International Journal of Computers and Informatics (IJCI)
Vol. (3), No. (8)

IJCI

المجلة الدولية للحاسبات والمعلوماتية
الإصدار (3)، العدد (8)

August 2024

An Approach for Assessing the Usability of Academic Websites: An Application to Websites' Universities

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Abstract

Websites are considered to be a key aspect of any organization's competitiveness. In addition to visual esthetics, usability of a website is a strong determinant for user's satisfaction and pleasure. There has been an increasing focus on Usability engineering in the last few decades. To attain the desired quality of websites, a lot of quality factors should be considered. Web quality factors can be organized around three perspectives: visitor, owner, and developer. Each perspective is mainly interested in some quality factors than others. The visitor is mainly concerned with seven quality factors: usability, accessibility, content quality, credibility, functionality, security, and internationalization. This study focuses on usability as an example of quality considerations that are more important from the visitor's perspective. Therefore, this study aims to propose an approach for enhancing the usability of websites. The proposed approach depends on a set of quality guidelines for three quality sub-factors of usability, which are: navigability, searching, and legibility. A case study is used to evaluate and illustrate the validity of the proposed approach.

Keywords: Quality, Websites, Usability, Evaluation Methods.

1. Introduction

A website is an application that is accessed via a web browser over a network to accomplish a certain business need. A website possesses its own peculiar features that are very different from traditional applications. Examples of such features are a variety of content, ever-evolving, the multiplicity of user profiles, more vulnerable systems, required to run uninterruptedly, and ramifications of failure or dissatisfaction. A website plays an important and critical role in our life. They become closely ingrained in our personal life and work styles, and they have already become crucial to the success of the business. The number of internet users has evolved from 16 million, in December 1995, to 3345 million, in November 2015 [10].

Although the importance and critical role of websites, many of them don't achieve a good return on investment and they tend to fail. The web development process is often ad-hoc and chaotic, lacking systematic and disciplined approaches and quality assurance and control procedures. Web quality is a crucial issue in a society that vitally depends on the internet. Its importance and benefits are not fully recognized and understood in spite of its critical role. Organizations that develop poor-quality applications are always spending a lot of money and time on correcting defects. It is vitally important to devote greater care and attention to WBA quality. The proposed approach provides quality guidelines that can be considered by WBAs developers for enhancing usability. In addition, the evaluation process can provide them with weaknesses and strengths that can be analyzed to increase usability in later development activities.

2. Literature Review

The previously introduced quality models for traditional software are not adequate because a website possesses its own peculiar characteristics that are different from

traditional ones. Some proposed web quality models are either directed toward a specific website perspective or deal with a limited number of quality factors. Other studies introduced several quality factors, but they didn't suggest means for achievement or they introduced limited guidelines for each quality factor or sub-factors. Therefore, these models don't provide the developer with the required assistance for how to fulfill the presented factors.

ISO/IEC 9126 describes a two-part model for software product quality. The first part of the model defines six characteristics for internal and external quality: functionality, usability, efficiency, maintainability, and portability [11]. The second part of the model defines four quality factors in use: effectiveness, productivity, safety, and satisfaction. Quality in use is the combined effect for the user of the six software product quality characteristics [12].

In [13], one layer web quality model is presented. It is based on eight quality factors. They are interactivity/functionality, usability, correctness, real-time information, information linkage, integrity, customer care, and socio-cultural aspects. Some of these quality factors require more decomposition. For example, usability can be divided into sub-factors like navigability, legibility, consistency, simplicity, and audibility. At the same time, socio-cultural aspects should be considered sub-factors for internationalization factor. In addition, the definition of the presented factors is not clear. For instance, it is considered that security is part of integrity while it is known in the literature that integrity is part of security [2]. The authors defined customer care factors as dealing with features like appeal and visual appearance, and these are more related to the presentation. Also, it contains uniformly placed hypertext links, and this is more related to navigation. Information linkage shouldn't be considered a quality factor, it is a necessity for the web. Finally, this model is directed toward the visitor's perspective.

In the late 1990s, Luis Olsina proposed a quantitative, expert-driven, and model-based methodology, for the evaluation and comparison of website quality, called Web Site Quality Evaluation Method (WebQEM). It helps the evaluators to understand and enhance the quality of WBAs. The main steps and activities of WebQEM can be grouped into four major phases, namely: quality requirements definition and specification, elementary evaluation, partial and global evaluation, and analysis, conclusion, and recommendations [6, 20, 21, 22, 24].

