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Evaluation of Usage of University Websites in Bangladesh

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ABSTRACT

The study evaluates some selected university websites in Bangladesh from the usability perspectives. Two online automated tools, namely, html toolbox and web page analyser were used along with a questionnaire directed towards users of these websites. Tools were used to measure the websites' internal attributes which can not be perceived by the users such as html code errors, download time, and size of the html pages. The questionnaire was developed and designed based on the 23 usability criteria divided into five categories. Each category deals with one usability aspect. The study showed that users are not satisfied by overall usability level of these websites and few of them are satisfied with the available features. However, there are some weaknesses in some aspects of the design, interface, and performances. Websites' internal features are identified and suggestions are provided in the study to enhance the usability of these websites.

Keywords: Usability, web page analysis, website, internet, university websites

1. INTRODUCTION

The first electronic web service of the last century have spread across the globe in various shapes and changing the faces of many organisations. The new e-revolution is not only reducing the global divide but also transforming societies into knowledge-based society all over the world[1]. Shortly after the commercialisation of the internet, the multimedia component of the internet (web) experienced the phenomenal growth. As a part of this growth, businesses and individuals raced to place web pages and content on the web[2]. Recently, a proliferation of electronic websites with a tremendous amount of information either with high quality, or with low quality, as well as sites that are outright misleading are seen[3, 4]. The explosion of the web has determined the need of measurement criteria to evaluate the aspects related to the quality in use, such as usability and accessibility of a web application. The objective is to make the website useful, profitable, user linkable, and accessible[5]. Awareness of quality issues has recently affected every industrial sector[6]. A university with a website that is difficult to use and interact can make the university position lower. Therefore, it is important for any organisation to have the ability to make an assessment of the quality of their e-services to improve their offerings over time and benchmark against competitors and the best practices in any industry[7]. The web is playing a dynamic role in diverse application domains such as business, education, industry, and entertainment. The present study focuses on usability of some academic university websites in Bangladesh. Recently, more universities in Bangladesh are creating their own web pages to create awareness and promoting university services to the user community. As a result, there are increasing concerns about the ways in which websites are developed and the quality delivered.

2. USABILITY OF WEBSITES: BANGLADESH PERSPECTIVES

Developing a website should be passed through several design guidelines to ensure that the website can achieve the purposes and goals intended to be accomplished. Additionally, an organisation's website is a gateway to its information, products, and services. As such, it should ideally be a reflection of the needs of the clients it serves. Unfortunately, website design is often driven by technology, organisational structure, or business objectives, rather than by users needs. However, in recent years, website owners and developers have gradually begun to acknowledge and address the issue of usability.[8]

Based on the International Standards Organisation (ISO) definition of usability, Powell[9] defines website usability as "the extent to which a site can be used by a specified group of users to achieve specified goals with

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effectiveness, efficiency, and satisfaction in a specified context of use". Note that this definition applies equally well to webpage usability. It also implies that usability is user- and task-dependent, as well as being related to how well the user is able to accomplish what they set out to do, how efficiently the user can do this, and how satisfied the user is during and after the process.

Powell[9] also recounts Nielsen's[10] usability guidelines for determining the usability of a website:

Learnability—How easy it is to learn to use?

Rememberability—How easy it is to remember how to use?

Efficiency of use—How much work does user require to do?

Reliability in use—Does it work correctly and help user perform tasks correctly?

User satisfaction—Is the user generally satisfied as a result of using the site?

Likewise, McLaughin & Skinner[11] break usability down into six related but distinct components:

Checkability: The system has or allows checks that ensure the correct information is going in and out of it.

Confidence: Users have confidence both in their capability to use the system and in the system itself.

Control: Users have control over the operation of the system, particularly of the information fed into and out of the system.

Ease of use: The system is easy to use.

Speed: The system can be used quickly.

Understanding: The system and its outputs are understandable.

Several evaluation methods have been proposed to assess the usability of websites to suggest enhancements in the design of websites. Some methods are opinion of experts, while others are directed towards users. Such evaluation methods include questionnaires for extracting, recording, and collecting information to measure the user satisfaction with website usability[12, 13]. The usability of any website can be evaluated and determined using usability evaluation methods and techniques. Generally, any website should meet the needs of its various stakeholders.[14] Educational website users are mainly concerned with the following two major questions:

(a) Can the desired information be found easily in website?

