Usability and Accessibility Evaluation of Pakistan’s E-commerce Sites

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ABSTRACT

Internet provides a platform that makes possible for diverse users to carry out their work ubiquitously via accessing web. With the increasing usage of web, online businesses are flourishing. Marketing techniques have evolved manifolds and online promotion is now preferred by companies to make people aware of their products, consequently leading to E-commerce growth. Although in developed countries E-shopping is quite in practice but in Pakistan; it is observed that the natives are still reluctant to use such sites for the purpose of purchase. When it comes to usability related issues, reasons for this reluctance vary from lack of awareness, dissatisfaction against the product, insecurity regarding their personal details to the insufficient or incapable usability features of website. This study attempts to highlight the key factors that restrict people in purchasing online from the comfort of their homes. As all human beings must be treated equally; therefore, all man-made stuff must offer same rights and ease of access to the disabled, as to normal people. Likewise, it also investigates the key issues faced by visually impaired people. 16 popular E-commerce sites, operating in Pakistan were selected for assessment. The study targets people with normal vision and the visually impaired, belonging to different age groups ranging from 14 to 60. The objective was the investigation of problems regarding the usage of these sites by analyzing them on the basis of pre-defined standards (set by Norman Nielsen’s heuristic principles for usability, and WCAG 2.0 guidelines for accessibility). Adequate recommendations are also suggested, based on the results of heuristic evaluation aiming for improvement of usability. For improving accessibility of these sites, evaluation tools provide design alternatives that can lead to ease of use for blind and people with low vision. Users’ engagement with these sites was observed by conducting user testing which contributed to make our results more authenticated, recommendations more practical and hypothesis justified.

Keywords: Accessibility, heuristic evaluation, e-commerce, usage of e-commerce sites, usability, WCAG 2.0

1. INTRODUCTION

The business of e-commerce in Pakistan is growing with each passing day, according to SMEDA (Small and Medium Enterprise Development Authority-Pakistan) in Pakistan, the ‘com’ culture is so named that commercial companies believe that internet is the key factor to do their business successfully. To make their businesses more proficient and pragmatic they must be found on e-world via web site which must be according to the international standards so that the business can grab more users/customers and allow them to penetrate in international market. This research is intended to assess the usability of the E-Commerce sites i.e. how well they are designed to fulfill the standards internationally applied.

Although E-Commerce business is expanding but still these sites are not that much popular so, this research primarily focuses to scrutinize the usability and accessibility of E-Commerce sites in Pakistan. To accomplish this task 16 well known e-commerce sites successfully running in Pakistan are selected for the evaluation. Each site goes through the heuristic and accessibility evaluation. Heuristic evaluation is carried out through Neilson’s usability principles and accessibility evaluation through WCAG 2.0 guidelines. The heuristic evaluation outcomes are divided into positive and negative findings which help in the formation of task set that has been exercised by the user in carrying out the experimental testing. Task set was performed by 45 users including normal and blind users in which most of them were familiar with these sites but few of them were novice.

Our study comprises of three portions: the usage of E-Commerce sites in Pakistan, the usability of these sites and their accessibility. This has been done by a survey to determine the usage of Pakistan’s E-Commerce sites, heuristic evaluation, accessibility estimation via accessibility evaluation tool, user testing based on task set to evaluate usability and accessibility of such sites and post study questionnaires following the testing. In both post study questionnaires, Likert scale has been used for scaling the responses in order to determine the level of usability and accessibility achieved by the specified sites.

1.1 Significance of Usability and Accessibility

Now days almost everything is on the way to automation either we talk about financial transactions or online shopping, ticket reservation or setting up an appointment everything demands to be online or it could be said that in access to everyone at every time.

Considering this demand of society, developers work to create E-Systems (websites, portals, ticket reservation systems etc.) that are easy, simple and undemanding to use. According to the definition in ISO DIS 9241(1997), “Usability is the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use” [3] and if these deficient in any of these; will ultimately drop their worth.

Also, every e system require to be in accessible to the people with disabilities in order to support them in carrying out their tasks with their limited resources (e.g. assistive technologies), they possess equivalent part in the
society. According to the study conducted by UNICEF four fifth of peoples having disability lives in developing countries[1] and if we talk about Pakistan then according to the statistics/data available with government in 2009, 6,789 persons are disabled in Pakistan[2]. The Web Accessibility Initiative (WAI), founded by the World Wide Web Consortium (W3C) to promote the accessibility of the Web, defines "web accessibility to mean that people with disabilities can use the Web. More specifically, Web accessibility means that people with disabilities can perceive, understand, navigate, and interact with the Web" (WAI 2006) [4]. Developers should also work to meet the guidelines defined by W3C.

2. FOCUS OF STUDY

This research paper evaluates the usability and accessibility of popular Pakistani E-Commerce sites. To examine these essentials more precisely we have selected the category of mobile and computing (tablets, computers and laptops). The usability and accessibility evaluation was first done by the research team and on the basis of that evaluation a comprehensive task was created which was later practiced by users. Different users of different fields and age group were selected in order to investigate the usage and problems faced by distinct people. Our objective is to compare and authenticate our findings with regard to the hypothesis that creates a foundation as to why and how Pakistani E-Commerce sites are not fulfilling usability and accessibility standards. The pre study survey and post study survey hold up better and accurate results.