The authors in [16, 17] followed a decomposition mechanism to produce a Web-Based Application Quality Model (WBAQM). The model is focusing on the relationship between web quality factors and sub-factors as well as attempting to connect quality perspectives with quality factors. The main idea to organize this model is that all quality factors are important for the success of a website, but this importance relatively differs according to 3 perspectives: visitor, owner, and developer. Each one of these perspectives is mainly interesting in some quality factors than others. The visitor is mainly concerned with seven quality factors: usability, accessibility, content quality, credibility, functionality, security, and internationalization. The owner is mainly concerned with three quality factors: differentiation, popularity, and profitability. The developer is mainly concerned with three quality factors: maintainability, portability, and reusability. According to quality factors from the visitor perspective, not all factors have the same relative importance regarding the web domain. Therefore, the seven-quality factors of visitor perspective are divided into two groups: domain-independent quality factors and domain-dependent quality factors as shown in Figure (1). Each quality factor is further subdivided into a set of quality sub-factors. For example, usability is decomposed into sub-factors like understandability, navigability, simplicity, searching, legibility, and audibility.

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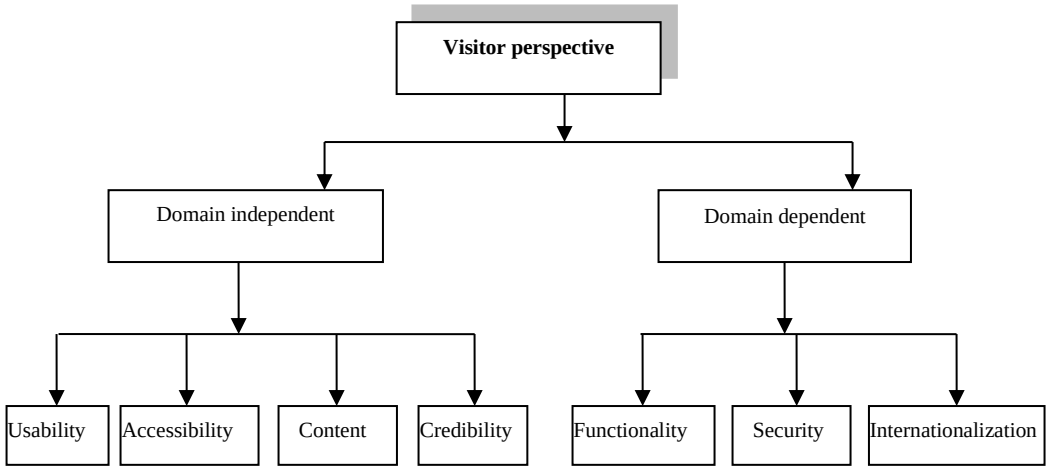

Figure (1): Quality Factors of Visitor Perspective

3. The Proposed Quality Guidelines for Achieving Usability

It is very important to have web quality models. These models contain the desired quality considerations, serve as guidance to the development process, and can be used to evaluate website quality against a pre-defined set of requirements. Although the importance of web quality models, special emphasis should be given to web quality guidelines. These guidelines give web developers some cues as how to achieve the proposed quality factors and can be used to evaluate running applications and discover weaknesses and strengths. Without following a set of excellent web quality guidelines, during the development process, the website may be failed. The aim of this paper is to introduce a set of web quality guidelines to assist developers in the development process to produce high-quality products. The authors expand the approach presented in [16, 17] and propose a set of quality guidelines for three quality sub-factors of usability, which is an interest of the visitor. These sub-factors are navigability, searching, and legibility, as shown in figure (2).

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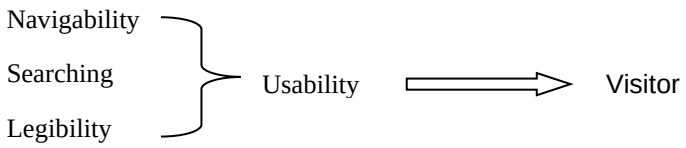

Figure (2): Sub Factors of Usability

3.1 Navigability Guidelines

Navigability is the extent to which a website is easy to browse. Websites should guide the visitors through the browsing process and support a complete set of navigational aids to allow the visitors to link to any part of the application and acquire more of the information they are seeking for [4]. The following set of guidelines can be considered to make websites easier to navigate:

1. **Having a main navigation menu**. Guiding visitors through website and providing access to the main sections/pages by using a main navigation menu [5, 14].
2. **Location of main navigation menu**. Placing the main navigation menu horizontally or vertically or both. Horizontally, near the top, just below the logo, or standing right beside it. Vertical menu should be placed on the left side of the page. Don't place it on the right of the page, or in the middle of it.
3. **Horizontal menu and displaying images area**. If there is an area dedicated for displaying images, don't put it before the horizontal menu.
4. **Number of horizontal navigational items**. Limiting the number of navigational items to about 7. Otherwise, using a vertical menu which able to accommodate a long list of navigational items.
5. **One-line horizontal navigation menu**. Horizontal navigation menu should be with one line/row. 2 or more lines/rows horizontal menu seems to be strange.

