

JISTEM - Journal of Information Systems and Technology Management
Revista de Gestão da Tecnologia e Sistemas de Informação
Vol. 10, No. 2, May/Aug., 2013 pp.235-250
ISSN online: 1807-1775
DOI: 10.4301/S1807-17752013000200003

USING UNIVERSITY RANKING SYSTEMS TO PREDICT USABILITY OF UNIVERSITY WEBSITES

Layla Hasan

Department of Internet Technology, Zarqa University, Jordan

ABSTRACT

This research investigated whether a university ranking system called Eduroute could provide useful information regarding the usability of universities' websites. A comparison was conducted between the results obtained by Eduroute regarding the ranking of the top three universities in Jordan, and the results obtained by the heuristic evaluation method regarding the usability of the top three universities' websites. Before employing the heuristic evaluation method, two steps were taken: Investigating the most frequently visited pages on a university's website from the viewpoint of 237 students, and developing a set of comprehensive heuristics specific to educational websites. Then, five heuristic evaluators were selected and asked to visit all the pages determined by the 237 students using the developed heuristics while evaluating each website. The results proved that the ranking of the three universities at Eduroute was an indicator regarding the overall usability of the sites; the first ranked university at Eduroute had the lowest number of usability problems identified by the evaluators, while the least ranked university had the largest number of usability problems. The heuristic evaluators also identified fourteen common usability problems on the three tested websites related to navigation, design, content, and ease of use and communication.

Keywords: Usability, university ranking system, Eduroute, Jordan, heuristic evaluation, educational websites.

1. INTRODUCTION

Academic institutions (i.e. universities, colleges) were among the early developers of websites to present themselves on the Internet (Astani & Elhindi, 2008; Sandvig & Bajwa, 2004; Peterson, 2006). However, the aim of their websites differed over time due to technological advances, and the increasing number of Internet users. For example, in early 1990, university websites started as informational websites for various technological advanced departments aiming simply to have a presence on the

Manuscript first received/*Recebido em* 25/02/2013 Manuscript accepted/*Aprovado em:* 12/03/2013

Address for correspondence / *Endereço para correspondência*

Layla Hasan, Department of Internet Technology, Zarqa University, Zarqa 13132 Jordan, E-mail :
l.hasan2@yahoo.co.uk

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web (Peterson, 2006; Astani & Elhindi, 2008). Nowadays, academic websites become a vital part of academic institutions, and one of their most visible faces (Peterson, 2006). Therefore, the aim of the websites for the academic institutions has changed. Early research indicated that higher education websites aimed to: Recruit major stakeholders of academic institutions (i.e. prospective students, prospective faculty, alumni, parents) (Astani & Elhindi, 2008; Astani, 2003; Pierce, 2005), provide a cost effective, and timely communication with their stakeholders (Mentes & Turan, 2012), and provide a way to present their image on the Internet (i.e. academic offering, programs, services, students resources) (Astani & Elhindi, 2008; Astani, 2003; Mentes & Turan, 2012).

As the importance of academic institution websites has increased with the increasing number of academic websites, and number of Internet users, the importance of university ranking websites, which review, and rank university websites, has increased as well. In fact, university ranking systems are gaining importance for at least two main reasons. The first relates to the fact that they provide the educational seeker (i.e. prospective students, current students, prospective faculty, current faculty, parents, alumni, employers) with all the information they need about the universities in terms of quality of education, accreditation, and reputation of the universities. The second reason relates to the fact that they provide an impetus for academic institutions to perform better.

There are many university ranking systems, which are based on different indicators, i.e. quality of education, quality of faculty, faculty-student ratio, and rich files. Eduroute is one of the major university ranking systems, which evaluates quality of a university website, and its content. It was noted that earlier research employed usability methods, including heuristic evaluation, to evaluate the usability of educational websites (Astani & Elhindi, 2008; Noiwan & Norcio, 2000; Pierce, 2005; Kostaras & Xenos, 2007; Toit & Bothma, 2010). However, there is a lack of research which investigates the findings obtained from usability evaluation methods (i.e. heuristic evaluation) while evaluating the usability of educational websites, and which compares them with the results obtained from university ranking systems.

