Evaluating the Usability of Educational Websites Based on Students' Preferences of Design Characteristics

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Abstract: *This research investigated the relative importance of specific design criteria developed for the purpose of this research, in the evaluation of the usability of educational websites from the point view of students; it then evaluated the usability of nine educational websites based on students' preferences. The results showed that content and navigation were the first and second preferred design categories to be considered while evaluating the usability of educational websites, while the organisation/architecture was the least important category. Also, the results showed that there was a statistically significant difference between males and females regarding only one category: the content. Females considered this to be the most important category while males considered it as the second most important. By contrast, the results showed that there were no statistically significant differences between the students of the two selected faculties (the Faculty of Information Technology and Science, and the Faculty of Economics and Administrative Sciences) concerning the relative importance of the developed criteria based on their majors/specialisations. In general, the results showed that the majority of the students were satisfied with the usability of the Jordanian university websites. Specifically, the results showed the students were satisfied with the content and navigation (ease of use) of the tested websites, but dissatisfied with the design of the websites.*

1. Introduction

Usability is one of the most important characteristics of any user interface; it measures how easy the interface is to use [11]. 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" [2]. A variety of usability evaluation methods have been developed to evaluate human interaction with an interface; these aim to identify areas for improvements in the interactions in order to increase usability [4]. The usability evaluation methods could be categorised into three general categories based on how the usability problems are identified:

- User-based methods (user-testing methods): include a set of methods that involves users in the process of identifying usability problems. The aim of these methods is to record users' performance (using different types of observations) or satisfaction (using questionnaires and interviews) with the interface being tested.
- Evaluator-based methods: include methods that involve evaluators in the process of identifying usability problems. Heuristic evaluation is an example of a common usability method related to this category. It involves having a number of evaluators assess the user interface and judge

whether it conforms to a set of usability principles (namely 'heuristics') [9].

- Tool-based methods: involve software tools in the process of identifying usability problems. The software tools automatically assess whether a website conforms to a set of specific usability guidelines. Most of these tools assess the quality of the HTML code of a website with regard to a number of guidelines.

Heuristic evaluation and user testing methods are two of the most frequently used methods for assessing website usability as observed by Kantner and Rosenbaum [5].

Research has offered some advantages that can be gained if the usability of websites is considered or improved. Agarwal and Venkatesh [1] and Nielsen [10] indicated that addressing the usability of sites could reduce the number of errors, enhance accuracy, and encourage positive attitudes toward the target interface. Furthermore, researchers 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 [7].

Despite the importance of making educational websites usable, few studies were found in the literature that evaluated the usability of such sites, including Arabic websites [8, 15]. The studies that were found stressed the importance of usability in the

design of educational websites and provided an outline of the design features that are important and that need to be included in the design of educational websites [3, 6-8, 12, 15]. However, these studies did not investigate, and therefore consider, the relative importance of the design features in the usability of educational websites from the viewpoint of students. It is worth mentioning, however, that research has been conducted which has investigated the relative importance of design features for the usability of different types of website, such as: an e-commerce site [13]; portals and search engines, retail, entertainment, news and information, and financial services [14]; online bookstores, automobile manufacturers, airlines and car rental agencies [1]; financial, e-commerce, entertainment, education, government, and medical [17] from the viewpoint of users. However, no research has been conducted specifically to investigate educational websites. The research described here aims to address the gap noted in the literature by evaluating the usability of nine Jordanian university websites. It has used design criteria that were specifically developed for the purpose of this research after taking into consideration the relative importance of the developed criteria for the usability of educational websites from the point view of students.

2. Related Works

2.1. Relative Importance of Design Issues

This subsection reviews studies that have investigated certain design criteria and shed light on the relative importance of design issues for different types of website from the point of view of users. For example, the study conducted by Pearson *et al*. [13] investigated the relative importance of five design criteria in the evaluation of the usability of an e-commerce site from the viewpoint of 178 web users. The objective of their research was to shed light on the criteria that influence successful web design, and to determine if gender has an impact on the relative importance of these usability criteria. The criteria related to navigation, download speed, personalisation and customisation, ease of use, and accessibility. The results showed that these five criteria were significant predictors of website usability from the point of view of website users. Ease of use and navigation were the most important criteria in determining website usability, while personalisation and customisation were the least important. It was also found that males and females viewed these web usability criteria differently. The two usability criteria, navigation and ease of use, were found to have significant differences based on gender. Females placed greater emphasis on both of these web usability criteria than did males.

Similarly, Tarafdar and Zhang [14] investigated the influence of six web design issues on the usability of websites using different criteria related to information content, ease of navigation, download speed, customisation and personalisation, security, and availability and accessibility. The investigation was carried out by two web users only who evaluated a total of 200 websites using the six design factors. These sites were selected from five different domains: portals and search engines, retail, entertainment, news and information, and financial services (40 sites in each industry). Interestingly, the results showed that the four design factors that influenced website usability were: information content, ease of navigation, download speed, and availability and accessibility. However, the results showed that security and customisation did not influence a website's usability.

Agarwal and Venkatesh [1] also investigated the relative importance of evaluation criteria in determining the usability of web sites for two types of user (consumers and investors) across four industry sectors: online bookstores, automobile manufacturers, airlines and car rental agencies. The criteria related to the Microsoft Usability Guidelines (MUG), which includes five categories: content, ease of use, promotion, made-for-the-medium, and emotion. The results showed that content was the most important category in all eight groups (four industries, two types of user). The second category of ease of use was modestly moderately important across all eight groups.

Similarly, Zhang *et al*. [17] investigated user perception regarding the relative importance of website design features in six different website domains: financial, e-commerce, entertainment, education, government, and medical. The five most important features were identified for each of the domains. The results also showed that there were certain features equally important among different domains. For example, the results indicated that an ease of navigation feature was a must-have for all six domains, while search tool was commonly ranked by the following four domains as important: education, government, medical, and e-commerce. The results showed that education and medical domains required comprehensiveness of information which was not ranked within the list of the five most important features in the other four domains.