6. **Short sub-menus**. Submenus should be short so that there are no invisible items and visitors can see and access the end of these sub-menus.
7. **Having footer as a secondary navigation tool**. Using footer on every web page as a secondary navigation tool. It is often formatted as text links for copyright statement, privacy policy, terms of use. It can be used to repeat some main navigational items or for pages that don't fit within the main menu. Footer can hold a lot of links because it may be multiple lines with a smaller font size.
8. **Including a clickable hierarchical bar**. Letting the visitors to know where they are in website by displaying a clickable hierarchical bar at the top of each web page content (except home page). This bar reflected the full path from the home page.
9. **Normal location of hierarchical bar**. Hierarchical bar should be placed on the left corner of the content area for languages that read from left to right. And on the right corner of the content area for languages that read from right to left.
10. **First item on the hierarchical bar**. Starting the hierarchical bar with Home, Home Page, Main Page, <WBA_name> Home, or Home Icon. Don't start it with Top, Position, URL, <WBA_name>, "H" or other.
11. **Having a "Home" link**. Letting visitors to return back to the home page from any internal page by having a 'home" link [3].
12. **The most appropriate locations for "Home" link**. Incorporating a "Home" link in any of 3 different locations. The first choice is to incorporate this link as a first link in the horizontal or vertical navigation menu. The second is to incorporate "Home" link in the footer. This option is preferable when the main menu is horizontal and has a lot of links and we want to save the space to link to the main sections of the website. The third is when a website has a clickable hierarchical bar at the top of every web page. In this case, the bar already has a clickable "Home" link and visitors can use it to return to the home page.

13. **"Home" link on home page**. "Home" link shouldn't be put on the home page, or maybe put but make it inactive. By this technique, we save a click to the visitors and provide guidance that they are on the home page.
14. **Having a "Site map" or an "A-Z Index" link**. Including a 'Site map" link [4] or an "Index" link on the home page and every web page. There is an approach to have both hierarchical map and an alphabetical index. So, the site map provides a meaningful framework and helps novice users to understand the overall structure of the website. The index provides a means for expert users to locate specific topics without going through a fixed sequence of information. But one of them (a site map or an index) may be sufficient. When index is presented, it should be presented on the home page as a text link, not as a horizontal list of letters from A to Z.
15. **Locations of the 'Site map" or the "A-Z Index" link**. Placing the "site map" link or the "A-Z Index" link on the footer (more common) or on the right top, near the search bar.
16. **Clickable elements in the site map page or in the index page**. The elements in the site map page and/or in the index page should be clickable, to enable the visitors to go to the wanted pages.
17. **Descriptive title for vague image link**. Helping the visitors to predict where they might go by using title attribute for some text and image links. For instance, a link within content and doesn't say too much about where it is going, an image which doesn't give any guidance about its destination. Using title attribute to provide additional information, not to duplicate content. If it is obvious where the link leads, don't use the title attribute.
18. **Identification of clickability**. Styling clickable elements so that web visitors don't confuse which elements are clickable and which are not. For example, when visitors hover over a text link, mouse's pointer changes to the hand Icon, link

turns to a different color, turns to uppercase, or increases font size, or underlining. Changing mouse's pointer to the hand Icon may be not sufficient. Combining this with another effect.

19. **Don't incorporate inactive links or links to blank pages**. If a web page is not ready for launching yet, then don't link to it. Some links take the visitors to blank pages or pages containing "under construction", "coming soon", not yet available", "in development", or similar notice. Other links reload the same page, and sometimes, nothing happens. These cases increase the work for the visitors and provide no benefit.
20. **Avoid text link duplication**. Limiting the number of link appearance on the page to one. Two links with the same link text always point to the same address. There is no need to duplication [18]. Instead of putting a link on different places on the page, just put it on its standard or more common place. Some designers use the footer to only repeat the main navigational items. The footer should be linked to additional information.
21. **Minimizing horizontal scrolling**. Most web visitors don't like to scroll horizontally. They can scan the pages faster from top to bottom rather than from left to right [3, 18].