(b) Can the information be found in timely manner?

The university websites in Bangladesh aim at providing up-to-date information and services to students, instructors, academic administrators, and other users in efficient ways. There are at present 88 public, private, and international universities in Bangladesh. Most of them have their own websites and 12 universities (8 private and 4 public) do not have any website[15]. Generally, usability studies of websites and particularly in academic websites are almost nonexistent. According to the Ranking Web of World Universities[16], Bangladesh University of Engineering and Technology (BUET) was the 26th position in top 100 South Asian universities and is the best among all public and private universities in Bangladesh.

However, global ranks of some universities in Bangladesh are Rajshahi University (71st); American International University, Bangladesh (83rd); East-West University (88th); Daffodil International University (92nd); Independent University, Bangladesh (98th); and North South University, Bangladesh (99th) in top 100 South Asian Universities. The research reported in this paper is intended to point out the strength and weakness of the usability aspects in the design of these academic websites, including interface, performance and effectiveness, content and organisation, and the educational purposes.The results are supposed to draw the attention of webmasters to overcome the limitations of these websites and improve their efficiency. This is the first time an effort has been made to usability analysis of some university websites in Bangladesh. This study may trigger more such research on this subject in Bangladesh and beyond.

3. LITERATURE REVIEW

There are many articles that discuss the effectiveness of websites from a usability standpoint. Many of these studies result from a need to evaluate a webpage based on information architecture rather than design attributes. Most studies involve the direct observation of students' performing a set of tasks and recording their ease or difficulty in doing so. The majority of studies agree that they are frustrated by confusing library terminology and an overwhelming amount of information. The present study focuses both the user's point of view and used automated tools to test usability of some academic websites in Bangladesh. However, as the use of the web has continued to grow, businesses have discovered that simply having a web presence no longer guarantees that an organisation's site will attract visitors.[2] As the dependency on web services increases, the need to assess characteristics with website quality and success increases. Websites characteristics are important; they have been a constant concern of research in different domains and they were widely studied in the e-commerce literature.[17]

Evaluations of the usability of websites have been conducted over the years and for many domains. For example, Akoglu[18] developed a special tool for assessing the usability of architectural department website in the University of Istanbul. The tool consisted of two parts: First part can be accessed by users where they visit and answer the questions about the website, and the second part was constructed for the use of administrator where he/she can manage the content of the usability evaluation. The evaluation was based on two environments: Traditional laboratory environment and internet environment. Battleson[19], *et al*. focused that usability testing is an invaluable tool for evaluating the effectiveness and ease of use of academic library websites. This article reviewed the major usability principles and explores the application of formal usability testing to an existing site at the University at Buffalo libraries. Nielsen[20] expressed that usability engineering is the most comprehensive and practical discussion of usability engineering and testing, covering the usability engineering life cycle from product conceptualisation to design and evaluation.

Kirakowski[21], *et al*. and Kirakowski[22] evaluated the user satisfaction with usability of five websites based on a questionnaire method. The authors developed a new questionnaire (named WAMMI) for the evaluation. The questionnaire showed that the evaluation of user satisfaction contributes to the successful development of websites. Harms & Schweibenz[23] used a combination of two methods of usability engineering for the web, namely, the heuristics method and the laboratory-test method with actual users involved in evaluating the usability of the Saarland Museum's website. The authors claim that this combination of methods provides good results, but it is costly in terms of time and resources. The results obtained from the evaluation led to the redesign of the Saarland Museum's website. With regard to academic websites, the research conducted by a group from the University of Maryland performed a usability evaluation for the master of information management (MIM) (part of the College of Information Studies at the University of Maryland, College Park) programme website to know whether their website meets the needs of its users. The methods focused on conducting user testing tasks and performed heuristics evaluation for these tasks. A set of recommendations were provided to guide future redesign of the website[24].

A similar case study was conducted by the Website Usability Testing Center at Wisconsin-Stout University to evaluate the usability of their University's website. The researchers used qualitative testing criteria such as navigation times through subject evaluations to assess the usability of the site. The study showed that the website suffers from several problems including website specific jargon, unorganised link patterns, confusing search engines, and poorly emphasised information. Based on the results of the evaluation the authors proposed a number of recommendations in order to improve and unify the university website[25].