This research aims to investigate the possibility of predicting the usability of educational websites using a university ranking system called Eduroute. The main objectives are:

- To obtain the findings from the Eduroute system regarding the top three universities in Jordan, which had the highest ranking based on Eduroute indicators.
- To employ the heuristic evaluation method to comprehensively evaluate the usability of the top three universities in Jordan identified by Eduroute.
- To make a comparison between the results obtained by Eduroute, and the results obtained by heuristic evaluation method.

This paper is organized as follows. Section two presents earlier research which employed the heuristic evaluation method in the evaluation of the usability of academic institution websites. Section three provides a summary of the major university ranking systems together with their indicators. Section four presents the methodology used by this research. Section five presents the results. Section six presents the discussion, and finally section seven concludes the paper.

2. RELATED WORK

Usability is one of the most important characteristics of any user interface; it measures how easy the interface is to use (Nielsen, 2003). Usability has been defined as: "A measure of the quality of a user's experience when interacting with a product or system - whether a web site, a software application, mobile technology, or any user operated device" (Anonymous, 2006). Usability does not only evaluate website quality, but also provides managers with insights regarding potential problem areas on a website (Agarwal & Venkatesh, 2002).

Heuristic evaluation is an example of a common usability method related to evaluator-based methods, which include methods that involve evaluators in the process of identifying usability problems. It involves having a number of evaluators assessing the user interface, and judging whether it conforms to a set of usability principles, namely 'heuristics', (Nielsen & Molich, 1990).

Only a few studies were found in the literature that evaluated the usability of educational websites. For example, Astani & Elhindi (2008) employed the heuristic evaluation method to evaluate the usability of the top 50 colleges, and universities. The study was conducted by two experts who evaluated, and rated the sites (based on Likert-scale) against five characteristics: Information content, navigation, usability, customization and download speed, and security. The authors indicated that the tested websites had usability problems related to old content, and inappropriate layout, which made it difficult for users to locate the information of interest. The results showed that the tested websites need to make improvements regarding some issues, including: Navigation, usability, customization, and security

Noiwan & Norcio (2000) also evaluated and compared the usability of two Thai and two US academic websites, using web usability checklist that aimed to measure the usability indexes of the sites. The checklist was categorized into four major sections: Finding information, understanding the information, supporting user tasks, and presenting information. Each guideline of the checklist was presented as yes/no question. The results showed that the sites had several usability problems, including: Lack of a site map, old content, lack of navigational tools or site index that help students to find information on the sites, and inconsistency problems. The results also showed that the Thai websites have additional problems, such as: Ineffective internal search functions, and language problems (i.e. misspelled words).

Alternatively, Pierce (2005) employed user testing, and heuristic evaluation methods to comprehensively evaluate the usability of the Harvard University website. Nielsen *et al.* (1994)'s ten heuristics were used during the heuristic evaluation. The results identified several design problems on the site, related mainly to: Lack of navigational tools, inconsistency in navigation throughout the site (i.e. on some pages the home link opened the Harvard home page, while on other pages, the home link opened the home page of the current section (i.e. Harvard Library), and an inappropriate presentation of content on the home page (i.e. there is a lot of news information on the home page of the site).

Similarly, Kostaras & Xenos (2007) employed the heuristic evaluation method to evaluate the usability of the website of the Hellenic Open University using the ten usability heuristics suggested by Nielsen *et al.* (1994). The usability assessment was conducted by five evaluators; two were usability specialists while the other three were

experienced in heuristics evaluation. The results revealed that the heuristic evaluation method was an effective, and useful method which identified 38 usability problems, most of which were not previously detected. Examples of the usability problems that were identified on the website are: Lack of navigational support links (i.e. there is no links at the end of long pages to go back to the top of the pages), inconsistency problems (i.e. variation of font sizes were used), errors in the internal search function, inappropriate design of the menu (i.e. in some cases menus were too deep), inappropriate choice of color, and lack of site map.

Furthermore, Toit & Bothma (2010) investigated the usability of the website of an academic marketing department in the University of South Africa, using the heuristic evaluation method conducted by two expert evaluators. The usability guidelines which were used in the evaluation consisted of five categories: Content, organization and readability, navigation and links, user interface design, performance and effectiveness, and educational information. Toit & Bothma (2010) mentioned few examples regarding the usability problems that were identified on the tested website, which related to: Poor navigation, old content, and incomplete information regarding the modules of the department.