3.2 Searching Guidelines

Searching is another mechanism that can be used to effectively retrieve the desired information and avoid browsing [5]. It has great importance, especially in the case of large applications. The following is a suggested set of quality guidelines that can be considered to add searching facility on the web pages:

1. **Adding a search facility whether a website has a good navigation system or not**. Internal searching is helpful and nice if the website has simple, clear, and

logical navigation. It is crucial in the case of heavy content WBA with many pages that can't all be listed easily together and are likely to grow in the future.

2. **Searching shape on home page**. Designing searching as a bar that consists of an input field and a submit button [18]. This shape is more understandable and easily recognizable than a linked text, a magnifying glass icon, an input field without a submit button, or even an input field with a text link instead of the button.
3. **Placement of the search bar**. Placing the search bar in the upper right corner for languages that read from left to right [1] and in the upper left corner for languages that read right from right to left.
4. **Position of the submit button regarding the input field**. Positioning the submit button immediately to the right of the input field for languages that read from left to right [18]. And positioning the submit button immediately to the left of the input field for languages that read from right to left.
5. **Small space between the input field and submit button**. Leaving a small space between the input field and the submit button. Don't stick them.
6. **Input field and submit button should be adjusted**.
7. **Label of submit button**. Labeling the submit button something meaningful and intuitive such as "Search", "Go", or "Find". Phrases like "OK", "Take Me There", "Start" or "Submit" tend to mislead web visitors.
8. **Color of input field**. Input field color should be white. White input field seems to be the standard. If the background behind the search bar is white or light, putting a border for the input field to be recognizable or setting a background to the search area.
9. **Color of submit button**. Giving the submit button a vivid color to be spotted. Vivid color like orange, red, blue, turquoise, or any color which fits with the used color scheme.

10. **Size of submit button**. Submit button shouldn't be very small. Designing it in a suitable size.
11. **Default words on input field**. If the input field has default words, they should disappear when the visitors put the mouse inside it.
12. **Clickability of submit button**. Identifying the clickability of the button by changing the mouse's pointer to the hand icon, or changing the border color, or both.
13. **Font size inside the input field**. Font size inside the input field should be readable [18]. When the researchers visited Morgridge Center for Public Service's website (www.morgridge.wisc.edu) they found that the font size inside the input field was very small, and they couldn't read what I typed.
14. **Magnifying glass**. Using a magnifying glass to communicate the function of the search element. The determination of the suitable location of it is left to the designer. It can be put to the left or right in the input field, on the right edge of the input field, or near the submit button. It can be also used as a submit button. In this case, it should be placed in the appropriate location as a submit button.
15. **Searching execution**. Making the search executable by either pressing the enter key within the input field or clicking the submit button.
16. **Searching available from all web pages**. Putting the search bar on all pages, or at least putting it only on the home page, and including a text link to the search page from the interior pages.

3.3 Legibility Guidelines

Legibility is the ease of reading. Reading on screen is difficult in nature. Web developers should be aware of some features that affect the ease of reading. Examples of these features are the contrast between foreground text and background

color, font type and size, and length of text lines. The following guidelines can be followed to increase the legibility of WBA:

1. **Running text and dancing images**. Letting the visitors read the text in peace and quiet by keeping the text static. Some web designers use running text as a way to highlight news and other important events. Running text is presented on the home page, in text fields or list boxes. In this way, a lot of text can be displayed in a little space. Designers also believe that running text, dancing images, or dancing text make the page fanny and cool. In fact, running text is a negative design element. It is difficult to read. It is also a cheap effect, old fashion, and makes WBA look unprofessional. Running text gives the visitors a headache, especially when it is running in different directions. The worst is that, when running text doesn't pause when the mouse over hover it. In this case, the visitors must wait until the end to re-read a part that they missed.
2. **Font type**. Selecting font type carefully. Font type should be simple, easy on the eyes, and more readable on screen. Complicated and stylish fonts perhaps make the website visually attractive but offer poor legibility. The studies indicate that serif fonts are more readable in print while Sans-Serif fonts are more readable on screen.
3. **Short text lines as possible.** Keeping the length of lines as short as possible. Long lines, which take up most of the screen width, are hard to read. One or two long lines are still readable on the screen. The problem with big paragraphs which may be reaching 30 long lines and sometimes more. The worst is that, when scrolling (horizontally and maybe also vertically) is needed to read these lines.
4. **Font size**. Specifying font size that most website visitors, without disabilities, can read it on arrival without requiring to enlarge or reduce the size. The larger size is more readable but, at the same time, it makes the page appear not good and consumes the space which must be saved for content offering. 12 point is the most

commonly used font size for the text body. This size can be a little reduced for heavy content pages. It is also can be a little enlarged for pages that don't contain a lot of content.