Launched in 2006, twitter has altered the manner in which the business industry and individuals communicate with each other. In 2007, Java et al. [7] discuss the micro blogging phenomena and classified user activities as information seeking, information sharing or social activity. In 2008, Krishnamurthy et al. [9] characterized twitter data from January 12 to February 22 of that year with respect to the follower/following user relationships, status update influences and growth patterns. Cheong et al. [3] perform text analysis of 1500 tweets on each of the 4 selected trending topics to determine the "collective wisdom" of the twitter community. TURank [16] extends the usefulness of tweets by identifying a twitter user's authority score through a user-tweet graph analysis. However, the emerging twitter research considers cross-domain recommendations [5] that can link concepts and the building of a personalized semantic-based recommender framework.

3. RESEARCH APPROACH

3.1 Usage

A pre study survey was conducted from general public teenagers together with adults, in order to evaluate the usage of Pakistani E-Commerce websites. This methodology lends a hand to validate our hypothesis regarding the general use of these websites. Moreover, survey outcomes provide a notion and awareness of E-Commerce websites that people have in their mental model. The survey comprises questions on the subject of E-Commerce usage and difficulties in terms of E-Commerce reliability, usability and accessibility.

3.2 Usability

Usability evaluation of sites was done in two phases:

a. Each member of our team individually goes through the process of common user tasks and evaluates the usability of websites according to the Ten Usability Heuristics of Jakob Nielsen.

b. After that we conduct a session of testing through 40 users (ages up to 20 to 35 with 1:2 ratios of males and females). They perform testing by the given task sets.

The results obtained by our heuristic evaluation and user’s experimental testing provisions the first hypothesis of this research.

3.3 Accessibility

Accessibility evaluation of the sites was performed on the basis of WCAG 2.0. The methodology employed for accessibility evaluation of the sites comprised of two parts.

a. Evaluation via online accessibility tools

b. Accessibility testing by task set/users

Online accessibility evaluation tools involving A Checker [9], Sort site [10] and Tawdids [11] was used to find the design flaws which affected accessibility of the sites. Some of the design defects hampered the users in achieving their objective. After the evaluation by accessibility tools, accessibility testing was conducted by task set. Testing was performed in Ida Rieu School and College for Deaf and Blind1. Five male users (all aged below thirty five) were given a task set to determine the level of difficulty faced by blind users while navigating E-Commerce sites. Some users were blind while some of them had severely impaired vision (low vision, not completely blind). The screen reader JAWS 14.0 [12] was used.

The results obtained from accessibility evaluation tools and testing by task set have been used to support the second hypothesis of this research., that is Pakistani E-Commerce sites do not fulfill the standards of accessibility set by WCAG 2.0.

4. ANALYSIS AND DISCUSSION

For the evaluation of usability and accessibility of e- Commerce sites, a set of 16 sites Pakistani E-Commerce sites was selected. All of these sites had a common specification, that is, they all contained the category of mobile and computing. Consequently, the task set designed for testing of the sites was based on the same category. The following sites were selected for evaluation: A&NElectronics [13], Blue [14], Daraz [15], E4U [16], HomeShopping [17], Ishopping [18], ITPlanet [19],

1http://idarieu.org/Beta/
Our research targeted the evaluation of E-Commerce sites on the basis of hypotheses. Each hypothesis has been justified individually on the basis of the results obtained from surveys and testing.

4.1 Hypothesis

The following hypotheses were made before evaluation of the sites. All of these targeted E-Commerce sites operated in Pakistan.

H1. E-Commerce sites of Pakistan are mostly used for the purpose of viewing product details and people don’t usually prefer shopping online on these sites.

H2. The usability of these sites does not match the standards set by Norman Nielsen’s usability heuristics.

H3. The accessibility of these sites does not satisfy the requirements of Web Content Accessibility Guidelines 2.0 (WCAG 2.0).

H4. Search filters provided by these sites are not sufficient, causing novice users considerably more time in searching any specified.desired product than expert users.

4.2 Proof to Hypothesis 1

To prove our first hypothesis, a survey was conducted. Total of 105 people belonging to diverse professional backgrounds became a part of this survey. The survey was conducted to uncover the purpose of E-Commerce sites and frequency of their usage. The questions were related to the service of E-Commerce and problems that are usually faced by the people while using these sites. The evaluation of survey responses lead to the justification of the first hypothesis of this study.

4.2.1 General usage purposes

![Figure 1: Percentage of using these websites](image)

47% of the users used these sites only to get an idea of products introduced in the market or to gather product specifications instead of purchasing them. 7% used these sites for the sole purpose of making a comparison of products, 8% were those who had made a purchase, out of which 6% were those who also used these sites for looking product details. 38% of users never used these sites before.

![Figure 2: Percentage of usages](image)

Statistics show that 65% of the users were familiar with these sites and used it for certain reasons but among these only 8% are the actual online buyers whereas the rest of them use these sites to look for product details particularly in combination to any other purpose, but not for purchase. This supports our stated hypothesis H1.

4.2.2 Users' willingness for future usage

![Figure 3: Future perception and trust level](image)

28 percent contributors of the survey were those who never used these sites. Among these, most of them had no intentions of using these sites in future. However just a small fraction were actually willing to visit these sites in future. Upon analysis of survey responses it is observed that the willingness of non-users to use these sites in future appears to be partially based on their perceived level of trust on these sites concerning the confidentiality of their data.

4.2.3 Results

The results obtained from the survey point in favor of the initially designed hypothesis stating that online shopping sites of Pakistan are mostly not used for purchasing products online, but provide a good means of collecting product specifications and are generally used to achieve the said purpose. Even though purchase are also made online by people using such sites and the quality services assist in retaining customers, the type of activity mostly preferred by people when browsing online...
shopping sites is, viewing product details, thus proving the hypothesis on usage.