The studies outlined above proved the usefulness of the heuristic evaluation method regarding its ability to identify various types of usability problems on educational websites. They provided useful examples regarding various types of usability problems that could be found on educational websites from the viewpoint of evaluators.

3. INTERNATIONAL UNIVERSITY RANKING SYSTEMS

An investigation into university ranking systems using Google search in March 2011 for the phrases 'university ranking Jordan' resulted in identifying various systems. This section presents a summary of the major university ranking systems, and their indicators.

a) 4 International Colleges and Universities (4ICU): This is an international university ranking website (4ICU.org). Universities and colleges worldwide are ranked by 4ICU by the popularity of their websites. The ranking is based upon an algorithm including three unbiased, and independent web metrics extracted from three different search engines: Google Page Rank, Yahoo Inbound Links, and Alexa Traffic Rank (4 International Colleges & Universities, 2011).

b) Webometrics: The "Webometrics Ranking of World Universities" is an initiative of the Cybermetrics Lab, a research group belonging to the Consejo Superior de Investigaciones Científicas (CSIC), the largest public research body in Spain. Webometrics uses four indicators to rank universities, that were obtained from the quantitative results provided by the main search engines, as follows (Webometrics Ranking of World Universities, 2011):

- Size (S): Number of pages recovered from four engines: Google, Yahoo, Live Search, and Exalead.

- Visibility (V): The total number of unique external links received by a site, which can be only confidently obtained from Yahoo Search.
- Rich Files (R): After the evaluation of their relevance to academic, and publication activities, and considering the volume of the different file formats. These data were extracted using Google.
- Scholar (Sc): Google Scholar provides the number of papers, and citations for each academic domain.

c) *QS World University Rankings*: The QS World University Rankings are based on the data covering four key areas of concern for students: Research, employability, teaching, and internationalization. The rankings according to QS are determined based on six distinct indicators (The QS World University Rankings, 2011):

- Academic reputation: This indicator is based on an online survey distributed to academics worldwide.
- Employer reputation: This indicator is based on a global online survey distributed to employers.
- Faculty student ratio: This is the most globally available, and accessible measure of commitment to teaching.
- Citations per faculty: This is related to the citation of faculties' publications. The source used in this evaluation is Scopus, the world's largest abstract, and citation database of research literature.
- International students: This regards to simple evaluations of the percentage of international students.
- International faculty: This regards to simple evaluations of the percentage of international faculty.

d) *Academic Ranking of World Universities (ARWU)*: The Academic Ranking of World Universities (ARWU), commonly known as the Shanghai ranking, is published by the Center for World-Class Universities (CWCU), Graduate School of Education (formerly the Institute of Higher Education) of Shanghai Jiao Tong University, China. Universities are ranked by the ARWU using several indicators of academic or research performance, including alumni and staff winning Nobel prizes and field medals, highly cited researchers, papers published in Nature and Science, papers indexed in major citation indices, and the per capita academic performance of an institution. The indicators are (The Academic Ranking of World Universities, 2011):

- Quality of education: The total number of the alumni of an institution winning Nobel prizes, and field medals.
- Quality of faculty: The total number of the staff of an institution winning Nobel prizes in physics, chemistry, medicine, and economics, and Field medal in mathematics. The number of highly cited researchers in 21 subject categories is also considered.

- Research output: The number of papers published in Nature and Science between 2004, and 2008, and the total number of papers indexed in Science Citation Index-Expanded and Social Science Citation Index in 2008. Only publications of 'Article' and 'Proceedings Paper' types are considered.
- Per capita performance: The weighted scores of the above indicators divided by the number of full-time equivalent academic staff.

e) *Eduroute*: This system focuses on studying and evaluating university websites, and not the performance of a university. The indicators that are used in ranking the universities are as follows (Eduroute, 2011):

- Volume: This indicator measures the volume of relevant and comprehensive information published on the website of a university.
- Online scientific information: This relates to publications, and their number which are one of the major, and most important things that have to be taken into consideration when ranking a university.
- Quality of links and content: This ranking factor mainly measures the quality of links, and the quality of content published on the website.
- Links quantity: This is a measure of the number of incoming links whether these links are from academic or nonacademic websites.