5. **Using upper case text sparingly**. Uniformally of size and shape of capitals make them harder to read than lowercase letters. So, don't use capital letters for long text and for entire headings/titles. Capitals can be used for the first letter in headings/menu items [18].
6. **Italic** Avoid using italic for long text or for entire paragraphs. Italic fonts look bad, particularly at a small size.
7. **Sufficient contrast**. Ensuring that there is sufficient contrast between foreground text and background color [1, 3, 5, 9, 18]. Best legibility results can be obtained from a combination of dark color with light color. Examples of combinations that have good contrast are black and white, black and light blue, and yellow and dark blue. Examples of combinations that don't have good contrast are grey and white, red and orange, red and purple, green and yellow, and white and light blue. However, designers could use tools like "Color Contrast Check" to test different colors and contrast. There are two approaches for choosing the color of text and background. The former is to employ dark text on a light background. The second is to employ light text on a dark background. I personally prefer the former, especially black text on a white background because the white background is simple, clean, and elegant. It makes the content stand out and gives the visitors comfort in exploring. Without proper contrast, visitors can't read the text and they will leave.
8. **Text scannability**. Online people don't read, they scan. Arrange the content for scannability by several ways: breaking up long blocks of text into smaller paragraphs, beginning each paragraph with the most important idea, having lots of headings, using short phrases that read quickly, removing unnecessary words

or sentences, and using bulleted or numbered lists rather than dense passages of text when appropriate [4, 5, 9, 19].

9. **Text aligning and ragging.** Aligning text on the left, ragging it on the right, increase reading speed because the straight left edge helps to anchor the eye when starting a new line.
10. **Line height**. Paying attention to the line-height of the elements within the page [5]. The choice of a suitable line-height depends on the font type used, font size, word spacing, and length of line. For instance, the longer the line, the bigger we need to make the line-height.

4. The Evaluation Process

The proposed approach depends on a set of quality guidelines for three quality sub-factors of usability. These sub-factors are navigability, searching, and legibility. The evaluation process aims to evaluate the usability of a website according to the proposed quality guidelines. The evaluation process starts with selecting a set of websites and ends by analyzing and comparing the outcomes. As illustrated in figure (3), the evaluation process contains the following steps:

1. Selecting a set of websites for evaluation.
2. Collecting data and applying elementary evaluation.
3. Aggregating elementary values to yield satisfaction level for each guideline, then, for each sub-factor.
4. Aggregating satisfaction values of each sub-factor to yield total satisfaction level for usability.
5. Analyzing and comparing outcomes.

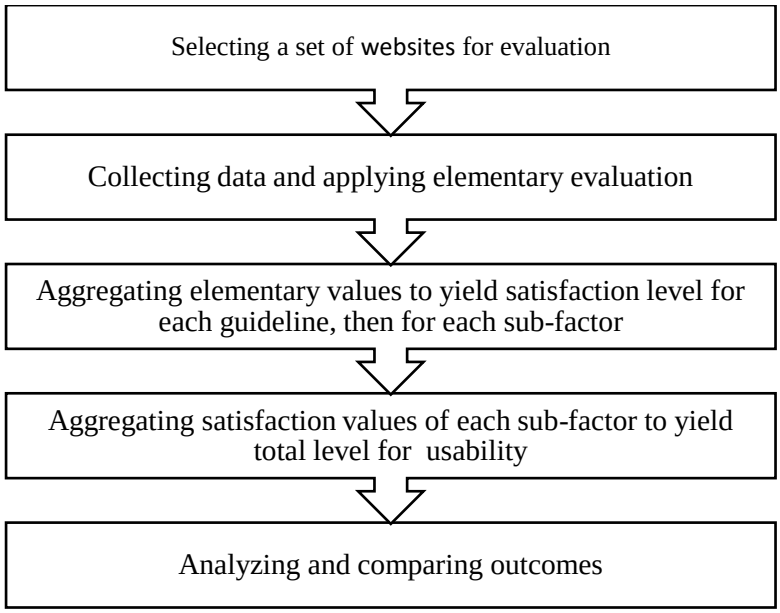

Figure (3): The Evaluation Process

4.1 Selecting a Set of Websites for Evaluation

Webometrics ranking of world universities is an initiative of the Cybermetrics Lab, a research group belonging to SCIC (Consejo Superior de Investigaciones Cientificas), the largest public research body in Spain. Cybermetrics Lab is devoted to quantitative analysis of the internet. Webometrics ranking is published twice a year (at the end of January and July months), covering about 20.000 higher education institutions worldwide [23]. The evaluation process is performed by selecting a sample of thirty websites that appeared in the final list of the July 2012 edition. The selected sample is shown in Appendix (A). This sample contains three groups namely: top group (ten websites of the highest rank), middle group (ten websites of the middle rank, and last group (ten websites of the least rank). What expected is that, top group will take higher rank in all examined sub-factors, then middle group

will take moderate rank, and then, last group will take the lower rank. If the outcomes of the evaluation process are as above, then our guidelines are valid.