The research by Chiew & Salim[26] focused on developing a web-based tool (called WEBUSE) which consists of 24-questions for evaluating the usability of websites. The report generated by the tool indicates how good is the website with respect to usability. The researchers claim that WEBUSE is suitable for the evaluation of all types of websites and for any domain. The tool can assist webmasters to improve their websites based on the response provided by the visitors of the intended websites.

Corry[27] , *et al*. conducted a usability evaluation of an existing Midwestern University Website. An analysis was conducted to restructure the information contained in the current Website; a prototype was developed and tested against the existing site. Usability was based on the ability of subjects (such as students, parents, and faculty) to quickly and accurately locates answers to a set of questions. While the study worked well, the metrics used to measure usability were limited to task completion time and the number of user errors.

Educational websites were also studied from many different perspectives. Zhang & Dran[28] developed a theoretical framework for evaluating website quality from a user satisfaction perspective. Others concentrated on some specific features of websites. For example, Lautenbach[29], *et al.* developed a framework to measure usability of websites, while Yoo & Jin[30] investigated and evaluated the design of university websites. Other researchers, while assessing the university websites took in consideration other features.

Pinto[31], *et al*. conducted a study on information provided by Spanish university websites on their assessment and quality processes. They analyse and evaluate the information provided by Spanish public universities on the web about their assessment and quality processes with the aim of detecting aspects for improvement and identifying best practices in universities that could act as a benchmark for the rest of the sector. The strengths and weaknesses of institutional websites were analysed at both individual level and as a whole; the possible relation between website quality and the characteristics of the universities was also examined.

4. RESEARCH OBJECTIVES

The specific objectives of the study were to:

- identify criteria for the evaluation of academic websites,
- investigate usability of some academic websites in Bangladesh with the identified criteria for the verification of validity, reliability, and usefulness, and

- find out the weakness of the university websites and give suggestions for improving the usability.

5. METHODOLOGY

In this study, two evaluation methods were used: Questionnaire and automated tools. Secondary sources of information were gathered through a comprehensive review of the relevant literature available on the internet.

5.1 Questionnaire-based Evaluation Method

In order to select the appropriate website evaluation usability criteria for the questionnaire-based evaluation method, the usability aspects in terms of user satisfaction, readability, navigation, and other aspects related to the websites of universities in Bangladesh were identified and analysed. The questionnaire was divided into two sections. The first section addressed the characteristics of participants, including: university name, internet and computer usage, age of participant, and the access frequency of participant university website. The second section included thirty questions that were used to evaluate the usability of some academic websites in Bangladesh. The questions were classified into five categories (Appendix 1):

(1) Content, organisation, and readability (Feature 1)

(2) Navigation and links (Feature 2)

(3) User interface design (Feature 3)

(4) Performance and effectiveness (Feature 4)

(5) Educational information (Feature 5)

Table 1 gives a list of selected universities whose websites are evaluated. After an extensive study[22, 27, 32-35] of related resources 23 websites usability evaluation criteria were identified as shown in Table 2.

5.2 Online Automated Tools

In another part of the evaluation, two automated evaluation tools were used to assess website usability, namely HTML Toolbox and Webpage Analyser. Since Websites are dynamic in nature, each item noted on the matrix was analysed within a day or so. Changes and new pages that appeared after the date of analysis were not included in the study. The first part of evaluation methodology was intended to focus on how to evaluate usability of the academic websites of the universities in Bangladesh from the user's perspective. However, usability evaluation methods that are conducted by human intervention (users and experts) can assess only the external attributes of the website (such as readability of the contents of the website) rather than its internal attributes (such as textual duplicates of links embedded in images). External attributes depend on the website and its usage, while the internal attributes of the website only depend on how the website has been designed and developed[36].

