360)</td>
<td>1053 (3159)</td>
<td>1960 (3920)</td>
<td>407 (407)</td>
<td>4510 (10840)</td>
<td>2.43</td>
<td>60.75</td>
</tr>
<tr>
<td></td>
<td>Question</td>
<td>Mean</td>
<td>Median</td>
<td>Mode</td>
<td>SD</td>
<td>Min</td>
<td>Max</td>
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</tr>
<tr>
<td>5</td>
<td>To what extent do you perceive mathematics is important to everyday life?</td>
<td>4.74</td>
<td>4.32</td>
<td>4.32</td>
<td>1.28</td>
<td>2</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>To what extent do you perceive that mathematics is boring?</td>
<td>2.77</td>
<td>2.36</td>
<td>2.36</td>
<td>0.87</td>
<td>1</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>To what extent do you perceive discomfort during mathematics classes?</td>
<td>2.84</td>
<td>2.42</td>
<td>2.42</td>
<td>0.77</td>
<td>1</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>To what extent do you perceive that mathematics is not to be liked because of the teacher?</td>
<td>2.35</td>
<td>1.93</td>
<td>1.93</td>
<td>0.63</td>
<td>1</td>
<td>5</td>
<td></td>
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<tr>
<td>9</td>
<td>To what extent do you perceive that mathematics is not necessary to life?</td>
<td>2.14</td>
<td>1.74</td>
<td>1.74</td>
<td>0.57</td>
<td>1</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>To what extent do you perceive that any subject with calculations and numbers should be disliked?</td>
<td>2.68</td>
<td>2.29</td>
<td>2.29</td>
<td>0.85</td>
<td>2</td>
<td>7</td>
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</tr>
<tr>
<td>11</td>
<td>To what extent do you perceive that mathematics is to be feared?</td>
<td>2.64</td>
<td>2.18</td>
<td>2.18</td>
<td>0.67</td>
<td>2</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>To what extent do you perceive that mathematics is important to everyday life?</td>
<td>5.10</td>
<td>4.67</td>
<td>4.67</td>
<td>1.28</td>
<td>2</td>
<td>7</td>
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</tr>
</tbody>
</table>
do you perceive that subjects with calculations and numbers should be appreciated?

Group Mean Rating (\(\bar{x}\)) = 2.40 60.00

Table 3 above, revealed that the summary result of the total opinion of students on the relationship between students’ perceptions of the importance of mathematics and their achievement in mathematics was 2.40 indicating a percentage of 60.00. However, the decision rule says that the mean of the scale used is 2.50, making any score above 2.50 to show “a high extent” students’ perceptions of the importance of mathematics is related to their achievement in mathematics. It also indicates that any score below 2.50 means to “a low extent” student’s perceptions of the importance of mathematics is related to their achievement in mathematics. Therefore, the score 2.40 above shows that to “a low extent” students’ perceptions of the importance of mathematics is related to their achievement in mathematics.