4.2 Collecting Data and Applying Elementary Evaluation

The researchers began collecting data from these websites in spreadsheets using the predefined questions and their expected answers of the checklists. Each proposed guideline can be quantified by binary value. 0 denotes unsatisfactory situation. 1 denotes satisfactory situation. In collecting data and examining process the researchers found that there are three classes of questions, as follows:

- Class one: Some questions/features need to examine one page. Examples of these questions are: what is the shape of searching on home page?, what does hierarchical bar start with?, There is no problem in this class.
- Class two: Some questions/features need to examine some pages, and once the feature appears on one page, there is no need to examine the rest. Examples of these questions are: does websites contain running text or dancing images?, Also there is no problem in this class.
- Class three: Some questions/features need to examine a lot of pages or examine all pages for each WBAs to be accurate in our answers. Example of these questions is that: is searching available on all web pages?, For such questions, we examined number of pages, and concluded the answers.

4.3 Aggregating Elementary Values to Yield Satisfaction Level for each Guideline, then, for each Sub-Factor

After examining websites and collecting data in spreadsheets, a stepwise aggregation mechanism has been performed to yield the quality satisfaction level for each guideline, and then yield the quality satisfaction level for each sub-factor using a scale from 0 to 100%. This can be done by calculating the percentage of the cells

which contain 1 to the total number of cells. 0% denotes a totally unsatisfactory situation. 100% denotes a fully satisfactory situation. The values between 0% and 100% denote a partial satisfaction. In the following sub-sections, the researchers show some mentioned guidelines and the outcomes of the examining process for each sub factor.

(1) Evaluation of Navigability Guidelines

- Having a main navigation menu: All examined websites, in the three groups, have a main navigation menu except BPK in last group. So, percentages of satisfaction are 100%, 100%, and 90% for top, middle, and last groups respectively.
- Location of main navigation menu: U of I in top group and XNU in middle group have right vertical ones. TCC in middle group has a navigation menu with two columns. SPCE in the last group put the horizontal menu above the institute name. So, percentages of satisfaction are 90%, 80%, and 80% for top, middle, and last ten groups, respectively.
- Short sub-menus: HU in top group has long drop-down sub-menu and visibility of its end depends on the display size and screen resolution. TCC in the middle group has very long drop-down sub-menus. About TCC item contains more than sixteen sub items (see figure 6). Web users can't reach to its end even in higher resolution (1366 by 768). Dellarte and FSCC, in the last group, have also long drop-down sub-menus. So, percentages of satisfaction are 90%, 90%, and 80% for top, middle, and last ten groups, respectively.
- Having a "site map" or an "A-Z index" link: Six websites in top group either have a site map or an index or both. Five WBAs in the middle group (CIA, Hult, AC, TCC, VCC) have a site map. Two in last group (Dellarte and NTCB) have a site map. No one in the middle and last groups have an index. AIMS (middle) and LUC (last) have a XML site map which is supposed to be

processed by search engines. So, percentages of satisfaction are 60%, 50%, and 20% for top, middle, and last groups, respectively.

After examining each navigability guideline, in each group, we found that, our proposed guidelines are satisfied in the three groups. Top group has reached 80%, middle group has reached 65.24%, and last group has reached 60.48%.