Alternatively, Zhang and Dran [16] presented a two-factor model that can be used to distinguish website design factors into two types: namely, hygiene and motivator factors. Hygiene factors are those whose presence makes a website functional, useful and serviceable, and whose absence causes user dissatisfaction (i.e. live/broken links). Motivator factors, however, are those whose presence will enhance users' satisfaction with the website and motivate them to return, while their absence will leave users feeling neutral, but not necessarily dissatisfied, as long as the fundamentals or hygiene factors are in place (i.e. the use of multimedia). Participants of the study were asked to distinguish web site factors into

hygiene and motivator factors in the context of CNN's website. The clearly identified hygiene categories include: technical aspects, navigation, and privacy and security, while the clearly identified motivator categories include: enjoyment, cognitive outcome, and credibility. However, the results indicated that eighty-six percent of the participants believed that website types do affect the way they judge hygiene or motivator factors. For example, the participants specifically commented that they expected educational websites to have accurate, factual, nonbiased, and richer materials.

2.2. Evaluating the Usability of Educational Websites

This section summarises earlier research that evaluated the usability of educational websites using different types of usability method. In fact, nearly all the studies that evaluated the usability of educational websites employed either user-based (i.e. user testing) or evaluator-based (i.e. heuristic evaluation) usability evaluation methods. For example, Gonzalez *et al*. [3] evaluated the usability of academic websites in the Spanish-Speaking Context of Use (SSCU) through the heuristic evaluation and cognitive walkthrough methods. A specialised software tool was developed based on heuristic evaluation techniques to support the usability evaluation of SSCU; this was used to evaluate the usability of 69 academic websites. The defined heuristics consisted of twenty-five questions related to four categories: design, content, navigation and search. The evaluation team which carried out the usability evaluation comprised two usability experts and two advanced students with solid knowledge of heuristic evaluation. The results showed the feasibility of applying both the specialised software tool and the particular cognitive walkthroughs while evaluating academic websites.

Kostaras and Xenos [6] also employed the heuristic evaluation method to evaluate the usability of the website of the Hellenic Open University. The usability assessment was conducted by five evaluators; two of these were usability specialists while the other three were experienced in heuristics evaluation. The heuristics used were the set of ten usability heuristics suggested by Nielsen *et al*. [9]. The results revealed that the heuristic evaluation method was an effective and useful method which identified various usability problems most of which were not previously detected.

Similarly, Papadopoulos and Xenos [12] evaluated the usability of the new version of the Hellenic Open University (HOU) website using heuristic evaluation by employing Nielsen's ten usability rules [9] and performance measurement (user testing). The evaluation was performed by experts and regular users (students of the HOU). The combination of the two evaluation methods identified several usability

problems that had not been traced in the website's development phase and revealed users' lack of satisfaction with the website.

Furthermore, Toit and Bothma [15] 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 were adapted from an earlier research study [8] and consisted of five categories: content; organisation and readability; navigation and links; user interface design; performance and effectiveness; and educational information.

However, Lencastre and Chaves [7] employed a questionnaire method aimed at students in the evaluation of the usability of an educational website used by Masters Degree students at Minho University, Portugal. The evaluation was conducted by asking five students from the Masters course to reply to a questionnaire. This consisted of 49 questions divided into seven categories: visual clarity, navigation, content, control, feedback, errors, and consistency. The questionnaire was designed to gather data about students' reactions to and perceptions of the educational website.

The study conducted by Mustafa and Al-Zoua'bi [8] was similar to the study conducted by Lencastre and Chaves [7] in the sense that they too employed a questionnaire specifically to evaluate the usability of educational websites (the websites of nine Jordanian universities) which was also aimed at students (252). However, Mustafa and Al-Zoua'bi [8] employed two online automatic tools **(**html toolbox and web page analyze**)** to measure the internal attributes of the websites which could not be perceived by users, The questionnaire was developed and designed based on 23 usability criteria divided into five categories: content, organisation and readability; navigation and links; user interface design; performance and effectiveness; and educational information. The results showed that the overall usability level of the studied websites was acceptable. However, there were some weaknesses in some aspects of the design, interface and performance. The usability category content, organisation and readability exhibited the highest evaluation value, followed by the category of navigation and links; both were rated "good" according to the scale that was used. The other three categories (i.e. educational information, user interface design, and performance and effectiveness) were rated "moderate". The results obtained from the studies mentioned above proved the usefulness of employing heuristic evaluation and user testing methods in the evaluation of educational websites.

The literature outlined above shows that research which investigated the relative importance of design issues or criteria in the evaluation of the usability of different types of website from the viewpoint of users,

did not specifically concern educational websites. The literature considered above also shows that research which evaluated the usability of educational websites investigated the extent of the tested websites' conformance to specific design issues. However, these studies did not investigate the relative importance of the design criteria used in their evaluation from the viewpoint of students before the evaluation.

3. Aims and Objectives

The aim of this research is to investigate the relative importance of specific design criteria in the evaluation of the usability of educational websites from the viewpoint of students and, based on students' preferences, to evaluate the usability of nine Jordanian university websites.

The specific objectives for the research are:

- To develop evaluation criteria for assessing the usability of educational websites.
- To ask students to judge the relative importance (weights) of the different categories of the developed usability criteria.
- To determine if gender has an impact on the relative importance of the developed usability criteria.
- To determine if students' majors/specialisations have an impact on the relative importance of the developed usability criteria.
- To ask students to provide ratings for nine Jordanian university websites on the developed usability criteria and their categories.
- To use the weights and ratings together to assess the overall usability of each Jordanian university website.

4. Methodology

4.1. Research Instruments

Usability criteria for assessing the usability of educational websites were developed based on an extensive review of the literature [1, 3, 6-8, 10, 12-15, 17]. Section 5 presents the categories and subcategories of the criteria.

In order to collect information regarding the characteristics (demographic information) of students who participated in the research, a pre-test survey was developed. In order to achieve objectives 2, 5 and 6 (i.e., obtaining the relative importance (weights) of the different categories of the developed usability criteria; obtaining the rates for the selected Jordanian university websites; and using the weights and ratings to calculate the overall usability of each Jordanian website), Agarwal and Venkatesh's [1] method for the assessment of usability that includes weights and ratings was adopted; based on this, two surveys were developed. The first survey (the relative importance survey) aimed to collect the relative importance

(weights) of the different categories and subcategories of the developed usability criteria by asking students to distribute 100 points across the five major categories of the criteria, and then to distribute the points assigned to each category across the corresponding subcategories (Appendix 1 presents two parts of the relative importance survey; part 1 which shows the instructions for assigning weights to the five main categories of the developed criteria, and part 2 which shows the instructions for assigning weights to the five subcategories of the one of the main categories- the navigation category). The second survey (the university ratings survey) was aimed at obtaining the ratings for every university website in terms of the various categories and subcategories of the developed usability criteria by asking students to provide ratings for each website included in this study.