4. METHODOLOGY

In order to select a university ranking system to conduct this research, and to make a comparison between its results and the results of the heuristic evaluation method, major university ranking systems were investigated together with their indicators (Section 3). The aim was to find a university ranking system, which considers quality of a university website through its indicators. It was found that *Eduroute* was the only ranking system which evaluates the quality of academic institutions' websites. It measures a university website in terms of four indicators including: Volume (20%), online scientific information (10%), quality of links and content (40%), and quantity of links (30%). *Eduroute* indicated that the first three indicators (volume, online scientific information, and quality of links, and content) measure quality of both content and navigation of a university website. It provides examples on issues that are usually considered while ranking a university website, such as: If the content of a university website is updated regularly; if a university website presents all the required information, and the degree of investments and efforts a university has put into its website. Therefore, *Eduroute* was selected since the issues it considers are similar to the usability issues included in many heuristic guidelines that are used to evaluate the usability of different types of websites, including educational websites. These issues are also included in the heuristic guidelines that were used in this research (Table1).

In order to evaluate the usability of the studied educational websites using the heuristic evaluation method, two documents were developed: Heuristic guidelines, and a list of tasks. The heuristic guidelines document includes a set of comprehensive heuristics specific to educational websites that was developed based on an extensive review of the literature (Agarwal & Venkatesh, 2002; Gonzalez *et al.*, 2008; Kostaras &

Xenos, 2007; Lencastre & Chaves, 2008; Nielsen, 2000; Toit & Bothma, 2010; Zhang *et al.*, 2000). The developed heuristics were organized into five major categories. Table 1 displays the categories, and the subcategories of the developed heuristics.

Table 1. The categories and subcategories of the developed heuristic guidelines.

Category	Subcategories
Navigation: Assesses whether a site includes main tools (i.e. navigation menu, internal search facility) and links which facilitate users' navigation through a site.	Navigation support; effective internal search; working links; no broken links; no orphan pages.
Architecture/organization: Relates to the structure of a site's information in which it is divided into logical clear groups, and each group includes related information.	Logical structure of a site; no deep architecture; simple navigation menu.
Ease of use and communication: Relates to the existence of basic information which facilitates communications with a university using different ways.	Quick downloading of web pages; easy interaction with a website; contact us information; foreign language support.
Design: Relates to the visual attractiveness of a site's design; the appropriate design of a site's pages, and the appropriate use of images, fonts and colors in the design of a site.	Aesthetic design; appropriate use of images; appropriate choice of fonts; appropriate choice of colors; appropriate page design; consistency.
Content: Assesses whether a site includes information that users require.	Up-to-date information; relevant information; no under-construction pages; accurate Information; information about the university; information about faculties; information about departments.

The -list of tasks- document includes ten tasks, which represent the pages students visit usually on a university website. Those pages represent the findings obtained from an analysis of a questionnaire that aimed to investigate the types of pages visited by 237 students on a university's website. The questionnaire was provided to students from various departments at one of the universities in Jordan as part of this research. The results found that the most frequently visited pages by students were: Academic calendar; university announcements / news; deanship of student affairs; student services; admission and registration; available courses (current and/or next); faculties; departments; study plans, and academic staff.

Five evaluators participated in this research; two usability specialist and three web experts. The evaluators were asked to visit all pages included in the list of tasks, and to use the developed heuristic guidelines, which presented in Table 1, while evaluating each website. The evaluators were asked to visit all pages related to all faculties, and their corresponding departments on each of the studied universities' websites. The evaluation was done independently by each evaluator, and completed over four months (May 2012 to August 2012).

The heuristic evaluators' comments on the compliance of each site to each heuristic principle were grouped together for each site, and categorized under the categories and sub-categories of the designed heuristic guidelines. Each heuristic sub-

category of each website was examined to identify problems with each site. These problems were classified, and similar problems were grouped together to identify common areas of usability problems on each website. These were examined to identify common areas of usability problems across the three websites. Consequently, fourteen problem sub-themes were generated, which correspond to four main problem-themes. The list of problem themes and sub-themes is explained in the results.

In order to determine the level of usability of the three studied university websites, and because of the fact that not all the university pages were investigated, a usability index was identified in this research, and calculated for the three websites. The usability index represent the number of usability problems found on a website divided by the average number of pages investigated on the site.