**Research Question 3**
To what extent do students’ self-concept relate to their achievement in mathematics?

**Table 4: Analysis of the opinion of students on their self-concept and achievement in mathematics**

<table>
<thead>
<tr>
<th>S/N</th>
<th>Question Items</th>
<th>VHE (4)</th>
<th>HE (3)</th>
<th>LE (2)</th>
<th>VLE (1)</th>
<th>Total</th>
<th>Mean ((\bar{x}))</th>
<th>Percentage rating (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>To what extent do you think you are talented in mathematics?</td>
<td>395 (1580)</td>
<td>620 (1860)</td>
<td>2650 (5300)</td>
<td>845 (845)</td>
<td>4510 (9585)</td>
<td>2.13</td>
<td>53.25</td>
</tr>
<tr>
<td>2</td>
<td>To what extent do you think mathematics is more difficult for you than your classmates?</td>
<td>958 (3832)</td>
<td>1409 (4227)</td>
<td>1623 (3246)</td>
<td>520 (520)</td>
<td>4510 (11825)</td>
<td>2.62</td>
<td>65.50</td>
</tr>
<tr>
<td>3</td>
<td>To what extent do you think mathematics is not one of your strength?</td>
<td>1039 (4148)</td>
<td>958 (2874)</td>
<td>1860 (3720)</td>
<td>655 (655)</td>
<td>4510 (11397)</td>
<td>2.53</td>
<td>63.25</td>
</tr>
<tr>
<td>4</td>
<td>To what extent do you think you would love</td>
<td>1184 (4736)</td>
<td>1432 (4296)</td>
<td>1669 (3338)</td>
<td>225 (225)</td>
<td>4510 (12595)</td>
<td>2.79</td>
<td>69.75</td>
</tr>
<tr>
<td></td>
<td>mathematics if it were not difficult?</td>
<td>To what extent do you think mathematics is for science students?</td>
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<tr>
<td>5</td>
<td>1015 (4060)</td>
<td>1071 (3213)</td>
<td>1714 (3428)</td>
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<td>4510 (1141)</td>
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<td>823 (3292)</td>
<td>868 (2604)</td>
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<td>980 (3920)</td>
<td>936 (2808)</td>
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<td>902 (902)</td>
<td>4510 (11012)</td>
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<td>958 (3832)</td>
<td>1364 (4092)</td>
<td>1691 (3382)</td>
<td>497 (497)</td>
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<td>969 (3876)</td>
<td>1049 (3147)</td>
<td>1748 (3496)</td>
<td>744 (744)</td>
<td>4510 (11203)</td>
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<td>62.50</td>
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<td>10</td>
<td>733 (2932)</td>
<td>1409 (4227)</td>
<td>(2932)</td>
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<td>4510 (12561)</td>
<td>2.79</td>
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<td>11</td>
<td>1128 (4512)</td>
<td>1488 (4464)</td>
<td>1691 (3382)</td>
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<td>4510 (12561)</td>
<td>2.79</td>
<td>69.75</td>
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</table>
mathematics? To what extent does your high confidence in mathematics influence your achievement in mathematics?

<table>
<thead>
<tr>
<th>12</th>
<th>Group Mean Rating (X̄) =</th>
<th>2.52</th>
<th>63.00</th>
</tr>
</thead>
</table>

Table 4 revealed that the summary result of the total opinion of students on the relationship between self-concept and achievement in mathematics was 2.52 indicating a percentage of 63.00. Furthermore, the decision rule says that the mean of the scale used is 2.50, making any score above 2.50 to show “a high extent” students’ self-concept is related to their achievement in mathematics. It also indicates that any score below 2.50 means to “a low extent” students’ self-concept towards mathematics is related to their achievement in mathematics. Therefore, the score above showed that to “a high extent” students’ self-concept towards mathematics is related to their achievement in mathematics.

**Hypothesis Testing**

**Hypothesis 1**

H₀₁: There is no significant relationship between students’ attitude towards mathematics and their achievement in mathematics.

**Table 5: Z-ratio test of significant relationship between students’ attitude towards mathematics and their achievement in mathematics.**

<table>
<thead>
<tr>
<th>Variable</th>
<th>X̄</th>
<th>sd</th>
<th>N</th>
<th>df</th>
<th>P</th>
<th>S. Error</th>
<th>Z-cat</th>
<th>Z-crit</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students’ attitude</td>
<td>62.83</td>
<td>3.43</td>
<td>4510</td>
<td>0.05</td>
<td>0.051</td>
<td>Z&gt;1.96 or Z&lt;-1.96</td>
<td>Reject Ho₁</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students’ achievement in mathematics</td>
<td>54.09</td>
<td>14.79</td>
<td>4510</td>
<td>9,018</td>
<td>0.05</td>
<td>0.228</td>
<td>38.17</td>
<td>Ho₁</td>
<td></td>
</tr>
</tbody>
</table>

The result on table 5 showed that the calculated value of Z is 38.17, which is greater than the critical value of 1.96 at the degree of freedom 9,018 at the 0.05 level of significance. Since the calculated Z-value is greater than the critical value, the null hypothesis that there is no significant relationship between students’ attitude towards mathematics and their achievement in mathematics is rejected. Hence, there is a significant relationship between students’ attitude towards mathematics and their achievement in mathematics.

**Hypothesis 2**

H₀₂: There is no significant relationship between students’ perceptions of the importance of mathematics and their achievement in mathematics.