4.2. Selection of the Websites

In order to select nine Jordanian educational websites, one of the major international university ranking websites was used; this was the 4 International Colleges and Universities (4ICU.org). Universities and colleges worldwide are ranked by 4ICU by the popularity of their websites. The list of Jordanian universities sorted by their web popularity, as provided by 4ICU for the year of 2011, was used to select the sample for this research. Nine of these websites which had the highest ranking were then picked out, as shown in Table 1. This number was chosen to keep the research at a manageable size for the students and researcher.

Table 1. The Jordanian universities included in the research.

	University	University Website	University Symbol
1	The University of Jordan	www.ju.edu.jo	U1
2	Petra University	www.uop.edu.jo	U2
3	Jordan University of Science and Technology	www.just.edu.jo	U3
4	Al Balqa Applied University of Science and Technology	newar.bau.edu.jo	U4
5	Mutah University	www.mutah.edu.jo/	U5
6	Al-albayt University	www.aabu.edu.jo/	U6
7	The Hashemite University	www.hu.edu.jo	U7
8	Yarmouk University	www.yu.edu.jo/	U8
9	Philadelphia University	www.philadelphia.edu.jo/	U9

4.3. Participants/Sample

The participants in this study were undergraduate students enrolled on twelve classes related to two faculties (the Faculty of Information Technology and

Science, and the faculty of Economics and Administrative Sciences) at one of the universities in Jordan. Six classes were selected from each faculty. The total number of students was 247; the number of males was 155, while the number of females was 92 (Table 2). 237 provided usable responses. Unusable responses, which were ten, were primarily related to incomplete information. In cases where some students were enrolled onto more than one of the classes included in the sample, they were asked to leave the session and to participate only once. Demographic information concerning the students is shown in Table 2. The students in each class carried out the procedure (Subsection 4.5) on three of the websites included in the sample. Each website was evaluated by four classes (two classes from each faculty).

Table 2. Demographic information of the research participants.

| | | Faculty | | |
		Science and Information Technology	Economics and Administrative Sciences	Total
Sex	Male	82	67	149
	Female	35	53	88
Computer Experience	< one year	0	4	4
	From one to three years	4	13	17
	> three years	113	103	216
Internet Experience	< one year	4	11	15
	From one to three years	20	40	60
	> three years	92	70	162
Frequently Use of Internet	Daily	101	84	185
	Weekly	13	24	37
	Monthly	3	6	9
	By semester	0	4	4
	Yearly	0	2	2

4.4. Pilot

A pilot study was conducted before the experiment/main test to test the method of assigning weights and ratings. Before conducting the pilot study, the surveys were translated into Arabic. The surveys were pilot tested using ten Jordanian undergraduate students using the Arabic language version. The pilot study identified some ambiguity in the surveys. Results from the pilot test were taken into consideration and minor changes were made to the surveys.

4.5. Procedure

All data collection sessions followed the same procedure. Data were gathered using five surveys in a university in Jordan where all students had access to the Internet. It is worth mentioning that the university from which the sample of students was selected was not included in the sample of the universities selected and evaluated in this research.

The session began with the researcher welcoming the students and explaining the objectives of the study; the number of websites that would be evaluated; the

number of surveys that needed to be filled in; and students' right to withdraw from the session at any time. The students were then asked to fill in the pre-test questionnaire in order to obtain information regarding their background and experience. Then, the students were asked to provide their perceptions of the relative importance (weights) of the developed usability criteria (5 categories) using the relative importance survey (Appendix 1). Following this, students were asked to distribute the points across the various subcategories. Before filling out the surveys related to the evaluation of three university websites (i.e. three university rating surveys), the students were asked to explore the website included in the first of the three surveys for a maximum of 10 minutes. Thus, one survey, the university ratings survey, was used to evaluate each of the three websites. After the exploration, the students were asked to fill in the survey for a particular website from the three test websites. This related to rating the website in terms of its compliance to the different categories of the developed usability criteria. The ratings were based on a seven-point rating scale (Likert scale). A similar procedure was followed by the students while testing the second and third websites. The order of the three websites (i.e. the three university ratings surveys) which were evaluated in each class/session was changed so that each website was tested fairly by all the students. The average time spent in conducting the session was one hour. All the evaluations were carried out in two weeks (during May 2011) to take into consideration the possibility that the sites included in the sample might change over time. The students were instructed to leave blank any criterion they were unsure of.

4.6. Analysis

The data collected were analysed in several ways. Descriptive analysis was used to analyse the data collected from the pre-rest questionnaire to describe the characteristics of the students. In order to find the relative importance (weight) for the developed criteria (the five categories and their corresponding subcategories) from the viewpoint of students, the average weight (relative importance) was calculated. Descriptive analysis (the mean and standard deviation) of the weights (i.e. the relative importance) of the developed criteria based on gender and faculty (major/specialisation) was carried out. To determine if there was a statistically significant difference in the relative importance of the web usability criteria based on gender and faculty, the one-way analysis of variance (ANOVA) was used for each category and the corresponding subcategories of the developed usability criteria.

In order to find out the ratings of the nine Jordanian university websites with regard to their conformance

with the subcategories of the developed usability criteria, Likert scores were calculated for each statement in the survey (the university ratings survey) for each website. A Likert score of 1-3 was regarded as a negative response, 5-7 a positive response, and 4 a neutral one. Negative statements identified a number of usability problems within the sites. The usability scores of the nine Jordanian university websites with regard to each subcategory related to the five categories of the developed usability criteria were calculated by multiplying the weight (the average of the subcategory) by the ratings of the site (the Likert score). Then, the usability scores of the related subcategories were added up for each website to produce the usability scores for each site with regard to the five major categories of the developed usability criteria. The usability score of the five categories related to each website were then added up to produce an overall usability score for each website.