5. RESULTS

According to the Eduroute university ranking for the year 2011, the results indicated that Hashemite University, the University of Jordan, and Yarmouk University were the top first, second, and third universities, respectively. Based on the indicators used by Eduroute to rank universities, the results could indicate that generally the website of Hashemite University had the best overall design quality in terms of its content, and navigation compared to the websites of both the University of Jordan and Yarmouk University, while the website of Yarmouk University had the worst design quality compared to the other websites. The results also could indicate that the website of Hashemite University had the lowest usability problems compared to the other tested websites, while the website of Yarmouk University had the highest usability problems. Unfortunately, the author could not obtain any further information from the Eduroute website regarding the specific values of Eduroute's indicators for each of the tested websites.

The results obtained from Eduroute were consistent with the findings obtained from the analysis of the heuristic evaluation. Table 2 presents the findings of this research which showed that the usability index (as identified in this research) for the website of Hashemite University was the lowest, indicating that it has the lowest number of usability problems per investigated pages, while the website of Yarmouk University has the highest usability index compared to the other tested websites, indicating that it has the highest number of usability problems per investigated pages.

Table 2. Usability index for the three websites.

	Hashemite University	University of Jordan	Yarmouk University
No. of Usability Problems	4176	2926	3399
Average No. of Pages Investigated	1875	1129	1187
Usability Index	2.23	2.59	2.86

An analysis of the qualitative data obtained from the heuristic evaluators provided comprehensive and detailed comments regarding the common areas of usability problems that were found on the three university websites. Fourteen common

areas of usability problems were identified which suggested identifying fourteen problem sub-themes. These fourteen problem sub-themes suggested identifying four main problem themes based on the types of the identified problems. The four problem themes are related to: Navigation, design, content, and ease of use and communication. Tables 3-6 show the fourteen problem sub-themes grouped according to their themes, the description of each problem, and the number of usability problems identified on each website.

Five common navigational problems were identified on the tested websites, as shown in Table 3. The results show that large numbers of weak navigational support problems were identified on the websites of Hashemite University, and Yarmouk University. For example, it was found that these websites had pages related to various departments which did not have a navigational menu or links to go back to the corresponding department (i.e. programs page on the Hashemite University website, and study plan page on the Yarmouk University website).

The results also show that the three websites had usability problems related to misleading links. For example, the link related to the name of the chairman (for all the departments of Hashemite University) opened a page that was not expected by the evaluators; it opened a page that displays an introduction to the department instead of information about the chairman of the department. Also, the results show that the websites of Hashemite University, and the University of Jordan had large number of broken links, while the website of Yarmouk University had large number of orphan pages. Furthermore, Table 3 shows that all the websites had problems with the internal search functions related to the different universities' sub sites investigated during this research.

Table 3. Usability problems sub-themes related to navigation problem themes that were identified on the three websites.

Problem Theme	Problem Sub-Theme	Description of the Problem	Number of Usability Problems		
			Hashemite University	The University of Jordan	Yarmouk University
Navigation	Weak navigation support	A page did not have a navigational menu or links to other pages in the site.	278	17	333
	Misleading links	The destination page, which was opened by the link, was not expected by users because the link name did not match the content of the destination page.	218	98	453
	Broken links	The site had pages with broken links.	529	208	21
	Orphan pages	The site had dead end pages that did not have any links.	15	6	220
	Ineffective internal search	The internal search did not work properly.	3	4	6

Four common usability problems were identified on the tested websites regarding their design, as shown in Table 4. Table 4 shows that all the tested universities' websites had a large number of inconsistency problems. The large number of inconsistency problems that was found on the sites is related to inconsistency in the language interface. This is related to links at the English language interface, which opened pages that displayed content in the Arabic language, and vice versa. Other common inconsistency problems that were identified on the sites consist of: Inconsistency in the font case (capital and small), inconsistency in the font size, inconsistency in the font style (regular and bold), inconsistency in the content, and inconsistency in the alignment of the header.

Also, the results show that all the websites had a large number of usability problems related to an inappropriate page design. The common usability problems found on the websites regarding this area consist of: Ineffective text format on the sites' pages (i.e. information, figures, and tables were not aligned correctly); the existence of many pages without headings or with inappropriate headings, and having long, and cluttered pages on the websites.