4.3 Proof to Hypothesis 2

The second hypothesis of this study stated that the usability of Pakistan’s E-Commerce sites does not match the standards set by Nielsen’s heuristic principles. To prove the suggested hypothesis, usability evaluation was distributed in two stages. The first segment covered evaluation by heuristic principles on the basis of a checklist, the findings obtained contributed in the development of a task set. The produced task set was used in the second segment of usability evaluation when task based testing was conducted followed by a post study questionnaire.

1) Usability evaluation phase 1: heuristic evaluation

Heuristics evaluation on Nielsen’s principles draws our attention to some constructive as well as destructive points for each heuristic. The findings are listed below.

a) Positive findings

1. Visibility of system status
   – Every display begins with a title or header that describes screen contents.
   – Icons/images displayed on the header briefly summarize the mechanism of transaction (pay cash on delivery, fast shipment, and free delivery).
   – There is usually some form of system feedback for every action performed by the user (E.g. page loads on click, “loading” indication while processing user input).
   – The position of the cursor is indicated by visual feedback (hover effect).
   – If multiple options can be selected in a menu, visual feedback is provided indicating user to select one or more options (checkboxes in search filters. Note: this does not apply for “add to compare” as it is not specified whether multiple items need to be selected or not).
   – Fast processing and series of short steps do not require information to be remembered.
   – By looking at the system the user can tell the state of the system (E.g. during ordering process the loading sign indicates that the system is processing information; if complete information is not displayed, users can understand that the page is loading).
   – GUI menus make obvious which item/s has been selected (applies for both single selection as well as multiple selection) (E.g. selected checkbox choices; the selected category name is indicated in bold indicating its sub categories, distinguished from other categories. Note: this does not stand true for list/grid view icon – not clear which on is selected).
   – It is made obvious whether de-selection is possible or not (checkboxes).

   – Navigational aid is provided (E.g. title and breadcrumbs).

2. Match between system and real world
   – Menu-naming terminology is consistent with user's language.
   – Related and interdependent fields appear in the same section on a screen (E.g. personal details, billing details, shipping details – fields of each category are logically grouped together and separate from other categories).
   – Some icons match cultural conventions (E.g. icons of shopping cart/basket, ‘f’ for Facebook, search icon, inverted triangle indicating drop down menu).
   – The system automatically enters commas in numeric values greater than 9999 and also includes leading or trailing spaces to align commas in price.
   – The system automatically enters abbreviation for Rupees (Rs.) for monetary entries.
   – Websites offer deals and offers (“clearance sale”, “buy now”) attracting users to make action.

3. User control and freedom
   – User is allowed to move back to previous menu (i.e. data entry form) for modifying data (E.g. user can move back to billing details from shipping details, if modification is required in previously entered data).
   – Users can de-select (a sort of undo operation) choices of the checkboxes in case of wrong selection.
   – Text saved in text fields help in reducing data entry time.
   – Prediction of search results while typing.
   – Use of broad as well as deep menu arrangement.
   – Users can move forward and backward between fields of data entry forms.
   – The system waits for a signal from the user before processing (user hits refine search button after selecting the desired choices).
   – “Clear All/Reset” button is provided in some sites, at the end of form/at the end of search filters.

4. Consistency and standards
   – Heavy use of all uppercase letters on a screen has been avoided.
   – Information regarding icons that are not labeled is usually displayed on mouse hover.
   – Because fewer and distinct icons are used, users won’t have much difficulty in memorizing the functionality of each icon.
   – Page titles, menu titles and menu items are brief and left-justified.
   – Most attention getting techniques are employed such that the colors do not irritate the user.
   – Sharp colors have been avoided for text or demarcation of items.
- Prompts are brief and deliver system messages in a language understandable by users.

5. Help users, recognize, diagnose and recover from errors
- The field in error is properly highlighted, helping users recognize the point of error.
- Even though the user is not provided with solutions to rectify error, they can determine the severity of error (e.g. if the email/phone provided to the system is invalid, problems maybe encountered while logging in to the system or during a transaction).
- When an error occurs, some of the sites provide sample input to help users rectify their error.
- In multi-page data entry screens, is each section is labeled (E.g. login system and registration link on same screen, but distinguished by headings).
- Items and zones are separated by spaces, lines, titles or shaded areas.
- Good color and brightness contrast between image and background colors doesn’t hinder user in reading information/screen elements.
- Menu items are displayed according to their relevance/importance (i.e. first word of each menu choice is the most important).

6. Error prevention
- User is not allowed to copy/paste password from password field to confirm/retype password field. System will indicate error if done so (Password confirmation does not match password!).
- Required field length for input field is indicated when incorrect length of input is provided by user (E.g. password must be at least 4 characters, name must be at least 2 characters).
- System will not allow invalid email/phone, as these details may be required in future. By doing so it prevents errors in advance.
- System doesn’t allow users to jump to next data form before completing the current one, thereby preventing users from missing out any relevant details (E.g. user can’t skip to shipping details before completing the billing details).
- Data inputs are case-blind.

7. Recognition rather than recall
- Information provided by the user (user details) is displayed on the screen or is easily accessible.
- Even though prompts and messages are not displayed on consistent positions in different screens, color and background of prompts help in easy scanning as they capture user’s attention.
- In most sites, information (textboxes, images, links) has breathing space around it.

8. Flexibility and efficiency of use
- Advanced search feature is provided for assistance of expert users.
- Easy to escape prompts for expert users.