Table 1. List of selected university websites in Bangladesh

S. No.	Name of university
1.	Bangladesh University of Engineering & Technology
2.	Dhaka University
3.	Rajshahi University
4.	Shahjalal University of Science & Technology
5.	Bangabandhu Sheikh Mujib Medical University
6.	Bangladesh Agricultural University
7.	University of Chittagong
8.	Dhaka University of Engineering and Technology
9.	Khulna University of Engineering and Technology
10.	National University
11.	ASA University
12.	Bangladesh University of Business and Technology
13.	BRAC University
14.	Daffodil International University
15.	East West University
16.	North South University
17.	Stamford University, Bangladesh
18.	United International University
19.	Independent University, Bangladesh
20.	University of Liberal Arts, Bangladesh

Table 2. Usability evaluation features

S. No.	Usability features
1.	Display space
2.	Scroll left and right
3.	Accessibility
4.	Distracting or irritating elements
5.	Orphan page
6.	Placement and content of site map
7.	Information search
8.	Link colours
9.	Up-to-date information
10.	Download time
11.	Back button
12.	Open new browser windows
13.	Respond according to users' expectations
14.	Web advertising
15.	Follow real world conventions
16.	Hyperlink description
17.	Consistent design
18.	Use of colour
19.	Organisation of information
20.	Navigational aids
21.	Registration information
22.	Faculties information
23.	Instructors information

These internal attributes of the website can be assessed and evaluated using automated tools. In this part of the evaluation, two automated online tools were

used: Web Page Analyser[37] and HTML Toolbox[38]. The internal attributes that were measured include: Total number of HTML files on the page; total number of objects on the pages; total number of images; total size of images; browser's compatibility; and total number of broken and bad links

5.2.1 Web Page Analyser

Web Page Analyser is a free web-based tool provided by Website Optimisation. It can calculate page size (html page size, total image size, and total image number), composition, and download time for website. In this study, the following attributes were measured using this tool**:**

- Total number of html files
- Total html page size
- Total size of images
- Total number of images
- Total number of cascading style sheet (CSS) files
- Total size of CSS files

5.2.2 HTML Toolbox

HTML Toolbox is available from NetMechanic Inc. It identifies site problems and automatically repairs HTML code for the websites. This tool can assist in the evaluation process by measuring and identifying some of the internal attributes of a website. The internal attributes that were measured using this tool include: download time; HTML check and repair; and browsers compatibility.

6. RESULTS AND DISCUSSIONS

6.1 Results of Questionnaire-based Website Evaluation

For this survey, in early December 2010, some of the graduate students of selected universities were contacted randomly through e-mail and given an explanation of the study. Twenty university websites were selected for this purpose. To maximise the response rate, students were briefed that their responses would be completely anonymous and the data would only be used for the purposes of this study. A total of 200 users representing 20 different universities have participated in the e-mail-based questionnaire evaluation method and response rate was 75 per cent (150).

Statistical Package for Social Sciences (SPSS) software was used to compile and analyse the surveyed data. In general the users of these universities have access to the internet through central library, computer centre, and departments. Hence, they were asked to indicate the location from which they prefer to access the internet. Majority of the students (75 %) had internet access at the central library and other responded (25 %) refers to at home, cyber cafes, and others. Ages of most participants ranged between 18 and 25 years. All the respondents were graduate and from different disciplines. As of gender, 73 per cent of the respondents were males and 27 per cent were females.

Table 3 presents a summary of the results obtained from the questionnaire-based evaluation method. It reveals that the summary of the strongly dissatisfied, dissatisfied, fair, agree and strongly agree features of the websites by the users. Table 3 shows the five usability features which are mainly related to the external attributes of the academic web sites. Each of the features focus different attributes of the website including academic information, content, services, effectiveness and decoration. The usability feature Educational information (Feature 5) exhibits the highest evaluation value as (40.9 %) students are strongly agree with the features which is followed by User interface design (18.4 %) (Feature 3), Navigation and links (16.9 %) (Feature 2), Content, organisation and readability (11.3 %) (Feature 1) and the lowest one is Performance and effectiveness (9.0 %) (Feature 4). According to the 5-item scale the overall usability value for the websites is about 40.2 per cent which are strongly dissatisfied and 19.3 per cent are strongly agree with the features. In comparison, about 17.7 per cent of the respondents were not satisfied, 41.1 per cent judged these websites as being fair and 20.1 per cent are agreed with respect to usability. The overall gap sizes are high indicating that the website's features are not close to meeting users desired quality in all areas.