(2) Evaluation of Searching Guidelines

- Adding a search facility: This guide is fully satisfied in the top group. All websites in this group have a search facility. Two websites (XNU and Sonoda) in the middle group and five WBAs (BPK, DCT, Dellarte, NTCB, and SJUT) in the last group don't have this facility. So, percentages of satisfaction are 100%, 80%, and 50% for top, middle, and last groups, respectively.
- Searching shape on home page: This guide is fully satisfied in top group. All websites in this group have a search bar consists of an input field and submit button. AIMS, and Hult, in the middle group, have an icon. WCCC, in the last group, has an input field only without a button or even a text link. So percentages of satisfaction for this edition are 100%, 60%, and 40% for top, middle, and last groups, respectively.
- Position of the submit button regarding the input field: All websites, in top group, have submit button on the right of input field. TCC, in middle group, puts submit button to the left of input field. All websites, in the last group, which have a submit button, put it on the right of input field. So, Satisfaction percentages are 100%, 50%, and 40% for top, middle, and last groups, respectively.
- Magnifying glass: Four websites (HU, SU, Penn, and MSU) in top group, and four websites (AIMS, Hult, AC, and ISDM) in middle group, and SPCE in last group, use a magnifying glass. So, Satisfaction percentages are 40%, 40%, and 10% for top, middle, and last groups, respectively.

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After examining each searching guidelines, in each group, we found that, our proposed guidelines are satisfied in the three groups. Top group has reached 85%, middle group has reached 55.63%, and last group has reached 37.5%.

(3) Evaluation of Legibility Guidelines

- Running text and dancing images: All examined websites, in top group, don't have running text or dancing images. XNU, in middle group, and SJUT, in last group, are websites which violate this guide. So, satisfaction percentages are 100%, 90%, and 90% for top, middle, and last groups, respectively.
- Text scannability: All pages, in all top websites, are scannable. A lot of pages, in middle group, have no headings, no numbered or bulleted lists, or even no colors, just big paragraphs, as in figure (4). Three websites (MAL, AIMS, and XNU) in middle group, and two WBAs (BPK and NTCB) in last group have unscannable pages. So, satisfaction percentages are 100%, 70%, and 80% for top, middle, and last groups, respectively.

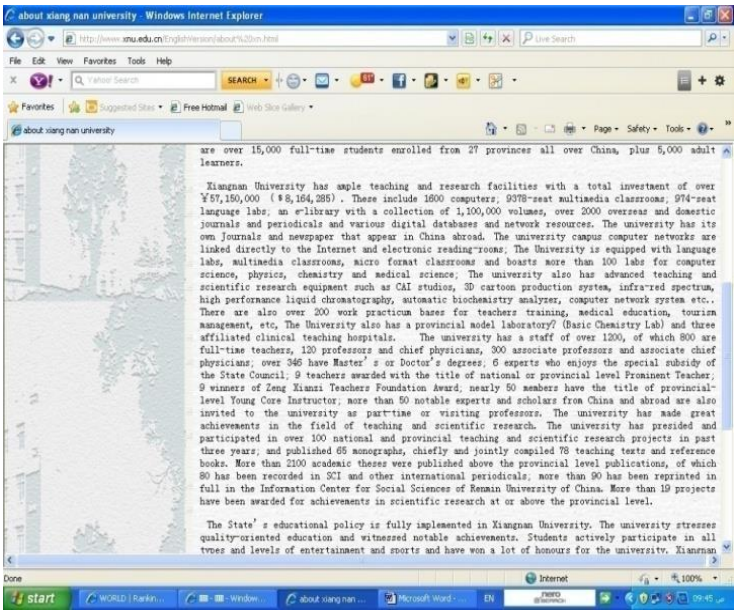

Figure (4): Unscannable Page

International Journal of Computers and Informatics, London Vol (3), No (8), 2024
https://doi.org/10.59992/IJCI.2024.v3n8p4 E-ISSN 2976-9361

- Text aligning and ragging: All websites, in the top group, have text aligning on the left and ragging on the right. Two WBAs (AIMS and XNU) in the middle group, and three in the last group (BPK, DCT, and SPCE) violate this guideline. So, satisfaction percentages are 100%, 80%, and 70% for top, middle, and last groups, respectively.

After examining each legibility guidelines, in each group, we found that our proposed guidelines are satisfied in the three groups. The top group has reached 94.17%, the middle group has reached 69.17%, and the last group has reached 71.67%. The partial outcomes of the evaluation process of the three quality sub-factors are shown in figure (5) which illustrates the level of satisfaction for each sub-factor in the three groups.

4.4 Aggregating Satisfaction Values of each Sub-Factor to Yield Total Satisfaction Level for Usability

In this step, the total satisfaction level for usability, with regard to each group, can be obtained. Figure (6) summarizes the final outcomes. Top group has reached 88.63%, middle group has reached 63.329%, and last group has reached 56.55%.

4.5 Analyzing and Comparing Outcomes

The process of examining thirty websites, from July 2012 edition of Webometrics ranking, has been finished and reached to partial and total satisfaction levels. The researchers analyze and compare the outcomes as follows:

- Regarding to navigability: Top group has ranked first and reached to 80%. Then the middle group has ranked second and reached to 65.24%. And then last group has ranked third and reached to 60.48%.