Qualitative data obtained from students' responses to the open-ended questions in the surveys (the university ratings surveys) were taken into account in determining the usability of the tested websites (i.e. features on the site students liked and other features they disliked). Students' answers were translated into English from Arabic. Several usability problems were identified from the answers of students, as well as some good features.

5. Criteria for Evaluating the Usability of Educational Websites

Specific criteria for evaluating the usability of educational websites were developed based on a literature review. The developed criteria consisted of five main categories. This section presents the categories and their corresponding subcategories:

- **Navigation**: This assesses whether a site includes the main tools (i.e. navigation menu, internal search facility) and links which facilitate the navigation of users through a site, enabling them to reach the required information quickly. Research showed that navigation was one of the design factors that influenced website usability [13, 14, 17]. Navigation comprised five subcategories. These were: *navigation support*: Navigational links are obvious in each page so that users can explore and find their way around the site and navigate easily; *effective internal search*: Internal search is effective: e.g. it is fast, accurate and provides useful, concise and clear results which are easy to interpret; *working links*: Links are discernible, working properly and not misleading so that the user knows what to expect from the destination page; *no broken links*: The site has no broken links; and *no orphan pages*: The site has no dead-end pages.

- **Architecture/organisation**: This criterion relates to the structure of a site's information which should be divided into logical, clear groups; each group should include related information. Architecture/organisation consists of three subcategories. These are: *Logical structure of site*: The structure of the site is simple and straightforward; related information is grouped together; *not deep architecture*: Architecture is not too deep so that the number of clicks to reach goals is not too large, e.g. it does not require clicking more than 3 links; and *simple navigation menu:* The navigation menu is simple and straightforward.

- **Ease of use and communication**: This relates to the cognitive effort required to use a website [1], and to the existence of basic information which facilitates communications with the university in different ways. Research has found that ease of use is an important factor/issue in determining web usability [1, 13, 14, 17]. Ease of use and communication comprises four subcategories. These are: *Quick downloading of web pages*: The download time of the pages is appropriate; *easy interaction with a website*: Interaction with the website is easy for different groups of users, e.g. navigating through the site's pages is easy; returning to the home page from any page is easy; finding information is easy; *contact us information*: Useful information to enable easy communication with the university is displayed, e.g. contact us (e.g. name, physical address, telephone number, fax number, email details); and *foreign language support*: The site's content is displayed in different languages.

- **Design**: This 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 colours in the design of a site. Design comprises six subcategories: *Aesthetic design***:** The site is attractive and appealing so that it impresses the potential customer; *appropriate use of images*: The quality of images is adequate, there are no broken images, images make a contribution to the understanding and navigation of the site, image size is relevant so that it has minimal effect on loading time; *appropriate choice of fonts*: Font types are appropriate and easy to read; *appropriate choice of colours*: Choice of colours for both fonts and background is appropriate, the combination of background and font colours is appropriate; *appropriate page design*: Pages are uncluttered, page margins are sufficient, the page title is appropriate; and *consistency*: Page layout or style is consistent throughout the website: e.g. justification of text, font types, font sizes, colours, and position of the navigation menu in each page.

- **Content:** This assesses whether a site includes the information users require. Research stresses the importance of this factor and shows that it is one of

the most important factors that influence web usability [1, 14]. Content consists of seven subcategories. These are: *Up-to-date information*: The information is up-to-date, current and often updated; *relevant information*: The information is sufficient and relevant to user needs, e.g. content is concise and non-repetitive, terminology/terms are clear and unambiguous; *no under-construction pages*: There are no 'under construction' pages; *accurate information*: The information is accurate; *information about the university*: Basic facts about the university are displayed, e.g. university overview, higher management, academic calendar, registration, description, photographs, etc.; *information about the colleges*: Adequate information about the colleges is displayed, e.g. overview, department, specialisations, etc.; and *information about the departments*: Adequate information about the departments is displayed, e.g. overview, academic staff, outlines, course descriptions, study plans, specialisations, etc.

6. Results

6.1. Relative Importance of the Developed Usability Criteria

The results showed that the most important design category for the usability of educational websites from the viewpoint of users was the content as it has the highest weight (as shown in Table 3). The results also showed that the navigation was the second most important category for the usability of educational websites. The results showed that ease of use, and communications and design were the third and fourth important categories respectively in the usability of educational websites from the viewpoint of students. Finally, the results showed that the organisation/architecture was the least important category for the usability of educational websites from the viewpoint of students.

Interestingly, the results showed that the weights of the subcategories varied; the highest weight assigned to a single subcategory was 7.16, while the lowest weight was 2.07. The subcategories with the highest weights, which represented the design features that students preferred the most for a usable educational website, included: logical structure of a site (7.16), quick downloading of web pages (6.20), simple navigation menu (5.77), not deep architecture (5.73) and easy interaction with a website (5.38). However, the design features which were the least important from the viewpoint of users were: no under construction pages (2.07), information about colleges (2.51), appropriate use of fonts (2.57), appropriate choice of colours (2.74), and information about the university (2.79) (Table 3).

It is worth mentioning that the students considered information about departments to be more important than information about colleges and the university, as they gave it a higher weight (3.01) compared to the other two subcategories (2.51 and 2.79, respectively) (Table 3).

Table 3. The relative importance (weights) for the categories and subcategories of the developed usability criteria and the total weight for each category.