6.2 HTML Tool Box

In this part of the evaluation, two automated evaluation tools were used to assess website usability. The results obtained from HTML Toolbox are presented in Table 4 and those of Web Page Analyser are given in Table 5.

Table 3. Evaluation of websites by users

Features	Usability scale rate (%)				
	Strongly dissatisfied	Dissatisfied	Fair	Agree	Strongly agree
Content, organisation, and readability	45.0	16.7	6.1	20.9	11.3
Navigation and links	33.3	22.2	8.3	19.2	16.9
User interface design	29.0	13.1	8.1	32.4	18.4
Performance and effectiveness	36.8	20.9	12.9	17.5	9.0
Educational information	56.9	15.9	5.7	10.2	40.9
Total feature	40.2	17.7	41.1	20.1	19.3

Table 4. Results obtained from HTML toolbox

S. No.	University website	Elements to be measured		
		Load time (28 Kbps)(s)	HTML check errors	Browser compatibility problems
1.*	www.buet.ac.bd	65.57	20	8
2.	www.univdhaka.edu	71.64	28	20
3.	www.ru.ac.bd	12.70	7	14
4.	www.sust.edu	4.78	3	8
5.	www.bsmmu.org	734.01	26	12
6.	www.bau.edu.bd	680. 50	18	25
7.	www.cu.ac.bd	343.98	17	29
8.	www.duet.ac.bd	78.77	25	32
9.	www.kuet.ac.bd	298.79	9	8
10.	www.nu.edu.bd	29.60	16	10
11.	www.asaub.edu.bd	36.49	11	10
12.	www.bubt.edu.bd	50.56	9	13
13.	www.bracuniversity.net	28.51	34	5
14.	www.daffodilvarsity.edu.bd	26.36	25	31
15.	www.ewubd.edu	1.02	0	0
16.	www.northsouth.edu	163.63	55	21
17.	www.stamforduniversity.edu.bd	58.63	16	16
18.	www.uiubd.com	67.22	2	16
19.	www.iub.edu.bd	61.19	5	11
20.	www.ulab.edu.bd	15.29	17	24
	Average	**107.43**	**16.3**	**15.65**

Source: www.netmechanic.com (Browsed and calculated on 5 March 2011)

Table 5. Results obtained from Webpage Analyser

S. No.	University website	Elements to be measured					
		THF	THS (K)	TIS (K)	TNI	TCS	TCSSS (K)
1.*	www.buet.ac.bd	1	50	100	26	2	20
2.	www.univdhaka.edu	1	22.88	227	32	1	2
3.	www.ru.ac.bd	1	42	168.64	64	9	25.04
4.	www.sust.edu	1	13.28	112	16	1	8
5.	www.bsmmu.org		28.41	2535	11	2	12.76
6.	www.bau.edu.bd	1	22.12	2334	52	3	28.13
7.	www.cu.ac.bd	1	23.59	1182.53	11	1	0
8.	www.duet.ac.bd	1	16.50	253	20	2	7.48
9.	www.kuet.ac.bd	1	42	50	15	6	0
10.	www.nu.edu.bd	1	25.48	80	14	0	0
11.	www.asaub.edu.bd	1	17.76	223	15	2	11.75
12.	www.bubt.edu.bd	1	19.90	238	21	2	5.85
13.	www.bracuniversity.net	1	25	64	47	2	3.90
14.	www.daffodilvarsity.edu.bd	1	89.32	326	59	4	7.08
15.	www.ewubd.edu	1	105 Bytes	0	0	0	0
16.	www.northsouth.edu	1	110	126	21	2	8
17.	www.stamforduniversity.edu.bd	1	32.89	129	65	6	109
18.	www.uiubd.com	1	95.93	64.87	35	3	68.37
19.	www.iub.edu.bd	1	127	636.76	131	14	63.68
20.	www.ulab.edu.bd	1	154	64	3	1	1
	Average	**1**	**53.15**	**445.69**	**32.9**	**3.15**	**19**

Source: www.websiteoptimisation.com (Browsed and calculated on 12 March 2011) (All the result shows in bytes and converted in KB) Note: THF: Total # of HTML file, THS: Total HTML page size (KB), TIS: Total size of images (KB), TNI: Total # of images, TCSS: Total # of CSS files, TCSSS: Total size of CSSS files (KB)