9. Aesthetic and minimalist design
- Field text/textboxes are aligned.
- Field labels or placeholders are provided, specifying what is required as input.
- Information essential to decision making is displayed on the screen (E.g. links to: help documentation, shopping cart, transaction details and methods).
- The number of items in cart or product comparison list can be viewed without leaving the page.
- Prompts and messages are expressed in the affirmative.
- It is easily understandable which lower-level menu choice is associated with which higher level menu.

10. Help and documentation
- On-time help (chat, email, call) provided apart from navigation and goal oriented help options (help documentation, FAQs, indications while transaction).
- The system also provides additional explanatory information including navigational, goal oriented and context sensitive help (menu title, page description, transaction steps, “forgot password” option).
- Help is easily accessible and relevant.
- The user can change the level of detail available (E.g. “Click to view details” option).
- Users can easily switch between help and their work.

b) Negative findings
Through the detailed evaluation of all sites, we created a ranking scheme of issues on their possible severe effects and proposing subsequent remedies for them. Some of the issues are illustrated with detailed point of problem however rest left concise.

- Cosmetic Issue: Affecting the appearance and can only managed if additional time is permitted.
- Minor Issue: User’s capability to navigate is obstructed and should be fixed when possible
- Major Issue: Should be fixed immediately; it irritates and confuses the user
- Catastrophic Issue: Requires instant modification as it prohibits user in performing their tasks.

Cosmetic issues
- User control and freedom
  - Exit/undo/modify/reset/cancel option is not provided at each step.
Suggestion: Exit/undo/modify/reset/cancel option should be provided and clearly visible.
- Aesthetic and minimalist design
Not specified that moving the cursor over the product image will enlarge it.

**Figure 4: Visual problem**

Every site has the feature to view the product from a close side but there is no icon or magnifier provided. Some of the sites have the option to double click on the product to have its preview but this feature is also not clear to the user. Here is the screen shot from one of the site which shows this issue and also it shows incorrect part of the product opposite to where the cursor is placed.

Suggestion: Plus (+) sign or magnifier should be used with the image to enlarge.

**Minor issue**

- Visibility of system status:
  - Icons not showing their status (e.g. grid/list view – which one is selected).

**Figure 5: Visibility problem**

From the 16 sites, only few sites have the choice to view products in list and grid view and among them some sites don’t show the clear status of which one is selected. The screen shot shows the products are in list view but the selected icon differs.

Suggestion: Selected icons should have hover effect or may be displayed in bold font or with any proper color.

- Vague feedback. Sometimes feedback is not provided.

Suggestion: Feedback must be provided for every important action, to inform user that what is going on.

- Multiple navigation bars (more than two).

Suggestion: Single navigation bar should be used that contains the main categories.

- User control and freedom
  - Cannot sort data (arrange/view) items by multiple sorting techniques

Suggestion: Multiple sorting techniques should be used to sort data by popularity, model, and price or in ascending/descending order.

- Consistency and standards
  - Links are not consistent

Suggestion: Links should be consistent on each page of the website so whenever user wants to visit the page by clicking on the link, he may not direct to the unpredicted page.

  - Unconventional icon placement (e.g. search icon placed to the left of search box).

**Figure 6: Search icon mistake**

Some important icons, like Search icon is not present at its appropriate location in some of the sites. In few sites like in the screen shot is shown, search icon is present to the right side and is not clearly visible. Usually search icon is present to the left side of the search box.

Suggestion: Icons like “Search” should be placed on proper position as users likely to see this icon on right side of the search box.

- Error prevention
  - Field length and default input is not provided in data entry forms.
Suggestion: Data entry forms should have field length and default input to prevent users from errors (e.g. Phone number should have field length of 11 numbers with default input 1111 1111111).

- Recognition rather than recall
  - Navigation pane does not provide recognition (poor arrangement of categories causes novice users more time to find categories).

Suggestion: The categories should be arranged correctly in navigation pane so user may not take time to find product category (e.g. mobiles and accessories should be a separate category).

- Aesthetic and minimalist design
  - Immediate actions are not highlighted.

Suggestion: Actions like adding/removing item to cart or order placed should be clearly visible to the user by highlighting with color or with a popup displayed in line of sight.
  - Indentation of links and objects is not appropriate.

Suggestion: Indentation between objects and icons should have a breathing space.

- Help and Documentation
  - Provided help is not sufficient for novice users. They may require detailed help.

Suggestion: Help should have link “Click here for More Help” or it may use complete and simple language that is easy to understand.

Major issues

- Visibility of system status:
  - Information is overloaded and inappropriate color contrast, font style and vague titles.

Some sites have vague menu titles and too much information on the page which is creating difficulties for the user to find appropriate information. Few of the sites use sharp and different colors for menus. The given screen shot shows the “Life Style” menu has electronics which further has mobiles and tablets inside it. This unusual and multicolored page layout may irritate the user.

Suggestion: Adequate and relevant amount of information should be presented on the screen with unambiguous titles of products. Suitable color contrast and simple font style should be used.
  - Cognitive thinking is required.

Suggestion: The information present on the page shouldn’t make user to think about the meaning of the information or where to move next.
  - Prompts and error messages not always displayed.

Suggestion: Prompts should be displayed and also they should locate in same place so that user can see them.
  - Incorrect visual feedback in menus and icons.

Figure 8: Information overloaded

Figure 9: Links do not appears to be clickable

When the cursor is moved over the marked area, it is shown as clickable; but in actual only the text (“Apple Mac”, etc.) provides a link to a new page.

The user may click on the dropdown icon or the box and think that the link is not working.

