Investigating the Relative Importance of Design Criteria in the Evaluation of the Usability of Educational Websites from the Viewpoint of Students

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***Abstract*—The importance of considering usability in the design and development of educational websites is well recognised. However, there is a lack of research which has exposed the design features students prefer on an educational website. This research developed specific criteria for evaluating the usability of educational websites consisting of 25 design issues distributed into five major categories: navigation, organisation / architecture, ease of use and communications, design, and content. Then the relative importance of the categories and subcategories of the developed criteria in the evaluation of the usability of educational websites was investigated from the viewpoint of 237 students. A further step was taken to determine if the relative importance differed based on the gender and major / specialisation of the students involved in the research (where students were selected from two faculties: Information Technology and Administration). The results showed that the order of the criteria from the most to the least important in the evaluation of the usability of educational websites from the viewpoint of students was: content, navigation, ease of use and communications, design, and organisation / architecture. The results also 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. However, the results showed that there were no statistically significant differences between the students of the two selected faculties regarding the relative importance of the criteria.**

***Index Terms*—Usability, design criteria, educational websites, human computer interaction**

I. Introduction

With the fast development of the Internet and increasing use of the www as both an information-seeking and an electronic commerce tool, web user interface studies have grown significantly [12]. Studies regarding the usability of web user interfaces from the viewpoint of users have indeed grown significantly, since usability is a key metric for evaluating the success of an organisation's web presence [1].

Earlier research investigated users' perceptions of the relative importance of web design features in the evaluation of the usability of different types of website, such as: an e-commerce site [8]; portals and search engines, retail, entertainment, news and information, and financial services [9]; online bookstores, automobile manufacturers, airlines and car rental agencies [1]; financial, e-commerce, entertainment, education, government, and medical [11]. However, there is a lack of research which has specifically investigated the relative importance of web design features to be considered when developing and/or evaluating educational websites in the evaluation of the usability of such websites from the viewpoint of students. Unfortunately, a university website design is often based on the perceptions of web designers and/or managers in a university instead of students' perceptions and needs. This research aimed to fill the gap noted in the literature and identified the relative importance of design factors in the evaluation of the usability of educational websites from the viewpoint of 237 students.

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II. Literature Review

Earlier research showed an interest in investigating the relative importance of different design factors on the usability of different types of website from the viewpoint of users. For example, the study conducted by Tarafdar and Zhang [9] examined the influence of six web design factors (information content, ease of navigation, download speed, customisation and personalisation, security, and availability and accessibility) on the usability of websites. The websites were selected from five different domains: portals and search engines, retail, entertainment, news and information, and financial services. The results showed that the four design factors that most influenced website usability were: information content, ease of navigation, download speed, and availability and accessibility. By contrast, the results showed that security and customisation did not influence a website's usability.

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

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category in all eight groups (four industries, two types of user). The second category of ease of use was modestly important across all eight groups.

Zhang *et al*. [11] also investigated user perceptions of 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 showed that ease of navigation was a must-have feature for all six domains and the search tool was commonly ranked as important by the following four domains: education, government, medical and e-commerce.

Rather than investigating the relative importance of design factors on the usability of more than one domain/industry, as mentioned in the above studies, the study conducted by Pearson *et al*. [8] investigated the relative importance of five design criteria in the evaluation of the usability of only one 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 the 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.

Alternatively, the study undertaken by Zhang and Dran [12] introduced a two-factor model that can be used to distinguish website design factors as two types, namely: hygiene and motivator. Hygiene factors are those whose presence makes a website functional, useful and serviceable, and whose absence cause users dissatisfaction (i.e. broken links). Motivator factors, however, are those whose presence will enhance users' satisfaction with the website, and motivate their 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. multimedia). The results showed that the identified hygiene categories included: technical aspects, navigation, and privacy and security, while the identified motivator categories included: enjoyment, cognitive outcome, and credibility.

The literature outlined above shows that there is an interest in investigating users' perceptions of the relative important of different design factors on the usability of different types of website. However, there is a lack of research that investigates students' perceptions of design factors that are important specifically in the usability of educational websites.

III. AIMS AND OBJECTIVES

The aim of this research was to examine students' perceptions of the relative importance of design criteria, specifically developed for the purpose of this research, in the evaluation of the usability of educational websites.

The specific objectives of the research were:

1.To suggest evaluation criteria for evaluating the usability of educational websites.

2.To obtain students' preferences on the relative importance of the different categories and subcategories of the developed usability criteria.

3.To investigate whether gender impacts on the relative importance of the developed criteria.

4.To investigate whether major / specialisation impacts on the relative importance of the developed criteria.

IV. METHODOLOGY

Criteria specific to evaluating the usability of educational websites were developed based on the literature review [1-11]. The developed criteria consist of five main categories. Table 1 presents the categories of the criteria and their corresponding subcategories. In order to collect information regarding the demographic background of students participating in the research, a pre-test survey was developed. In order to achieve objective 2 (obtaining the relative importance (weights) of the different categories of the developed usability criteria), Agarwal and Venkatesh's [1] method for the assessment of usability that includes weights was adopted, and based on it a relative importance survey was developed. This survey aimed to collect data to show 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 its corresponding subcategories.

The participants in this study were undergraduate students enrolled in twelve classes related to two faculties (Faculty of Information Technology and Faculty of Administration) at one of the universities in Jordan. Six classes were selected from each faculty. The total number of students who provided usable responses was 237; the number of males was 149 while the number of females was 88. In cases where some students were enrolled in more than one of the classes included in the sample, they were asked to leave the session and to participate only once.

A pilot study was conducted before the main test to test the method of assigning weights to ensure that students had an understanding of the method. 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 ambiguity in the surveys. Results from the pilot test were taken into consideration and minor changes were made to the surveys.