**Table 6: Z-ratio test of significant relationship between students’ perceptions of the importance of mathematics and their achievement in mathematics.**

<table>
<thead>
<tr>
<th>Variable</th>
<th>X̄</th>
<th>sd</th>
<th>N</th>
<th>df</th>
<th>P</th>
<th>S. Error</th>
<th>Z-cat</th>
<th>Z-crit</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students’ perceptions</td>
<td>60.00</td>
<td>3.21</td>
<td>4510</td>
<td>0.048</td>
<td>0.048</td>
<td>Z&gt;1.96 or Z&lt;-1.96</td>
<td>Reject</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The result on table 6 showed that the calculated value of \( Z \) is 25.60 which is greater than the critical value of 1.96 at the degree of freedom 9,018 at the 0.05 level of significance. Since the calculated \( Z \)-value is greater than the critical value, the null hypothesis that there is no significant relationship between students’ perceptions of the importance of mathematics and their achievement in mathematics is rejected. Hence, there is a significant relationship between students’ perceptions of the importance of mathematics and their achievement in mathematics.

**Hypothesis 3**

\( \text{H}_0^3: \) There is no significant relationship between students’ self-concept and their achievement in mathematics.

The result on table 7 showed that the calculated value \( Z \) is 38.16 which is greater than the critical value of 1.96 at the degree of freedom 9,018 at the 0.05 level of significance. Since the calculated \( Z \)-value is greater than the critical value of 1.96, the null hypothesis that there is no significant relationship between students’ self-concept and their achievement in mathematics is rejected. Hence, there is a significant relationship between students’ self-concept and their achievement in mathematics.

**Table 7: Z-ratio test of significant relationship between students’ self-concept and their achievement in mathematics.**

<table>
<thead>
<tr>
<th>Variable</th>
<th>( \bar{X} )</th>
<th>sd</th>
<th>N</th>
<th>df</th>
<th>P</th>
<th>S. Error</th>
<th>Z-cat</th>
<th>Z-crit</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students’ self-concept</td>
<td>62.83</td>
<td>4.93</td>
<td>4510</td>
<td></td>
<td></td>
<td>0.073</td>
<td></td>
<td>Z&gt;1.96</td>
<td>Reject Ho3</td>
</tr>
<tr>
<td>Students’ achievement in mathematics</td>
<td>54.09</td>
<td>14.79</td>
<td>4510</td>
<td>9,018</td>
<td>0.05</td>
<td>0.228</td>
<td>38.16</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Conclusion

From the analyses of data and the discussion of findings, the following conclusions were made:

i) There is a significant relationship between students’ attitude towards mathematics and their achievement in mathematics at the senior secondary II level in Rivers State, Nigeria

ii) There is a significant relationship between student perceptions of the importance of mathematics and their achievement in mathematics at the senior secondary II level in Rivers State, Nigeria

iii) There is a significant relationship between students’ self-concept and their achievement in mathematics at the senior secondary II level in Rivers State, Nigeria.

**Recommendations**

Considering the findings and discussions of this study, the following recommendations were made:
i) In order to eliminate or minimize poor performance in mathematics at public examinations, the researcher recommended that students should be made to attend seminars and workshops on attitudinal change towards mathematics.

ii) That the search light of blame on poor performance in mathematics should be re-focused on areas such as students’ perceptions of the importance of mathematics, even at the primary school level

iii) The prolonged students’ self-concept on mathematics which are negative could be eliminated by guidance and counseling tutors at school

iv) That the pedagogical training given to teachers of mathematics at the secondary school level should be re-emphasized before mathematics teachers are employed to teach.

v) Since, the problem of this study was the poor performance of students in mathematics at the senior secondary school level in Rivers State, parents should not blame governments, teachers of mathematics and WAEC alone, but look inside at home by helping students adjust the negative concepts and perceptions towards mathematics as a subject.