Categories	Subcategories	Weight	Total Weights for each Category
Navigation	Navigation Support	5.11	20.75
	Effective Internal Search Tool	5.01	
	Working Links	4.49	
	No Broken Links	2.96	
	No Orphan Pages	3.17	
Organisation/ Architecture	Logical Structure of a Site	7.16	18.66
	Not Deep Architecture	5.73	
	Simple Navigation Menu	5.77	
Ease of Use and Communications	Quick Downloading of Web pages	6.20	19.88
	Easy Interaction with a Website	5.38	
	Contact Us Information	4.43	
	Foreign Language Support	3.86	
Design	Aesthetic Design	4.27	19.16
	Appropriate Use of Images	3.16	
	Appropriate Use of Fonts	2.57	
	Appropriate Choice of Colours	2.74	
	Appropriate Page Design	3.35	
	Consistency	3.06	
Content	Up-to-date Information	4.74	21.56
	Relevant Information	3.23	
	No Under Construction Pages	2.07	
	Accurate Information	3.20	
	Information about the University	2.79	
	Information about Colleges	2.51	
	Information about Departments	3.01	
Total Weights			**100**

The ANOVA test revealed no statistically significant differences between males and females regarding the relative importance of four categories of the criteria: navigation, organisation/architecture, ease of use and communication, and design (Appendix 2). However, the ANOVA test showed that there was a statistically significant difference between males and females regarding the relative importance of the content category (Appendix 2). The females considered this category as the most important and gave it therefore the highest weight (23.58), while the males considered this category as the second most

important category and therefore gave it the weight of 20.37. The descending order of the usability categories based on their relative importance according to males was: navigation, content, ease of use and communication, design, and organisation/architecture. However, the descending order of the usability categories based on their relative importance according to females was: content, navigation, ease of use and communication, organisation/architecture, and design.

The ANOVA test showed that there were no statistically significant differences between the students of the two faculties (the Faculty of Science and Information Technology, and the Faculty of Economics and Administrative Sciences) concerning the relative importance of the five categories of the criteria.

The descending order of the categories based on their relative importance according to the students of the Faculty of Science and Information Technology was: navigation, content, ease of use and communication, design, and organisation/architecture. However, the descending order of the categories based on their relative importance according to the students of the Faculty of Economics and Administrative Sciences was: content, navigation, ease of use and communication, organisation/architecture, and design.

6.2 The Usability of the Jordanian University Websites

This subsection presents the results obtained from the analysis of the quantitative and qualitative data obtained from the surveys regarding the usability of the nine Jordanian university websites. Details of the results obtained are available from the author; the results from each website are summarised below.

6.2.1. The University of Jordan

This website was ranked as the third website in terms of preference among the other eight websites (Appendix 3 and Table 4). The overall usability score of this website was 910.69. The students, through the qualitative data obtained from the open-ended questions, provided more information regarding issues they liked (i.e. the content of the website; the ease of navigation and interaction with the site; and the interest in graduate students where pages were allocated for them to keep in touch with each other) and disliked (i.e. the design of the site; the large amount of information presented on the home page with a lack of order) regarding the design of the site.

6.2.2. Petra University

This website was ranked as the first preferred website from the viewpoint of the students and had the highest overall usability score: 962.64 (Appendix 3 and Table 4). The students, via the answers of the open-ended questions, provided useful information regarding issues they liked and others they disliked on this website.

Examples of the aspects students liked in this website were: the attractive design of the site; the content of this website; the fact that it was easy to navigate and interact with the site; and the electronic registration provided by the site.

6.2.3. Jordan University of Science and Technology

This website was ranked as the fifth website in order of preference among the other eight websites and its overall usability score was 886.84. The students, through the answers of the open-ended questions, defined some preferable aspects on the website (i.e. the content of the site; the ease of use, navigation and interaction with the site; and the electronic registration feature), and some issues they did not like (i.e. the unattractive design of the site; inappropriate and inconsistent colours and fonts used on the site). Most students revealed that they were unhappy with the website since it does not support Arabic.

6.2.4. Al Balqa Applied University of Science and Technology

The overall usability score of this website was 877.32 and it was ranked as the seventh preferred website according to students' viewpoint. The qualitative data obtained from the students showed their satisfaction with some features of the site such as: the content of the university website; it was easy to use, and the electronic registration. However, the students expressed their dissatisfaction with some issues on the website such as: the overall appearance of the site; and the small number of images used on the site.

6.2.5. Mutah University

This website was ranked as the fourth preferred website from the viewpoint of students; its overall usability score was 897.05. The qualitative data obtained from the students stressed the fact that the students were satisfied with the content of the site; the quick downloading of the site's pages, ease of navigation and ease of use; and the availability of an electronic registration system. Regarding the issues with which students were dissatisfied, these included: poor and unaesthetic design of the site; inappropriate choice of colours and fonts; and inconsistent colours.

6.2.6. Al-albayt University

This website was the least preferred website among the other eight websites; it had the lowest overall usability score compared to the other eight websites (Appendix 3 and Table 4). The qualitative data obtained from the open-ended questions proved that the students were dissatisfied with this website. The students provided information regarding the issues that made them dissatisfied with the site such as: the inappropriate, unaesthetic and unattractive design; complex structure;

irrelevant content; inconsistency (colours and page design); and slow downloading of web pages.

6.2.7. The Hashemite University

The overall usability score of this website was 873.99; it was ranked as the eighth preferred website according to the students' preferences. The qualitative data obtained from the open-ended questions shed light on the features of the site which the students were satisfied with, such as: the content of the site (especially the academic staff contact information); and quick downloading of the web pages. However, the students indicated there were issues which made them dissatisfied with the site; these mainly related to: the design of the site; and the fact that information about higher education was not provided in the Arabic language.

6.2.8. Yarmouk University

This website was ranked as the second preferred website from the viewpoint of students, and its overall usability score was 937.58 (Appendix 3 and Table 4). The qualitative data obtained from the open-end questions showed that the students were satisfied with: the design of the site; content of the site; easy to navigate and interact with the site; electronic learning; and the well-designed library website. However, the students mentioned some issues with the website which they did not like, such as: its deep architecture; and inconsistency between Arabic and English interfaces.

6.2.9. Philadelphia University

This website was ranked as the six preferred website from the students' viewpoint with its overall usability score being 880.28. The students, via their answers to the open-end questions, listed the areas they liked in this website, such as: the content of the website; the availability of contact us information (email addresses) of the academic staff; ease of interacting with the site; electronic learning; and electronic registration. However, the students did not like some features on the site, such as: its design; inappropriate use of colours; fonts; images; and inconsistency.

Table 4. The descending order of the nine Jordanian university websites with regard to their overall usability scores.