Figure 10: Links supposed to be inaccessible

These icons do not appear to be clickable. Hovering the mouse over them provides a hint for clicking them by making them prominent. Otherwise neither do they look concrete nor do they seem clickable.
Most of the sites don’t have the option for ‘Signup’ along with ‘Login’ and if provided, the terms used are misleading. The screen shot depicts the same. Furthermore, majority of sites do not provide links to ‘Wish list’ and ‘Product Compare’ page along with ‘Shopping Cart’ option in the header, which builds a barrier for user in purchasing the desired product with ease.

Suggestion: Signup should be present with Login option so if user is not registered he may signup. Compare option should be with shopping cart or wish list so if user want to buy the product from the comparison list he may buy it.

- User control and freedom
  - Lack of basic search filters and advanced search feature not provided to assist expert users.

Users can refine search results only by brand name. No additional search filters are provided.

Suggestion: Basic and advanced search filters should be provided to users to easily find their product.

- Options are selected without clicking and sometimes system doesn’t wait for user's task to complete and starts processing (e.g. page loads as soon as one or more checkbox are selected, predictive searching and detection of error in email field).

Suggestion: Options should only be selected by clicking and system should wait for the user’s response and then proceed further (e.g. selecting of multiple sorting techniques for a product).

- Consistency and standards
  - Mnemonics are not supported and also menu titles do not match the task structure.
Suggestion: Mnemonics should be supported so that user can easily find products by seeing them. Menu titles should not be misleading so that user can perform their tasks correctly by selecting the right menu.

- Help users, recognize, diagnose and recover from errors
  - Vague error description. Rectification of error is not provided. Error messages should be clearly highlighted.

Suggestion: Semantic and syntactic description is required for clear error description. Errors should be clearly highlighted and can be modified when required.

- Error prevention
  - Numbers are accepted in “first name field” apart from “user name field”, digit input is accepted for “city”.

Suggestion: Complete validation rules should be applied to the forms (registration/login/order forms).

- No confirmation is required for commands with destructive consequences (e.g. remove item from cart).

Suggestion: System should confirm from users before performing such actions.

  - Data entry form can only viewed by scrolling down. Required fields may unintentionally be left blank.

Suggestion: Required fields must be marked and data entry form should not be placed to the bottom of page which requires scrolling.

  - Recognition rather than recall
    - While a transaction is in process, all the essential details should be accessible (displayed and easy to modify) at each step.

Suggestion: When transaction is being processed modification of essential details should be prohibited.

- Aesthetic and minimalist design
  - Accelerators are not provided. Operations cannot be performed via keyboard (e.g. selection of item via tab key).

Suggestion: Operations should be performed via keyboard shortcuts and mouse clicks.

  - Icons are neither distinct nor do they stand out from their background.

Suggestion: Icons should use hover effect and prominent color to stand out from their background.

- Help and documentation
  - Contact customer service (by email or call) option is provided by the system but Help documentation is not easily accessible.

Suggestion: Help or FAQs menu should be located on the navigation bar for easy access.

- User control and freedom
  - Users cannot move to next nested menu before filling out the current one also they are allowed to modify previous menus.
Figure 17: User freedom in not provided accurately

User can move to previous menus to modify details, but is not allowed to jump to next menu before filling out the required details of current menu/tab.

Suggestion: Short process should be used for order placement and in data entry forms as users don’t want to fill the extra details which are not relevant.

- Flexibility and efficiency of use
  - Popup windows (advertisements/deals/offers for newsletter) do not specify how to exit. This is required for novice users.

Suggestion: The close window mark (x) should be given and clearly visible on the popup windows (Advertisements/deals/offers for newsletter).

- Help and documentation
  - Help is not provided accurately.

No help or FAQ’s provided, the page is blank.

Figure 18: Help is not provided

Suggestion: Help should be presented that it contains information about the problems in simple language.

2. Usability evaluation phase 2: evaluation by task set

The heuristic evaluation comes up with positive and negative findings. The negative findings are a proof to our 2nd hypothesis, to ascertain it we formed a task set to prove our findings factual which requires to search a product with given specifications, comparison of two products, Order placement, seek for the help documentation/FAQ’s and track the order placed before.

This task set was tested by 41 users having different educational background however most of them were novice, and the post study questionnaire helps us to furnish our results.

a) Data analysis

The questions asked in the post study questionnaire assist us in justifying the hypothesis. We use the following grading scale to examine the results;

Agree: The user completes the appropriate task
Disagree: The user finds difficulties in performing the tasks
Neither agrees nor disagrees: The user was able to accomplish the task but couldn’t rate the task as easy or difficult.
Strongly agree: The user doesn’t find any difficulty and perform tasks instantly.
Strongly disagree: The user is stuck and was unable to perform the task.

Task 1: Search the product with given specifications

Result: Most of the users were able to search the specified product.

Observation: although 63% of users were successful in carrying out this task however most of the users faced difficulties in using search filters.

Figure 19: Percentage of users who found the specified product

Task 2: Comparison of two products

Result: Most of the users accomplished this task but the some of them were unable because in our evaluation some sites lack in the “compare” feature that leads the increase of that percent.
Observation: The compare feature provided in ecommerce sites performs functions somewhat close to viewing product details. Most users comprehend these two operations as referring to the same thing, however this is not true. This incorrect user perception was observed when users required explaining what the compare feature was. Even after given explanation they couldn’t carry out the specified comparison task with perfection. Partial blame for this problem goes to the sites design where product compare feature and its elements were not clearly visible to the user. However, it has been revealed that design flaws are not the only reason behind low use of product compare feature. The primary reason behind this is the incorrect mental model of users and their lack of awareness regarding the use of this feature.