Table 4 shows that the average download time for all websites is 107.43 second, and the average html check errors are 16.3, and the average browsers compatibility problems are 15.65. Each of the three evaluation measures is described as:

6.2.1 Load Time

Page load time depends on several factors such as: the size of the HTML file and any frames it references, the number and size of the images, the use of HEIGHT and WIDTH attributes with image and table tags, the number of servers that must be contacted to download files and images, and the speed of the user's modem. For the websites covered in this study, the average download time was approximately 107.43 s which exceeds 15 s, the recommended acceptable level. Very few of the universities have standard loading time, namely, Shahjalal University of Science & Technology (SUST), East West University (EWU), and University of Liberal Arts, Bangladesh (ULAB). Others universities might be attributed the large number and size of images some of these websites contain.

6.2.2 HTML Check Errors

These errors are places where the web page does not follow the rules for proper HTML coding. These problems may cause the page to display incorrectly under different browsers. As Table 4 indicates, there were 16.3 html code errors in the websites covered in this study. Some of these problems represent places where HTML tags or attributes are used that does not follow the latest HTML standard and may not be supported by all browsers.

6.2.3 Browsers Compatibility Problems

The measure, as assessed by the tool, shows how well the web page is displayed by different browsers. As Table 4 shows, 15.65 compatibility problems were found in the studied websites. This number represents problems which affect the website visitors.

6.3 WebPage Analyser of University Websites

WebPage Analyser is used to examine the internal attributes of the websites including HTML page sizes, total number of images, total number of HTML files and other relevant items of websites. Table 5 summarises the result obtained from the WebPage Analyser.

6.3.1 Average Number of HTML Files

The average number of HTML files for 20 web pages (including the main HTML file) is 1 which most browsers can multithread. Minimising HTTP requests is a key for website optimisation. The tool used indicated that such a value is appropriate.

6.3.2 Average Size of HTML Page

The average web page size is 53.15 KB (54425.6 bytes) which will load in 23.93 seconds on a 56 Kbps modem as show in Table 4.

6.3.3 Average Size of Images

The average image size is 445.69 K (456386.56 bytes) which is over the acceptable threshold, which is 100K. The tool issued a warning for such a value.

6.3.4 Average Number of Images

The average number of images is 32.9 which is not reasonable. Hence, the tool issued a warning for such a value.

6.3.5 Average Number of CSS Files

The average number of external CSS files is 3.15. Because external CSS files must be in the HEAD of an HTML document; these must load first before any body content displays. Although they are cached, CSS files slow down the initial display of the web page. The tool indicated that such a value is appropriate.

6.3.6 Average Size of CSS Files

The average size of external CSS files is 19 K (19456 bytes) which is less than the threshold value (i.e., 4080 bytes). This will fit into three higher-speed TCP-IP packets. The tool indicated that such a value is appropriate.

7. FINDINGS AND RECOMMENDATIONS

In this study, two evaluation approaches were used: questionnaire method and online automated tools. The results obtained from both approaches showed that the usability of the university websites in Bangladesh are not satisfied or students do not agree with the features. Study findings and recommendations are:

- In automated tool box, this study counted that the average download time was approximately 107.43 s which exceeds the standard levels. In order to improve this, it needs to reduce the number of servers connected to the sites and reduce some of the images that occupy large places.
- Errors are places where page does not follow the rules for proper HTML coding. These problems may cause page to display incorrectly under different browsers. There were 16.3 html code errors in the websites covered in this study and it needs to use good coding practices. Compatibility problems are places where it uses an HTML tag or attribute that is not part of the HTML 4.0 standard and may not be

supported by all browsers. The best way to view web site in various browsers is to download and install each one. However, not all may be compatible with operating system. Some of the tools, namely, Browser Shots, CrossBrowserTesting.Com, BrowserCamp and Adobe Browser Lab allow to view site in different web browsers, just as they would actually appear.