No.	Jordanian University	Overall Usability Score
1	Petra University (U2)	962.64
2	Yarmouk University (U8)	937.58
3	The University of Jordan (U1)	910.69
4	Mutah University (U5)	897.05
5	Jordan University of Science and Technology (U3)	886.84
6	Philadelphia University (U9)	880.28
7	Al Balqa Applied University of Science and Technology (U4)	877.32
8	The Hashemite University (U7)	873.99
9	Al-albayt University (U6)	749.51

6.3. Common and Unique Design Issues

This subsection summarises common and unique strengths and weaknesses related to design issues in the investigated websites.

6.3.1. Common Strengths

The results showed that the investigated websites were strong in the following design areas:

- Content: Nearly all the investigated websites (eight out of the nine) had satisfactory content from the viewpoint of the students. Specifically, the students liked the content of the sites as it was: clear, accurate, detailed and relevant, and related to the information about the university, colleges and departments (presented by all universities). The students also liked the information about the academic staff as presented by The Hashemite University, Yarmouk University and Philadelphia University.
- Ease of use/navigation/interaction with the site: The students indicated that almost all the sites (eight out of the nine) had an interface that was easy to use/ navigate and interact with.
- Quick downloading: The students indicated that they liked the quick downloading of the web pages related to six out of the eight of the investigated websites.
- Arabic language support: The students liked the support of most of the investigated websites for the Arabic language (eight out of the nine).

6.3.2. Common Weaknesses

The results showed that the investigated websites shared the following common weaknesses:

- Design: The students indicated that they did not like the design of nearly all the investigated websites (seven out of the nine). The students did not like the colours, fonts and images used throughout the sites.
- Consistency: The students disliked, on most of the investigated websites, the fact that the websites were inconsistent in: colours, fonts, the Arabic and English language interfaces, and the design of the pages.

6.3.3. Unique Strengths

The results showed that the students made some comments regarding design factors which they liked that were presented on some of the websites. These included :

1. The availability of a graduate students' section, as featured on the websites of the University of Jordan and Yarmouk University.
2. The connection to Facebook, and/or YouTube, and/or Twitter, as provided on the websites of the

University of Jordan*,* Mutah University and Philadelphia University.

3. The support of electronic registration, as provided by the websites of Petra University, Jordan University of Science and Technology, Mutah University, Yarmouk University and Philadelphia University.

6.3.4. Unique Weaknesses

The results showed that the students raised some issues which they disliked regarding design features that were present on some websites. These included:

- The fact that one website, Jordan University of Science and Technology, did not support the Arabic language. Also, the lack of support for the Arabic language in the higher education information by The Hashemite University.

7. Discussion

7.1. Relative Importance of Design Features

As indicated in Section 2, earlier research which investigated users' preferences on the relative importance of website design features, did not specifically concern educational/academic websites. However, this research has addressed the gap noted in the literature and focused primarily on investigating the relative importance of website design features on the usability of educational websites from the viewpoint of students.

The results of this research revealed that the content category was the most important category that influenced the usability of educational websites from the point of view of students. This is in agreement with the results obtained from earlier research [1, 14, 16, 17]. This result stressed the importance of the content design category, not only not only in the domain of e-commerce websites, as shown by [1, 17] and other domains (financial, entertainment, government, and medical) [17], but also in the educational website domain.

The results of this research showed that navigation was the second most important category in terms of the usability of educational websites from the point of view of students. This was in agreement with the results obtained by Person *et al*. [13] and Zhang *et al*. [17]. Zhang *et al*. [17] found that search tools were ranked important in four domains (education, government, medical, and e-commerce); the search tools constituted one of the subcategories of the navigation category suggested and used in this research. This stressed the importance of considering navigational issues when designing educational websites, as well as e-commerce, education, government, medical websites as shown by earlier research [13, 17].

There was agreement between the results obtained by this research and earlier research regarding the importance of the ease of use/ease of navigation design category while designing/ evaluating the usability of websites. The results of this research revealed that ease of use was the third most important design category which influences the usability of educational websites from the viewpoint of students. Other research which investigated this category across different types of website (e-commerce, portals and search engines, entertainment, news and information, financial services, financial, entertainment, government, and medical) [1, 13, 14, 17] also stressed the importance of this category. For example, Zhang *et al*. [17] found that ease of use was a must-have feature for all six of the domains they investigated. This stressed the importance of the ease of use category when designing a usable website and/or evaluating the usability of different types of website.

The results of this research showed that the least important category that influenced the usability of educational websites from the viewpoint of students was the organisation/architecture of the site. The students also rated the design category as the fourth most important category that influences the usability of educational websites. These results, together with the previous ones, shed light on the design categories and subcategories that must be taken into consideration when designing and/or evaluating the usability of educational websites, as well as the design categories and subcategories which should have less focus when designing and/or evaluating the usability of such websites (Table 3).

The results of this research were comparable with other research [13] regarding the rating of the design categories of the suggested criteria differently by males and females. However, there was some inconsistency between the results of this research and the results obtained by Pearson *et al*. [13] regarding the types of category which were significantly different based on gender. The results of this research showed that content was the only category which showed significant differences based on gender, since females placed a greater emphasis on this than did males, while the results of Pearson *et al*. [13] showed that the navigation and ease of use categories had significant differences based on gender, where females placed greater emphasis on them than did males. The differences between the results might relate to the fact that the research conducted by Person *et al*. [13] concerned e-commerce websites, while this research considered educational websites. This suggests that universities and/or academic institutions which are especially for females should give the content category first priority when designing usable educational websites, or when evaluating the usability of their websites. However, universities and/or academic institutions for males should give the navigation

category the first priority. Furthermore, universities and/or academic institutions could take into consideration the order of the design categories, from the first to the least important from the viewpoint of students, which was different based on gender, as discussed in Section 6.1.

This research, unlike earlier research, also investigated whether the relative importance of the design categories of the suggested criteria differed from the viewpoint of students based on the differences in their major/specialisation. The results, as discussed in Section 6.1, showed that all the design categories did not have statistical significant differences based on faculty (major/ specialisation). However, the order of the design categories, from the first to the least important from the point of view of students, was different based on faculty, as discussed in Section 6.1. This provides evidence for universities and/or academic institutions to consider the preferences of design categories from the viewpoint of students based on their specialisation/major. For example, websites of academic institutions specialising in scientific faculties could consider content and ease of use as the most important design categories when evaluating the usability of their websites or designing usable websites. However, specialist websites for administrative faculties could consider navigation and content as the most important categories when designing and/or evaluating the usability of their websites.