Task 3: Place an order

Result: This task was completed by majority users but few of them were not comfortable in performing the task because the terminologies used for placing an order were not familiar to users. About 56% of them were able to complete the task, while few of people approximately 17% of two shares were unable to accomplish the task and somehow unbiased.

Observation: Most of the users performed their task but many of them were accomplished after a great effort. The problems that hinder users’ ability to perform their tasks accurately were analyzed in post study evaluation. Even though, most of them answered agree to the questions relating their problems but in actual they obstructed many times while performing the task. The issues faced by many users were problem in navigating sites and rectification of their mistakes when they were going wrong.

Task 4: Find help documentation and FAQs

Result: Users found help after a great effort as it was not easily accessible.

Observation: Help was not easily found on many websites by most of the users but very few of them were found it without any trouble. 22% of the users were unable to access because it was not present in menus or in any link that was clearly visible. Also, 22% of them were unable to understand the terminologies used in FAQs or help and also in some sites detailed help was given which user didn’t read and replies to this question neutrally.
b) Result

From the results of negative findings and user testing it can be said that the usability of the sites is not according to the standards. The major problems that affect the usability of sites were the navigation aid, appropriate system feedback and vague information presentation. Most of the issues of negative findings are similar to those encountered during user testing.

4.4 Proof to 3rd hypothesis

For proving the hypothesis relating to accessibility, the methodology was divided into two parts, first part is to evaluate the sites by accessibility tools and another is to evaluate the sites by testing via blind users.

1) Accessibility evaluation phase 1: accessibility evaluation tools

To determine the accessibility of websites, we first evaluated the sites via web accessibility tools (names of which have been specified in this paper previously)[9] [10]. There are some requirements which if met, classify the content as conforming to WCAG 2.0[7]. The evaluation tools helped us in evaluating the sites under the blanket of WCAG 2.0 guidelines and targeted the design flaws that affect accessibility of the sites. WCAG 2.0 checkpoints has a priority level assigned to it which is based on the checkpoint's impact on accessibility: [8]

- Level A: Web developers must satisfy these requirements; otherwise it will be impossible for one or more groups to access the Web content. It is the minimum level of conformance [7].
- Level AA (Double-A): Web developers should satisfy these requirements, otherwise some groups will find it difficult to access the Web content.
- Level AAA (Triple-A): Web developers may satisfy these requirements, in order to make it easier for some group to access the Web content.

<table>
<thead>
<tr>
<th>Principles</th>
<th>Problems identified</th>
<th>Guidelines violated</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Perceivable</td>
<td>No text alternative provided for non-text content</td>
<td>1.1.1</td>
</tr>
<tr>
<td></td>
<td>Content cannot be presented in different ways without losing information</td>
<td>1.3.1</td>
</tr>
<tr>
<td></td>
<td>Sensory characteristics are not used</td>
<td>1.3.3</td>
</tr>
<tr>
<td></td>
<td>Decorative images are not implemented in a way that can be ignored by assistive technology</td>
<td>1.1.1</td>
</tr>
<tr>
<td></td>
<td>Tabular information, visual lists and Unicode marks are not properly implemented.</td>
<td>1.3.1</td>
</tr>
<tr>
<td></td>
<td>The dir attribute is not given to direct images.</td>
<td>1.3.1</td>
</tr>
<tr>
<td></td>
<td>Sensory characteristics are not used</td>
<td>1.3.3</td>
</tr>
<tr>
<td></td>
<td>The “image element” may require a long description.</td>
<td>1.1.1</td>
</tr>
<tr>
<td></td>
<td>Use of inappropriate color</td>
<td>1.4</td>
</tr>
<tr>
<td></td>
<td>Input, object and script using color alone.</td>
<td>1.4.1</td>
</tr>
<tr>
<td></td>
<td>Alt text does not convey the same information as the image.</td>
<td>1.1.1</td>
</tr>
<tr>
<td></td>
<td>Image may contain text that is not in Alt text.</td>
<td>1.4.5</td>
</tr>
<tr>
<td></td>
<td>The object link to multimedia file may be missing equivalent alternative.</td>
<td>1.2</td>
</tr>
<tr>
<td></td>
<td>Resize text so that it is easier for users to see and hear content including separating foreground from background.</td>
<td>1.4.4</td>
</tr>
<tr>
<td></td>
<td>Make Web pages appear and operate in predictable ways</td>
<td>3.2.2</td>
</tr>
<tr>
<td></td>
<td>Change of context occur without user activation</td>
<td>3.2.2</td>
</tr>
<tr>
<td></td>
<td>Input element has no text in label.</td>
<td>1.3.1</td>
</tr>
<tr>
<td>• Operable</td>
<td>Blinking and Scrolling Text movement</td>
<td>2.2</td>
</tr>
<tr>
<td></td>
<td>Bypass blocks are used to navigate to find content and help users where they are.</td>
<td>2.4.1</td>
</tr>
<tr>
<td></td>
<td>Same page title on multiple pages</td>
<td>2.4.2</td>
</tr>
<tr>
<td></td>
<td>Link texts are not provided with meaningful purpose.</td>
<td>2.4.4</td>
</tr>
<tr>
<td></td>
<td>Anchor text may not identify the link destination.</td>
<td>2.4.4</td>
</tr>
<tr>
<td></td>
<td>The “on mouse over” event handler missing “on focus” event handler.</td>
<td>2.1.1</td>
</tr>
<tr>
<td></td>
<td>All functionality not available via keyboard</td>
<td>2.1.1</td>
</tr>
<tr>
<td></td>
<td>Header nesting is incorrect</td>
<td>2.4.6</td>
</tr>
</tbody>
</table>
Table 2: Level AA