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GENDER/ WOMEN IN SCIENCE AND TECHNOLOGY IN BAYELSA STATE, ITS GOALS AND CHALLENGES FOR THE NEW MILLENNIUM DEVELOPMENT

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Abstract
The gender dimension of science and technology (S&T) has become an increasingly important and topical issue worldwide. For over thirty years now, the United Nation General Assembly and the UN Economy and Social Commission have emphasized the inequalities and disparities in the educational opportunities open to women and girls, and in women access to training and the labour market (Ligia, 2007; Walter, 2007). In Bayelsa state many women and girls are excluded from participation in science and technology (S&T) activities by poverty and lack of education (at all levels), and by aspects of their legal, Institutional, political and Cultural environments. On primary education the state achieves gender parity. However gender parity decreases in secondary education and the gap widens even more in tertiary education. The situation of educational system in the past sixteen years whereby women and girls were directed to the farm to do farm work while the men and boys were given the opportunity to go to school even though they were not fully committed. Presently this state has achieved overall progress in gender equality and female empowerment according to the latest 2007 data due to continuous establishment of schools from primary to tertiary levels of which Niger Delta University is one. This institution offers many courses in science and technology and has produced a lot of female graduates both in pure and applied sciences such as pharmacy, medicine, engineering etc. Women face a lot of challenges in Science and Technology career for their work are underrated and are less considered for any grants in Bayelsa state even in Nigeria at large. If this erroneous attitude is checked and our women are given equal opportunities like their male counterparts, this will help increase the pool of women in this field.

Keywords: Gender parity, Science and Technology, Women, Education, Economy

Introduction
In the commonwealth of Independent states (CIS) women’s participation in research is significantly higher (43 percent) than the world average (European Commission, 2004). In Africa, it is estimated that about 31 percent of researchers are women. In almost one- half of countries with available data, however, women represent less than 30 percent of researchers. As we enter the twenty- first century, the pace of technological advances continues to accelerate, with great potential to improve the lives and livelihoods in developing and developed countries, and with profound implications for the global economy (L’oreal UNESCO Awards for Women in Science, 2007). Despite some global trends, only part of the world’s population has benefited from Scientific and Technological advances and the resulting improvements in quality of life and life expectancy. Over 1 billion people are living in poverty, and most of them are women and children. Worldwide, 1 billion people have no access to safe water; 2.7 billion do not have access to adequate sanitation and over 800 million remain chronically undernourished (WWAP, 2006;
This paper is thus undertaken to evaluate the role of women in science and technology, its challenges and the way of improving these to actualize the ultimate goal of full participation of women in this field.

The Role of Science and Technology (S&T) in improving sustainable and equitable development

The role of science and technology (S&T) in promoting sustainable and equitable development has not yet been fully recognized, but already there is consensus that S&T is critical to any strategy to improve quality of life and the socio-economy and environmental situation of any country. Poverty and hunger can have political, social, cultural, environmental and economy roots. Science and Technology (S&T) can help to meet some of these challenges and reduce poverty by promoting economy development, creating job opportunities and increasing agricultural and industrial productivity. S&T can provide clean and renewable energy sources, and can help to improve health and education and predict and manage the effects of climate change and biodiversity. Science, technology and innovation also have the potential to improve nutrition, increase crop yields, provide clean water and improve soil management, and can lead to the development of vaccines and cures for diseases (UNIFEM, 2000).

Role of Women in Science and Technology (S&T)

In many countries, women have unrecognized and invaluable traditional and local knowledge and are major producers of commodities, merchandize, food, energy and water. Using scientific and technological knowledge in a way that complements and refines such traditional and indigenous knowledge can increase productivity levels and improve monitoring and managing of our ecosystems. Yet imbalances in how science and technology is applied for social development often disadvantage women in particular (UNIFEM, 2000; Blackden and Banu, 1999). In a great number of communities around this study state, even around the world, women play a vital role in the incubation transfer of critical local knowledge on which survival strategies are based (ITDG, 2000; Appleton et al., 1995) Not only can modern science validate this local or traditional knowledge and the skills arising from women’s role- food production, energy provision, traditional healing practices and the management of natural resources- but technology has considerable potential to reduce the labour of such work and increase the marketable skills and productivity of women working in these areas; thereby adding value to their economic activities (Juma and Lee, 2005; Huyer, 2004). Science and Technology can be important tools to empower women.

The complex interrelationships between women and technology may be illustrated by looking at three vital areas; food security, water and sanitation, and energy.