7.2. Usability Evaluation of Jordanian Educational Websites

The results of this research agreed with the results obtained by the research conducted by Mostafa and Al-Zou'bi [8] regarding the fact that the majority of the students were satisfied with the usability of the Jordanian university websites that were investigated (seven of the websites included in the sample of Mustafa and Al-Zou'bi's study [8] were included in the sample of this research). This indicated that the majority of the students were satisfied with most features relating to the usability of the websites that were evaluated.

Also, there was agreement between the results of the earlier research [8] and this research regarding the design factors (categories) the students believed that the tested websites conformed to. Earlier research showed that the two design factors (categories) to which the tested websites conformed were: content, organisation and readability, and navigation and links. The two categories in which the tested websites conformed less, however, related to the design, performance and effectiveness categories. The results of this research also showed that Jordanian university websites conformed to the content and navigation categories, but did not conform to the design category

from the viewpoint of students. Furthermore, Section 6.3 shows, based on the qualitative data obtained from the open-ended questions, that the common strengths of the tested websites include the content, while the common weaknesses of the tested websites include the design category

However, the study of Mustafa and Al-Zou'bi [8] did not report the specific strengths and weaknesses of each Jordanian university website; it reported the overall results of all the investigated websites with regard to five categories without explaining the usability level of each website. Furthermore, Mustafa and Al-Zou'bi [8] employed only a quantitative method. However, unlike the earlier research [8], this research highlighted the specific weaknesses and strengths of each Jordanian university website with regard to their level of conformance with five design categories related to the suggested criteria and their corresponding subcategories; this provides useful results for each university.

Furthermore, unlike earlier research [8], this research not only depends on quantitative data, but also employed a qualitative method through the use of open-ended questions. This provided additional important evidence regarding features that students liked and disliked in the investigated sites. Section 6.3 summarised common and unique design features that students liked about the design of the tested websites, and common and unique weaknesses that students disliked concerning the design of the tested websites. This provides useful information for universities and/or academic institutions while designing their websites.

8. Conclusions

This research provides empirical evidence for academic institutions and universities regarding the relative importance of specific design features on which to focus when designing and/or evaluating the usability of their educational websites. The results showed that content and navigation were the most and second most important design categories respectively for the usability of educational websites from the viewpoint of students. The results also showed that the third, fourth and least important categories for educational websites were: ease of use and communications; design; and organisation/architecture, respectively.

This research also investigated whether gender and major/specialisation had an impact on the relative importance of the developed usability criteria. The results showed that there was a statistically significant difference between males and females regarding only one category: the content. Females considered it as the most important category while males considered it as the second most important category. By contrast, the results showed that there were no statistically significant differences between the students of the two

selected faculties concerning the relative importance of the developed criteria based on majors/specialisations.

This research employed students to evaluate the usability of nine Jordanian university websites using specific criteria and then, based on the relative importance of the developed criteria, the overall usability score for each Jordanian university website was calculated. Students were also asked to provide qualitative data regarding issues they liked and disliked on the tested websites. The results provided detailed information for each tested website regarding their conformance with the developed usability criteria. In general, the results showed that the majority of the students were satisfied with the usability of the Jordanian university websites. Specifically, the results showed the students were satisfied with the content and navigation (ease of use) aspects of the tested websites, and were dissatisfied with the design of the websites. The results also showed that Petra University had the highest overall usability score while Al-bayt University had the lowest. The results provided by this research offered evidence for the owners of the tested Jordanian university websites regarding the strong and weak features of their websites.

The developed usability criteria, which are specific for the evaluation of educational websites, provide guidance for the designers and evaluators of such websites regarding website features that should be taken into consideration while designing and/or evaluating educational websites.

This research, however, has four limitations, which could influence the results obtained. The first is related to the participants/sample used in this research. It was limited to students, while other stakeholders of educational websites (i.e. faculty staff, parents) were not taken into consideration.

The second limitation is related to the fact that this research employed only one user testing method, which was questionnaire, in the process of evaluating the usability of the Jordanian university websites. Other usability methods, such as the heuristic evaluation, which involves evaluators/experts in the process of identifying usability problems, were not employed.

The third limitation is concerned with the selection of only nine Jordanian university websites to conduct this research. The evaluation of all the Jordanian university websites was not undertaken

The fourth limitation is related to the developed criteria that were used for evaluating the usability of the websites. Some issues were not considered while developing the criteria, which might influence the results, such as: number of clicks

Acknowledgment

References

[1]   Agarwal R. and Venkatesh V., "Assessing a Firm's Web Presence: A Heuristic Evaluation Procedure for the Measurement of Usability", *Information Systems Research*, vol. 13, no. 2, pp. 168–186, 2002.

[2]   Anonymous, Step-by-Step Usability Guide, 2006, <http://www.usability.gov> [accessed 20.09.2011].

[3]   Gonzalez M., Granollers T., and Pascual A., "Testing Website Usability in Spanish-Speaking Academia through Heuristic Evaluation and Cognitive Walkthrough", *Journal of Universal Computer Sciences*, vol. 14, no. 9, pp. 1513-1528, 2008.

[4]   Gray W. and Salzman C., "Damaged Merchandise? A Review of Experiments that Compare Usability Evaluation Methods", *Human-Computer Interaction*, vol. 13, pp. 203-261, 1998.

[5]   Kantner L. and Rosenbaum S., "Usability Studies of WWW sites: Heuristic Evaluation vs. Laboratory Testing", in the Proceedings of ACM 15th International Conference on Systems Documentation, Salt Lake City, UT, USA, pp. 153-160, 1997.

[6]   Kostaras N. and Xenos M., "Assessing Educational Web-site Usability using Heuristic Evaluation Rules", in the Proceedings of 11th Panhellenic Conference in Informatics, Corfu, Greece, pp. 197-201, 2006.

[7]   Lencastre J. and Chaves J., "A Usability Evaluation of Educational Websites", in the Proceedings of EADTU Conference, France, 2008.

[8]   Mustafa S. and Al-Zoua'bi L., "Usability of the Academic Websites of Jordan's Universities", in the Proceedings of the International Arab Conference on Information Technology, Tunisia, pp. 2-9, 2008.