- The number of HTML files is appropriate for these websites and the total size of this HTML file is 54425.6 bytes, which is more than 50 K and not appropriate. Reducing photos, mp3, video, and web pages may make the size of HTML standard.
- As the size of images of these websites is not acceptable consider different graphic formats to achieve smaller file sizes (from JPEG to PNG for example). Finally, substitute CSS techniques for graphics techniques to create coloured borders, backgrounds, and spacing.
- The average number of images on these pages is 32.9 and there is a need to reduce this to a more reasonable number. Recommend combining, replacing, and optimising graphics. Replace graphic rollover menus with CSS rollover menus to speed display and minimise HTTP requests. Consider using CSS sprites to help consolidate decorative images. Finally, consider optimising parallel downloads by using different hostnames to reduce object overhead.
- The average number of external CSS files on this page is 3.15 and is appropriate. Because external CSS files must be in the HEAD of HTML document, they must load first before any BODY content displays. The average size of external CSS files is 19456 bytes, which is above 8 K and less than 20 K. For external files, ideally keep them less than 1160 bytes to fit within one higher-speed TCP-IP packet (or an approximate multiple thereof). Consider optimising CSS and eliminating features to reduce this to a more reasonable size.
- The study covered various aspects of usability, some of which have been meeting the user expectations. It has been pointed out that some features of evaluation have satisfied the users but most of the users (40.19 %) are strongly dissatisfied with the features of these websites. This finding suggests that website authority needs to focus on these categories for better usability of these websites by the users.
- Result of the content, organisation, and readability; navigation and links; user interface design; performance and effectiveness, and educational information categories are not satisfactory at the user's point of view of these university websites. The questionnaire-based evaluation findings reveals that these websites should be designed based on more content; incorporate more educational information; and priority should given for designing user friendly websites.

8. CONCLUSIONS

The present study showed in general that usability features of the university websites in Bangladesh do not have good features. At user end, it failed to meet the user demands and expectations. At the same time web-based diagnosis tools reveal that internal qualities of these websites are not ideal. University websites contain educational features which aim to provide the information and services to its stakeholders in different ways. To achieve these purposes, universities websites design should go through several design guidelines to ensure that users are more satisfied with the services provided by these websites.

By evaluating the usability aspects of these websites we can improve the usability of these websites. Universities webmaster should pay more attention to the universities web design and content to make them more attractive to the user community. This study has been exploratory and there is a scope for future usability research in this area.

It would be useful to carry out a more comprehensive study covering more institutions and more diagnosis tools to measure the usability of the university websites in Bangladesh. The present study findings open the door to further studies of this area in future.

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Appendix 1

Questionnaire on Usability Evaluation of the University Websites in Bangladesh

Usability features	Corresponding statement	SD	D	F	A	SA
Questions for evaluating content, organisation and readability (Feature 1)	a. This website contains most of my important topics and are up-to-date b. I can easily find what I want at this website c. The content of this website is well organised d. Easy to read website content e. Language is comfortable and familiar f. Need not scroll left and right at this website.					
Questions for evaluating navigation and links (Feature 2)	a. I can easily know where I am at this website b. This website provides useful cues and links c. It is easy to move around at this website by using the links or back button of the browser d. website links are well maintained and updated e. The website does not open too many new browser windows when I am moving around f. Placement of links or menu is standard throughout the website and I can recognise them					
Questions for evaluating user interface design (Feature 3)	a. This website's interface design is attractive b. I am comfortable with the colours of website c. This website contains no feature that irritates me such as blinking text and looping animations d. This website has a consistent feel and look e. It does not contain too many advertisements f. The design of the website makes sense and it is easy to learn how to use it					
Questions for evaluating performance and effectiveness (Feature 4)	a. Need not wait too long to download a file b. I can easily distinguish between visited and not visited links c. I can access this website most of the time d. Website responds to my actions as expected e. It is efficient to use this website f. This website always provides clear and usefulmessages when I do not know how to proceed					
Questions for evaluating education purpose (Feature5)	a. I can easily access the registration page and I can easily register for semester b. When I need to register, the website providesinformation about what the courses are offered and who is teaching the courses c. This website is regularly updated in terms ofpersonnel and course information in order to keep their information up-to-date d. I can easily contact with my instructors because it gives information about instructors' office location and hours, and e-mail addresses e. This website suffers from problems during registration process for students f. I know who I can contact for more informationabout anything in this website					

SD-strongly dissatisfied; D- Disagree; F-Fair; A-Agree; SA- Strongly agree