<table>
<thead>
<tr>
<th>Principles</th>
<th>Problems identified</th>
<th>Guidelines violated</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Perceivable</strong></td>
<td>Use of inappropriate color</td>
<td>1.4.1</td>
</tr>
<tr>
<td></td>
<td>Ensure foreground and background color have enough contrast.</td>
<td>1.4.3</td>
</tr>
<tr>
<td></td>
<td>Image may contain text that is not in Alt text.</td>
<td>1.4.5</td>
</tr>
<tr>
<td></td>
<td>Consecutive text and image links to the same resource.</td>
<td>1.1.1</td>
</tr>
<tr>
<td></td>
<td>Color contrast between the color of selected link text and its background is</td>
<td>1.4.3</td>
</tr>
<tr>
<td></td>
<td>inappropriate.</td>
<td></td>
</tr>
<tr>
<td><strong>Operable</strong></td>
<td>All functionality not available via keyboard</td>
<td>2.1</td>
</tr>
<tr>
<td></td>
<td>Site missing site map.</td>
<td>2.4.5</td>
</tr>
<tr>
<td></td>
<td>Heading tags used for formatting.</td>
<td>2.4.6</td>
</tr>
<tr>
<td></td>
<td>Text content is not readable and understandable.</td>
<td>3.1.2</td>
</tr>
<tr>
<td><strong>Understandable</strong></td>
<td>Text content is not readable and understandable.</td>
<td>3.1.2</td>
</tr>
<tr>
<td></td>
<td>Form submission error messages may not provide assistance.</td>
<td>3.3.3</td>
</tr>
<tr>
<td></td>
<td>Repeated components may not appear in the same relative order each time they appear.</td>
<td>3.2.3</td>
</tr>
<tr>
<td></td>
<td>Form submission data may not be presented to the user before final acceptance of an irreversible transaction.</td>
<td>3.3.3</td>
</tr>
<tr>
<td></td>
<td>Long quotations may not be marked using the block quote element.</td>
<td>3.2.4</td>
</tr>
<tr>
<td></td>
<td>Use relative rather than absolute units in HTML attributes.</td>
<td>3.4</td>
</tr>
<tr>
<td></td>
<td>Headings must be nested correctly.</td>
<td>3.5</td>
</tr>
</tbody>
</table>

Accessibility evaluation results reveal that majority of errors lie in the category Level A, some errors belong to Level AA. It is observed that these sites are not capable to meet the foremost requirements of Level A and AA, so we can state that presence of Level AAA requirements is not possible. Several design flaws were found in the accessibility evaluation that may hamper users in their objective but this is yet to be proved in accessibility testing.

As Level A is the lowest level of conformance, problems associated with it need a lot of developers’ concern and must be rectified. Fulfilment of Level A requirements would mean that basic operations can be performed with ease by most users.

Next, if time permits, the focus should be on removal of problems associated with Level AA as some users may find it difficult to access web content. As far as level AAA is concerned, the evaluated E-Commerce sites are not designed to address the requirements of level AAA.

2) Accessibility evaluation phase 2: task based evaluation

To determine the accessibility, task based evaluation was performed with a total of 5 blind people belonging to Computing background. The task set required them to search a mobile phone supplied with precise features. The details comprised (but were not limited to) category name, brand name and model number. The hypothesis is further justified by the post study questionnaire following accessibility testing. The statistics obtained from user responses have been discussed.
a) Text Equivalent for Non-equivalent Elements

Testing results show varied opinions of users regarding menu categories. 60% test participants found the product they were looking for in the category where they expected it to be. 20% agreed that the recognition provided by the site was insufficient and only a small percentage of 20% disagreed to revisit the site. The above obtained results show that even though participants were able to search the specified product but they did so experiencing some hurdles along the way.

b) Focus on menu categories

If menu items are characterized by succeeding real world conventions, navigation of the site becomes considerably easy and the user can search for information in significantly less time. Logical arrangement of menu categories assists in recognition for future use.

The presentation and the sequence of information are among those important points that contribute to bringing a user back to a site. If the user is unable to find the desired information with ease, the first time they visit a site; it is more likely that they would never visit the same site again.

c) Spotlight on Search Filters

Search filters provide ease to user in limiting the results displayed on screen. It assists them in searching the desired product in relatively less time. Pakistani E-Commerce sites provide less search filters as we observed in usability evaluation and evaluation through accessibility tools. The statistics show how search filters of Pakistani online shopping sites appeal users.

d) Quantity and relevancy of information

The result on the amount of information presented and its relevancy shows that 40% users confirm that the web pages are overloaded with irrelevant information. 40% users observed that the screen contains
just the right quantity of information which was relevant to their needs.

Figure 27: Information presentation

Figure 28: Responses to navigation aid

Upon analysis of the navigation aid supported by the sites, the results confirm that navigation aid provided proved to be quite helpful for the users and they could navigate their way with ease except for only 20% of them who found themselves lost and sometimes couldn't look for a way out by proceeding further or going back.

The possible reason for users’ confusion in navigation is the lack of link list support provided by these sites.

A sites’ navigation is dependent on link list of each page which contains links to all subsequent screens in a form of list. This list is used to move to any page linked to the current page permitting users to either move forward or backward according to their convenience.