[9]   Nielsen J., "Heuristic Evaluation". In J. Nielsen and R. L. Mack (Eds.); *Usability Inspection Methods*, John Wiley & Sons, New York, pp. 25-64, 1994.

[10] Nielsen J., *Designing Web Usability: The Practice of* Simplicity, New Riders Publishing, 2000.

[11] Nielsen J., *Usability 101: Introduction to usability*. Useit.com, 2003. <http://www.useit.com/alertbox/20030825.html> , [accessed 14.02.2006].

[12] Papadopoulos T. and Xenox M., "Quality Evaluation of Educational Websites Using Heuristic and Laboratory Methods", in the Proceedings 2nd Panhellenic Scientific Student Conference on Informatics, Related

Technologies, and Applications, Samos, Greece, pp. 43-54, 2008.

[13] Pearson J., Pearson A., and Green D., "Determining the Importance of Key Criteria in Web Usability", *Management Research News,* vol. 30, no. 11, pp. 816-828, 2007.

[14] Tarafdar M. and Zhang J., "Analyzing the Influence of Website Design Parameters on Website Usability", *Information Resources Management Journal*, vol. 18, no. 4, pp. 62 - 80, 2005.

[15] Toit M. and Bothma C., "Evaluating the Usability of an Academic Marketing Department's Website from a Marketing Student's Perspective", *International Retail and Marketing Review,* vol. 5, no. 1, pp. 15-24, 2010.

[16] Zhang P. and von Dran G., "Satisfiers and Dissatisfiers: A Two-Factor Model for Website Design and Evaluation", *Journal of the American Society for Information Science*, vol. 51, no. 14, pp. 1253-1268, 2000.

[17] Zhang P., von Dran G., Blake P., and Pipithsuksunt V., "A Comparison of the Most Important Website Features in Different Domains: An Empirical Study of User Perceptions", in the Proceedings of Americas Conference on Information Systems (AMCIS'2000*)*, Long Beach, CA. August 10-13, pp. 1367-1372, 2000.

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Appendix 1: The relative importance survey

Part 1: Instructions for assigning weights to the five main categories of the developed criteria.

Please distribute 100 points, which represent weights, across the five major categories presented in the Table below based on the importance of these categories in the evaluation of the usability of any educational website from your perspective. For example, if navigation is the most important category then give it a higher weight.

No.	Criteria	Explanation	Weight
1	**Navigation**	This assesses whether a site includes the main tools (i.e. navigation menu, internal search facility) and links which facilitate the navigation of users through a site, enabling them to reach the required information quickly.	
2	**Architecture/ organization**	This criterion relates to the structure of a site's information which should be divided into logical, clear groups; each group should include related information.	
3	**Ease of use and communication**	This relates to the existence of basic information which facilitates communications with the university in different ways.	
4	**Design**	This 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 colours in the design of a site.	
5	**Content**	This assesses whether a site includes the information users require.	
Total weights			

Part 2: Instructions for assigning weights to the five subcategories of the navigation category.

Please distribute the ---- points you have assigned to the navigation category (Part 1) across its five corresponding subcategories based on the importance of these subcategories in the evaluation of the usability of any educational website from your perspective. For example if the navigation support is the most important subcategory then give it a higher weight.

No.	Criteria	Explanation	Weight
1	**Navigation support**	Navigational links are obvious in each page so that users can explore and find their way around the site and navigate easily	
2	**Effective internal search**	Internal search is effective: e.g. it is fast, accurate and provides useful, concise and clear results which are easy to interpret	
3	**Working links**	Links are discernible, working properly and not misleading so that the user knows what to expect from the destination page	
4	**No broken links**	The site has no broken links	
5	**No orphan pages**	The site has no dead-end pages	
Total weights			

Appendix 2: Descriptive and ANOVA results which show the impact of gender on the relative importance of the categories of the developed usability criteria.

Descriptive Results					ANOVA Results					
Category		N	Mean	St. Deviation		Sum of Squares	df	Mean Square	F	Sig.
Navigation	Male	149	21.05	8.919	Between Groups	37.785	1	37.785	0.440	0.508
	Female	88	20.23	9.823	Within Groups	20169.025	235	85.826		
	Total	237	20.75	9.253	Total	20206.810	236			
Organisation/ Architecture	Male	149	18.91	7.663	Between Groups	24.643	1	24.643	0.428	0.514
	Female	88	18.24	7.468	Within Groups	13542.673	235	57.628		
	Total	237	18.66	7.582	Total	13567.316	236			
Ease of Use and Communications	Male	149	19.92	7.851	Between Groups	0.702	1	0.702	0.009	0.923
	Female	88	19.81	9.867	Within Groups	17592.749	235	74.863		
	Total	237	19.88	8.634	Total	17593.451	236			
Design	Male	149	19.75	11.616	Between Groups	142.332	1	142.332	1.101	0.295
	Female	88	18.15	10.945	Within Groups	30390.892	235	129.323		
	Total	237	19.16	11.374	Total	30533.224	236			
Content	Male	149	20.37	9.831	Between Groups	570.222	1	570.222	5.286	0.022
	Female	88	23.58	11.269	Within Groups	25352.141	235	107.881		
	Total	237	21.56	10.480	Total	25922.363	236			

Appendix 3: The usability scores of the nine Jordanian university websites with regard to their performance on the five categories of the developed usability criteria.

Criteria	U1	U2	U3	U4	U5	U6	U7	U8	U9
Navigation	110.32	103.81	103.17	100.92	108.99	87.62	109.72	108.56	100.65
Organisation/ Architecture	87.84	97.59	91.00	91.72	89.28	80.09	82.39	94.16	91.00
Ease of Use and Communications	110.41	110.25	100.14	103.47	103.80	82.23	102.86	105.46	103.38
Design	88.70	107.46	92.8	86.98	88.80	76.52	82.01	100.15	86.75
Content	116.13	124.40	112.46	111.14	115.31	96.59	120.04	120.92	116.73
Overall Usability	**910.69**	**962.64**	**886.84**	**877.32**	**897.05**	**749.51**	**873.99**	**937.58**	**880.28**