Furthermore, the results show that all the websites had usability problems related to the images that were presented on their pages. The problems are mainly related to poor quality, and broken images. Finally, Table 4 shows that the websites of Hashemite University, and the University of Jordan had usability problems regarding pages with an inappropriate combination of background and font colors.

Table 4. Usability problems sub-themes related to design problem themes that were identified on the three websites.

Problem Theme	Problem Sub-Theme	Description of the Problem	Number of Usability Problems		
			Hashemite University	The University of Jordan	Yarmouk University
Design	Inconsistency	The site's design, layout, or content was inconsistent throughout the site.	418	360	294
	Inappropriate page design	A page did not clearly represent its content or it had an inappropriate design, such as being cluttered or had inappropriate headings.	1121	995	1039
	Problems with images	The site had images of poor quality, or it had some broken images on some pages (i.e. images were not displayed).	87	551	31
	Inappropriate choice of colors	The site used an inappropriate combination of background and link colors.	57	28	0

Table 5 presents the common usability problems identified on the websites regarding content. The results show that the websites of Hashemite University, and the University of Jordan presented outdated information on their pages. Examples on these pages include: News, announcements, events, and faculty members committee pages on Hashemite University website; and latest news, activities, and faculty council pages on the University of Jordan website. The results also show that all the websites had a large number of usability problems regarding irrelevant content that was presented on their pages. The common usability problems that were found on the websites regarding this type of problems related to: Missing information about the faculty members, and courses related to various departments of the tested websites, and also empty pages. Furthermore, the results show that the content of the tested websites was not reviewed carefully; many spelling, punctuation, and grammatical errors were found.

Table 5. Usability problems sub-themes related to content problem themes that were identified on the three websites.

Problem Theme	Problem Sub-Theme	Description of the Problem	Number of Usability Problems		
			Hashemite University	The University of Jordan	Yarmouk University
Content	Outdated content	The content of a page was outdated.	68	41	0
	Irrelevant content	The content of a page was not clear to users. For example, there was missing information about courses or faculty members. Also, pages displayed an unclear message, had repetitive content, or empty content.	1020	480	900
	Grammatical accuracy problems	The site's content was not free from errors. For example, it had spelling errors, grammatical errors, or punctuations were inaccurate.	290	50	15

Table 6 presents the identified usability problems on the three tested websites regarding the ease of use and communication. The results show that it was not easy to interact with the websites in order to visit some pages, such as course schedule page on the website of the University of Jordan. The results also show that Hashemite University, and the University of Jordan websites had problems related to the fact that they did not support the Arabic language. The language interface of the Hashemite University website including its 13 faculties, and their corresponding departments was written only in the English language. Regarding the University of Jordan website, it was found that most of its faculties (16 out of 18), and their corresponding departments were presented using only the English language. However, Yarmouk University website

presents the university faculties, and their corresponding departments using the English and Arabic languages.

Table 6. Usability problems sub-themes related to ease of use and communication problem themes that were identified on the three websites.

Problem Theme	Problem Sub-Theme	Description of the Problem	Number of Usability Problems		
			Hashemite University	The University of Jordan	Yarmouk University
Ease of Use and Communication	Difficult interaction with a website	It was not easy to visit pages or to find information on the site.	8	3	35
	Not supporting more than one language	The site did not display its content in languages other than English.	64	85	0

6. DISCUSSION

This research addressed a gap noted in the literature regarding the use of a university ranking system (Eduroute) to predict the potential usability of educational websites. This research proved that the results obtained from the Eduroute university ranking system regarding the order of the top three universities in Jordan (for the year 2011) were indicators of the overall number of usability problems identified on the three websites. The website of the top first university in Jordan according to Eduroute had the lowest number of usability problems among the other two websites according to the heuristic evaluation method, whilst the website of the top third university had the highest number of usability problems.

The results of this research suggest an additional advantage for making educational websites usable. Research has offered some advantages that can be gained if the usability of educational websites is considered or improved. Lencastre & Chaves (2008) indicated that addressing the usability of educational websites could help students to enjoy the learning experience, increase students' confidence, and encourage students to use the website. This research proved that considering the usability of educational websites could improve the ranking of a university website at one of the major university ranking systems (Eduroute). It is suggested that educational institutions could conduct usability studies in order to improve the usability of their websites and therefore to obtain the advantages of usable educational websites.