Some of the tested sites do not allow users to generate link lists for easy navigation. As the link lists cannot be created, users cannot move to the next screen, resulting in poor navigation results.

f) Support for new users

Figure 29: Interaction of new users with the sites

Some of the people who participated in testing were frequent users of online shopping and bidding sites. When their views were gathered on the design of sites, for the ease of first time users, the result indicates that there is not one user who “strongly agrees” on the point that the sites are well designed to assist first time users. Only 20% agree are in favour of the well design of the sites and the support it provides to new users.

g) Determining which way to go

A system should be designed in such a way that the user always feels in control of the system. It should be clearly indicated where the users can proceed to from their current position and whether or not they can escape from an unpleasant condition, if so how.

Figure 30: Users’ capability for succeeding actions

All users who participated in testing affirm that they were always aware of what they are able to do next. They could mostly find their way around problems and accomplish what they were aiming for.

h) Additional support for accessibility

For people with visual impairment some additional features such as sound effects and keyboard shortcuts are very necessary for browsing the site.
The responses acquired for additional support provided by the site are quite interesting. All 16 sites evaluated do not support sound feedback. However, 40% of users strongly agree that keyboard shortcuts were present, whereas 60% are in denial of the said statement that keyboard shortcuts were present.

The combined results on the support of additional features lead to the conclusion that the sites under discussion have a lack of additional support which results in significant increase in duration of completing a task for visually impaired users. This result also supports our fourth hypothesis on the poor satisfaction of basic accessibility requirements.

i) Error Indication

Indication of error is an important part of web accessibility. It is necessary that the system indicates the point of error and also suggest ways for rectification in case an error occurs.

Post study survey responses uncover that 60% of the results remain neutral as the users never encountered any error during their task. From the users who faced some sort of problems, 20% of the users strongly agreed and a same percentage strongly disagreed to the indication of the point of error.

Error messages were provided in almost every site, but some of them failed to indicate the error location. In some cases where the error was specified, the error messages could not successfully deliver mechanisms of error rectification. Hence the users were either stuck at some point and required help, and in other cases where they figured out how to remove their errors, considerable time was wasted also contributing to user frustration.

j) Result

The results obtained from accessibility testing phase and post study questionnaire were partially in favor of our suggested hypothesis but for some points they contradicted with it.

The hypothesis on accessibility presented for this study stated that the accessibility of Pakistani E-Commerce sites does not satisfy the requirements of Web Content Accessibility Guidelines 2.0 (WCAG 2.0). But the results obtained after accessibility evaluation and testing prove differently. The results provide evidence that the suggested hypothesis does not stand true and cannot be justified completely in fact it is partially false. Accessibility evaluation tools applied on selected E-Commerce sites of Pakistan discovered the numerous design flaws in these sites. The design flaws belonged to different levels. The results of testing and questionnaire further reveal that problems were encountered in navigation of the site.

However, the users were able to achieve what they required, so we reach to the conclusion that these sites provide such a level of accessibility that allows users to perform basic operations. If the complexity of tasks increase, the user cannot be attained the desired result and will ultimately be stuck at some point. So, major accessibility issues need to be resolved in order to improve the site.

3) Recommendations

With the increasing demand of usage of graphics in web pages to make them more attractive, often the drawbacks associated with it are ignored. One of the
associated problems is the readability of such elements that is affected, as Screen readers are unable to read some elements.

Some Screen readers (JAWS 14.0 in particular) are not capable of reading out elements that involve complex graphics. This readability issue was observed during accessibility testing by blind users where JAWS could not read out all elements of the web pages. Possible reason for this problem is the usage of complex graphical elements involved in the sites' design, apart from other reasons; causing the screen reader to skip some elements.

If the site is targeted for diverse users then its content must be reachable and understandable by everyone. Therefore, considerations must be made accordingly while designing web pages; that is, designing the site with a view of the possible complications that may arise because of poor or no support for the elements used, by the technologies that assist the disabled.

As JAWS is widely used for its extensive features, when possible only those editors should be used that are supported by JAWS so that relevant details are not missed by the Screen reader. If for instance use of advanced editors is required, JAWS must be upgraded to provide advanced support.

Thus, satisfying clients’ demand of graphics and at the same time reducing the problems that maybe encountered by users during navigation of sites.

The design flaws that lead to accessibility violation must be handled by development team and rectified on the basis of their priority level.

4.5 Proof to 4th Hypothesis

The proof to the suggested hypothesis on insufficiency of search filters is dependent on the findings obtained during usability and accessibility evaluation stages. However, the hypothesis has been justified independently as well.

Search filters provided are not sufficient for better results in mean time. This statistics shows that although users have searched the required product but still 24% agree on the need to have more filters and 7% strongly agree. This deduces that search filters are must in exploration of a product which has more than one feature; so that search becomes specific with least time.

5. CONCLUSION

In the fast paced growing trend of E-Commerce, the sites not only have local competitors but global too. There is no room for error and those who cannot satisfy customers are not in the game.

Recommendations on the negative findings of E-Commerce sites operated in Pakistan have been suggested.

Using which, the sites’ performance in terms of usability can be improved significantly.

After analyzing all the data obtained from the surveys, testing based on task sets and user reviews, we conclude that all except one of the hypotheses presented for this research have been proved true. The hypothesis on accessibility of E-Commerce sites was neither completely justified nor nullified.

Where there is a cluster of drawbacks and major errors associated with the sites, existence of positive findings cannot be ignored as well. Evaluation of Pakistani E-Commerce uncovered some interesting features, which appear to be motivating factors for the developers as well as users of these sites that E-Commerce in Pakistan has the ability to expand and penetrate in international market to compete with the E-Commerce giants. The aim should be to improve the quality of online shopping experience by providing ease of use to consumers and bring out the best in developers.

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No matter how old we grow our parents are always there to support us whenever we need them. We would like to thank the precious gift Allah has granted us, our parents for all their support and care.

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