Food security

In Bayelsa state women are responsible for up to 80 percent of food production through subsistence farming, food processing and marketing – yet they are too frequently overlooked when it comes to providing technology and other resources to support agricultural development. As a result, women’s food production activities have been marginalized (Muntemba and Chimedza, 1995; Stamp, 1989). In some communities in this state virtually all unpaid work carried out by women is agriculture-based. Other important and less-studied components of women’s agricultural activities include livestock management and the preparation and sale of street foods (Lee-Smith, 2004; Tinker, 1997; Maeda-Muchango, 2003). Economic development and the development of sustainable livelihood are closely linked to food security (Muntemba and Chimedza, 1995). Food supplies can be dramatically reduced by natural disaster such as
droughts or flooding or human-caused crises such as war. Severe ecological degradation can quickly diminish land productivity, and policy choices concerning which crops are grown and where (and who profits from them) can have an immediate impact on primary producers. With adequate economic resources, including increased mobility and access to credit and markets, food crises can be ameliorated and families helped to raise their income to a sufficient level for basic livelihood.

**Water and Sanitation**

In many countries women and men have different roles and responsibilities in the use and management of water. Women and girls are frequently responsible for collecting water for cooking, cleaning, health and hygiene and if they have access to land, food cultivation. Lack of convenient access to clean water resources costs women countless hours in fetching water, and adds the burden of caring for those ill from polluted supplies. In many rural areas of developing countries, women and girls can spend four to five hours per day carrying heavy containers and waiting in lines, a burden that inhibits their involvement in education (Khosla and Pearl, 2003). In many communities, women have to work long distances to use toilet facilities, and about one in ten school age African girls does not attend school during menstruation or drops out at puberty because she has no access to clean, and private sanitation facilities at school (Khosla and Pearl, 2003). Other water issues include pollution, environmental degradation, and the contamination of groundwater and aquifers. Though women often determine water usage, they are rarely involved in making vital decisions relating to sanitation and hygiene (such as decisions over the availability and placement of toilets). Hence clean drinkable water is increasingly short supply. Eighty percent of all sickness in world is attributable to unsafe water and sanitation. Waterborne diseases kill 3-4 million people, mostly children, annually, and millions more are sickened with diarrhea, malaria, schistosomiasis, arsenic poisoning, trachoma and hepatitis-diseases that are preventable by access to clean water and healthcare information (UNWWAP, 2006; Khosla and Pearl, 2003; UN, 2002).

**Energy**

Biomass-plant matter grown for use as solid, liquid or gas fuel- is the main energy source of a great number of the world’s rural households. Biomass is grown from several plants, including switchgrass, hemp, corn, poplar, willow and sugarcane. In poorer countries like some communities in Bayelsa state, however, it is often of low quality, producing smokes and particulates that are damaging to human health. Through long hours of exposure to smoke and particulates in kitchens, women in developing countries experience higher levels of lung and eyes diseases than men. As Joy Clancy, Margaret Skutsch and Simon Batchelor point out in The Gender- Energy- Poverty Nexus (2003) women and girls in rural areas also tend to be responsible for gathering biomass (commonly for several hours each day), with further health repercussions, and girls are frequently kept away from school for this task. There are a variety of aspects to gendered perspectives on energy use, households in urban areas have to buy their cooking fuel, which can cost up to 20 percent of their income. Although women are generally responsible for house- hold energy provision and use- particularly through cooking, cleaning and fuel collection- when energy is purchased, men often make the decision. Studies have found that men tend to see the benefits of electricity in terms of leisure activities, improving quality of life and educating children, while women think in terms of reducing their workload and expenditures, and improving health (Clancy et al., 2003).

By upgrading energy sources, agricultural and handicraft technologies, water and sanitation, many technologies have the potential to improve lives, especially those of women. Recognizing
gendered patterns of behavior and improving opportunities to benefit from science and technology for social development can have an impact not only on women, families and communities, but on a country’s socioeconomic development as a whole (ECOSOC, 2004; UNCSTD, 1995). Women are very often active agents of change in the use and application of energy, both in their roles as producers and users of energy and in their economic activities and involvement in community organization.

**Challenges faced by women to fully participate in Science and Technology (S&T) or Factors that contribute to low number of women in S&T**

Andresse St Rose, a research associate at the American Association of University Women has done research on challenges that girls and women face in studying and working in Science, Technology, engineering and math field (STEM). She says the gender gap begins at a very early age. Both boys and girls have similar interest in STEM, but the advise the girls receive from the society affects their interest negatively, even though girls score higher marks than their male counterparts in STEM in secondary schools, as they head off to University, the number of women in STEM classes drops.