Despite the fact that this research concerned with comparing the results obtained from a university ranking system to the results obtained from a famous usability evaluation method (heuristic evaluation), it offered usable results regarding common types of usability problems that could be found on educational websites, which is comparable to the results obtained from earlier research. Earlier research, which evaluated the usability of educational websites using the heuristic evaluation method, provided examples of the usability problems that could be found on such websites, as summarized in Section 2. These problems related specifically to: Outdated content, lack

of navigational support links/tools, inconsistency problems (i.e. font size), ineffective internal search functions, some language problems (i.e. misspelling words), an inappropriate page design, and incomplete information. These were confirmed by the results of this research. Specific examples of problems identified in this research were discussed in Section 5. This research also provides other types of common usability problems that could be found on an educational website, based on the qualitative data obtained from the heuristic evaluators who investigated a large number of pages on the three studied universities' websites. These usability problems include: Misleading links, broken links, orphan pages, problems with images, irrelevant information, difficult interaction with a website, and a lack of support to the Arabic language.

These results, together with the results obtained from earlier research, provide useful information to educational institutions regarding common types of usability problems that could be found on their websites. These issues should be taken into consideration, and should be investigated, and improved in order to improve the overall usability of educational websites, and therefore to obtain the advantages of making educational websites usable.

7. CONCLUSIONS

The importance of university ranking systems is well recognized by academic institutions, and their stakeholders (i.e. students, faculty, community) since they represent a useful source of information about the performance of universities (i.e. quality of education, citation per faculty). This research investigated the possibility of predicting usability of educational websites using a university ranking system called Eduroute. It employed the heuristic evaluation method, which comprehensively evaluated the usability of the top three universities' websites in Jordan identified by Eduroute. Then, a comparison between the results obtained by the heuristic evaluation method, and the results obtained by Eduroute was made.

The results showed that the ranking of the three websites was an indicator to the overall usability of the sites; the first ranked university at Eduroute had the lowest number of usability problems per investigated pages, while the least ranked university had the largest number of usability problems. The results also described fourteen common usability problems that could be found on a university website, which related to four problem themes that were identified in this research, and related to: Navigation, design, content, and ease of use and communications.

This research has implications for research and practice.

Implications for research: This research is the first to investigate the possibility of predicting usability of educational websites using a university ranking system called Eduroute by making a comparison between the results obtained by Eduroute regarding the top three universities in Jordan, and the results obtained by the heuristic evolution method. This research offers a base for future research. Future research is needed to investigate the results obtained by Eduroute and the heuristic evaluation method using a large sample, which could be selected from different countries. Future research could also be conducted by considering other university ranking systems, which focus on the performance of universities (e.g. *Webometrics*, *QS World University Rankings*, *Shanghai ranking*) to investigate the usability of the top universities in these ranking systems.

Implications for practice: The results of this research have three implications for practice. The first concerned raising awareness among universities, specifically in Jordan, regarding the importance of considering the usability of their websites in order to improve the ranking of their university website in one of the major university ranking systems (Eduroute).

The second implication relates to the fact that the results of this research, which described fourteen specific types of usability problems identified on the three universities' websites in Jordan in terms of their type and number, are particularly useful for managers, designers, and/or evaluators of the three tested universities' websites. This is related to the fact that the detailed clarification of the fourteen problems shed the light on areas of usability weaknesses on the tested websites, and therefore could help managers, designers, and/or evaluators of the three tested universities in determining how effective their websites are as tools for online communication with their stakeholders. Such clarifications could also help and encourage them to fix the identified usability problems in order to improve the overall usability of their websites, enhance the effectiveness of their websites; and achieve the objectives of their universities (i.e. specifically those related to teaching and research).

The third implication relates to the fact that the results of this research could be important for other universities, which are willing to evaluate and improve the usability of their websites. The fourteen specific types of usability problems that were identified in this research provide guidance regarding website features that should be taken into consideration when designing and/or evaluating educational websites.

A limitation of this research is that only a small number of websites were selected; three Jordanian universities' websites, to conduct this research. As mentioned, further research should be conducted using a large number of universities' websites selected randomly from other countries.

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