- Regarding to searching: Top group has ranked first and reached to 85%. Then the middle group has ranked second and reached to 55.63%. And then the last group has ranked third and reached to 37.5%.

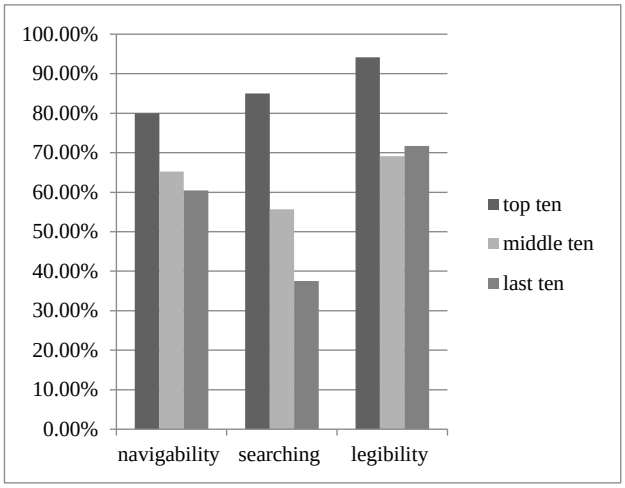

Figure (5): Satisfaction Level for each Usability Sub-Factor

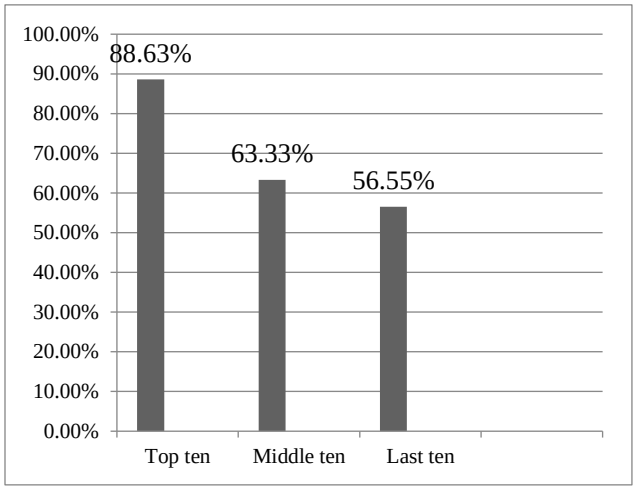

Figure (6): Total Satisfaction Level for Usability in each Group

- Regarding to legibility: The vast majority of legibility guidelines are satisfied in top group with high level. It may be surprising to find that last group has token a higher rank than middle group. We believe the reason is that last group didn't have a lot of content to examine. A lot of their pages were approximately blank. So, we didn't find long text lines, italic entire paragraphs, scannability problems, or contrast problems so much. While most pages in the middle group offered unscannable content, with long text lines and contrast problems what are debased the rank. The more noticeable bad feature that exists in last group and not exists in middle and top groups was running text and dancing images. Consequently, the top group has ranked first 94.17%. Then the last group has ranked second and reached to 69.17%. And then the middle group has ranked third and reached to 71.67%.

As a final remark and regarding all involved sub-factors. The top group has ranked first and reached 88.63%. Then the middle group has ranked second and reached to 63.329%. And then the last group has ranked third and reached to 56.55%.

5. Conclusion and Future Work

The researchers have concluded that it is very important to have web quality models. These models contain the desired quality considerations, serve as guidance to the development process, and can be used to evaluate website quality against a pre-defined set of requirements. They also concluded that special emphasis should be given to web quality guidelines. These guidelines provide some cues to web developers as how to assure quality and assist them to reduce the complexity of the web development process. Therefore, this paper aims to propose an approach for enhancing the usability of WBAs. The proposed approach depends on a set of quality guidelines for three quality sub-factors of usability, which are: navigability, searching, and legibility. The proposed approach can be used to evaluate the adherence to these guidelines and can provide the developers with weaknesses and strengths that can be analyzed to increase usability in later development activities.

Finally, an experimental study was done to provide evidence about the suggested guidelines. The experimental study was performed by selecting a sample of thirty WBAs that appeared in the final list of the July 2012 edition of Webometrics Ranking of World Universities. The objective of Webometrics is not to evaluate WBAs, their design, or usability. Webometrics ranks the universities from all over the world based on their web presence, impact, and academic excellence. In this work, the researchers examined extent of achievement or availability of the proposed web quality guidelines in the selected WBAs.

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