The environment in college STEM classrooms is often a deterrent to women. Stereotypes abound and they don’t feel welcome. Women also feel isolated particularly in fields like engineering, where they may be only one of two women in the room. A wide range of factors may explain the lower number of women in senior Research and Development positions, including work-life balance, gendered patterns and approaches to productivity, and performance measurement and promotion criteria. An increasing body of research examining the nature of the scientific endeavour from the perspective of race, class and gender reveals the pitfalls of an academic career system that is based on a traditional male model of labour market participation. This includes long working hours, limited allowance for personal life and responsibilities, emphasis on early achievements and exclusive identification with science and the workplace. Scholarly review processes rarely take into account gendered patterns of productivity and careers, domestic and child-bearing responsibilities, or publication patterns. Many countries including Nigeria are already working to substantially increase the participation of women in research and development. But although sex discrimination does play a role in women’s lower participation in science, in general the problem is larger, having to do with how the system is constructed. It tends to be those who fit the traditional male model set by those already in powerful positions who are assessed as better scientists (European Commission, 2004). For example, in the United States, having children significantly reduces the chances of promotions for women, but not for men (Olson, 1999).

One of the prime factors restricting women’s participation in the scientific endeavour is that existing systems of defining and evaluating scientific excellence are not as gender neutral as they are claimed to be. Bias occurs in the definition of scientific excellence and assessment criteria, choice of explicit and implicit indicators to measure excellence, differing application of measurement criteria to men and women, and the failure to integrate women in scientific networks and assessment frameworks. The key question posed here is the following: Are women’s and men’s achievements assessed on the same basis and from the same level of opportunity and inclusion? (European Commission, 2005). A number of researchers have emphasized the biased nature of science pointing out that it is a human activity heavily influenced by prevailing social, political and economic factors (Rosser, 1988). Related questions concern how other social and life situations—such as race, geography, disability, socioeconomic status, age, marital status and sexual orientation—affect not only the practice of science, but
perceptions of scientific merit (Harding, 1993; Malcom, 2006). For women, current measurements of performance and productivity work to their disadvantage. A United State National Science Foundation (NSF) review of gendered career patterns found that women faculty earn less than their male colleagues; they are promoted less frequently, and they publish less frequently. These results emerged even when studies are controlled for factors such as age, experience, academic rank and family characteristics. As a result, women participate less in senior societies, committees and prestigious activities (NSF, 2003).

“Count-based” and publication-focused measurements of employment experience and publication record also tend to penalize women by not properly reflecting the quality of their contributions. Many studies show that women prefer to focus on teaching and interaction with students (NSF, 2003). Studies on citation rates and patterns have revealed interesting (and often gender-based) trends. While straight index counts generally indicate lower production by women, use of a quality-weighted index that takes into account the number of times an article is cited will demonstrate a higher level of scholarly production by women. A study by Sonnert and Holton (1995) of 699 scientists in the United States found that women tended to produce work that was more comprehensive and succinct, so that while they have fewer number of publications, these publication tended to be more widely cited. In biochemistry, J. Scott Long (1992) found that the average paper by a woman was cited 1.5 times more often than that of a man, because women tend to be more cautious, thorough and attentive to detail in preparing work for publication. This is partly due to a sense of example insecurity about the quality of their work, as well as a sense (often based in reality) that their work is not rated as highly as that of their male colleagues. Women achievement are frequently underrated example Rosalind Franklin and Jocelyn Bell who received no formal credit for their part in Nobel Price-winning scientific work (Handelsman et al., 2004; Symonds et al., 2006). The result is that women’s work often has to be sweamless to be valued as its worth (Schiebinger, 1999; Rathgeber, 2002; Margolis and Fisher, 2002).

Although women are as likely as men to collaborate on research projects, and co-author less than men, this is a disadvantage in ranking because single and co-author publications are weighted equally (Sonnert and Holton, 1995). Since both women and men tend to collaborate with researchers of the same sex, the lower number of women in S&T fields restricts women’s opportunities for collaboration (NSF, 2003). Other indicators that give clues about the achievements of women in scientific career could be funding success rates by gender or the proportion of women on scientific boards. The European Commission’s WiS database shows that in most EU countries men have higher success rates, even in Nigeria, in obtaining research funding than women, though not statistically significant. Women are under-represented on scientific boards in most countries, due to their low proportion on scientific boards which is a reflection of their participation in the process of setting the scientific agenda.

Studies of grant awards indicate that structural and social inequalities exist in the award evaluation and selection process. One study found that male applicants to Sweden’s Medical Research Council (MRC) and researchers with an affiliation with one of the evaluators were more successful (Wennera and Wold, 1997). Competence was one factor in the final decision, but women had to demonstrate much higher credentials than men to obtain the same grants. Many science awards favour men over women due to gender disparity (Carnes et al., 2005; Malcom, 2006). A recent experiment shows prevalent double standards: curriculum vitae were ranked more highly by both male and female assessors when assigned male names (Steinpreis et al., 1999). In another study both men and women were given a research article by an author
identified variously as John T. Mckay, Joan T. mckay, J.t. Mckay (sex-neutral), Chris T. Mckay (ambiguous with respect to sex) and Anonymous. When identified as written by a male author-John- the article received the highest reviews; next in ranking was the article identified as written by J. T, and third was Joan, When readers thought the initials J. T. indicated a woman trying to hide her identity, the article was ranked lower (Paludi and Bauer, 1983).

Factors that can improve Women’s participation in Science and Technology.
The government should increase women and girls’ access to education and careers in S&T increases the likelihood that women will join men as full participants in Research and Development activities.

Each department of Science and Technology in Nigerian Universities and other higher institutions of technological learning should have the main objectives to assist the National Advisory Council on Innovation (NACI) to promote a research agenda, including influencing funding that will improve women’s quality of learning. The government should assist NACI to promote innovation that will allow women to make a greater contribution to wealth generation in Bayelsa State, Nigeria. Provide advise on developing mechanisms that will increase the participation and contribution of women in Science and Technology.

Highlight role models that promote women’s entry and advancement in S&T
Monitor the institutional impact of these actions
St Rose says active recruitment of women by college Science technology engineering and mathematics ( Stem) departments would help. Young women also need to be exposed to possible Stem career paths to increase their interests. In many cases Stem departments don’t actively recruit students, they want to see who shows up on their doorsteps. But we need to see more active outreach for women. Also women chose the field that is personally fulfilling, and they are advised to go into traditionally female occupations such as social work or teaching, but a lot of Stem fields- such as engineering and biomedical research are also helpful to society hence they should be advised to do them. Universities should also become more mindful about the life choices of juggling the demands of work and family that all young people- women face, positive role model are crucial.

Women leadership roles in the Stem industry is important, because they will become role models and mentors for the next generation. Hence, women after studying and get a Stem degree should practice in S&T industries. This will help increase the pool of women overall.

The equality approach argues for gender parity on the basis that women should have equal opportunity to contribute to and benefit from Science and Technology (an argument that can in itself be considered a sufficient basis for reforming the science system) (Schiebinger, 1999). Women scientists continue to be absent in top managerial positions from educational and research institutions and also the ministerial level. Inevitably, this excludes female voices from being heard-and in equal partnership- in decisive decisions on the current and future orientation of Science and Technology (Rathgeber, 2002; Campion and Shrum, 2004). These vices should discouraged in the professional forum. Undoubtedly, varied experience is important, and effort must be made to develop women’s skill through opportunities that fit their circumstances, such as a programme of short visits instead of a longer posting or assignment to international teams in their home country. Equal pay for equal work is widely agreed to be a basic human right.

Conclusion
In view of aforementioned roles, challenges and improvements of women full participation in Science and Technology, it can be stated that the potential of S&T to contribute to national
socioeconomic development cannot be realized without making the best use of all sectors of a nation’s population. Knowledge is at the centre of a strong, dynamic and evolving innovation system, which depends upon the input and contribution of all stakeholders, in all sectors of Science and Technology. Although women and girls in many countries are enrolling in and succeeding at the full range of Science courses at all educational levels (and in some countries the participation of women in the life sciences is at least equal to that of men), a great number of the world’s women still face socio-cultural economic and religious barriers to full participation in Science and Technology. If all these biased attitudes against women in S&T are abrogated and the improving factors listed above are put into consideration, adopted and applied, Bayelsa state would be a state to be proud of in terms of advanced socioeconomic involvement in Nigeria through Science and Technology skills, thereby boost the morale of this great nation Nigeria, not only in Africa but in the world at large.

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