All data collection sessions followed the same procedure. The session began with the researcher welcoming the students and explaining the objective of the study. The students were then asked to fill in the pre-test survey 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 (five categories) using the relative importance survey. Following this, students were

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asked to distribute the points across the various subcategories. The average time spent conducting the session was half an hour.

TABLE 1: Criteria for evaluating the usability of educational websites.

Categories	Subcategories
Navigation: Assess 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**
Organisation / Architecture: 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 site** **Not deep architecture** **Simple navigation menu**
Ease of use and communications: Relates to the cognitive effort required to use a website [1], and 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, colours in the design of a site.	**Aesthetic design** **Appropriate use of images** **Appropriate choice of fonts** **Appropriate choice of colours** **Appropriate page design** **Consistency**
Content: Assess whether a site includes information users require.	**Up-to-date information** **Relevant information** **No under-construction pages** **Accurate Information** **Information about the university** **Information about the colleges** **Information about the departments**

Data collected were analysed in several ways. Descriptive analysis was used to analyse data collected from the pre-rest survey to describe the characteristics of the students. In order to find out the relative importance (weight) for the developed criteria (the five categories and their corresponding categories) from the viewpoint of students, the average weight (relative importance) was calculated. Descriptive analysis (the mean and standard deviation) of the weights (relative importance) of the developed criteria based on gender and faculty (major / specialisation) was then calculated. 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 its corresponding subcategories of the developed usability criteria.

V. RESULTS

The results showed that content was the most important design category for the usability of educational websites from the viewpoint of students as it had the highest weight (21.56) (Table II). The results also showed that navigation was the second most important category for the usability of educational websites with a relative weight of 20.75. Ease of use and communications, design, and organisation / architecture were the third, fourth and least important categories, respectively in the usability of educational websites from the viewpoint of students.

The results also shed light on the weights of the subcategories. For example regarding the weights of the subcategories of the content category, the results showed 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 II).

The results showed that gender impacted on the relative importance of the developed criteria. The descending order of the categories of the developed usability criteria based on their relative importance according to males was: navigation, content, ease of use and communications, design, and organisation / architecture. By contrast, the descending order of the categories of the developed usability criteria based on their relative importance according to females was: content, navigation, ease of use and communications, organisation / architecture, and design. Furthermore, the ANOVA test showed that there was a statistically significant difference between males and females regarding the relative importance of only one category of the developed criteria: the content (Appendix 1). 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 a weight of 20.37.

Also, the results showed that major / specialisation impacted on the relative importance of the developed criteria. The descending order of the categories of the developed usability criteria based on their relative importance according to the students of the Faculty of Information Technology was: navigation, content, ease of use and communications, design, and organisation / architecture. However, the descending order of the categories of the developed usability criteria based on their relative importance according to the students of the Faculty of Administration Studies was: content, navigation, ease of use and communications, organisation / architecture, and design. Furthermore, the ANOVA test showed that there were no statistically significant differences between the students of the two faculties (the Faculty of Information Technology and the Faculty of Administration) concerning the relative importance of the five categories of the criteria (Appendix 2).

VI. DISCUSSION

This research addressed the gap noted in the literature and focused primarily on investigating the relative importance of website design features in the evaluation of 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 view of 237 students. This is in agreement with the results obtained from earlier research [1, 9, 11]. This stressed the importance of the content design category, not only in the domain of e-commerce websites, as shown by [1, 11] and other domains (financial, entertainment, government, and medical) [11],

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but also in the educational website domain. The results of this research showed that the navigation was the second most important category in the usability of educational websites from the point view of students. This also was in agreement with the results obtained by Pearson *et al*. [8] and Zhang *et al.* [11]. Zhang *et al*. [11] found that search tools was ranked important in four domains (education, government, medical, and e-commerce); the search tool was 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 [8, 11]. Furthermore, there was an 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 influenced 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, 8, 9, 11] also stressed the importance of this category. For example, Zhang *et al*. [11] found that ease of use was a must-have feature for all six domains that they investigated. This stressed the importance of the ease of use category while designing usable websites 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 view-point 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 design categories and subcategories which should have less focus when designing and/or evaluating the usability of educational websites (Table II).

The results of this research were comparable with other research [8] regarding the different rating of the design categories of the suggested criteria by males and females. However, there was some inconsistency between the results of this research and the results obtained by Pearson *et al*. [8] 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 had a significant difference based on gender since females placed greater emphasis on it than did males. The results of Pearson *et al*. [8], on the other hand, 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 Pearson *et al*. [8] concerned an e-commerce website while this research concerned educational websites. This suggests that universities and/or academic institutions that are specially for females should give the content category first priority while designing usable educational websites or while evaluating the usability of their websites. However, specialist 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 V.

TABLE II: 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 Webpages	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**

This research, unlike earlier research, investigated whether the relative importance of the design categories of the suggested criteria differ from the viewpoint of students based on the differences in their major / specialisation. The results, as discussed in Section V, showed that none of the design categories showed a statistically significant

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difference 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 V. This provides evidence for universities and/or academic institutions to consider the preferences of design categories from the viewpoint of students based on their major / specialisation. For example, websites of academic institutions specialising in information technology could consider content and ease of use as the most important design categories while evaluating the usability of their websites or in designing usable websites. However, specialist websites for administration faculties could consider navigation and content as the most important categories while designing and/or evaluating the usability of their websites.

VII. CONCLUSIONS

Based on the literature, this research suggested specific usability criteria which could be considered when developing and/or evaluating the usability of educational websites. This research also shed light on the relative importance (weights) of the categories and subcategories of the suggested usability criteria in the evaluation of the usability of educational websites from the viewpoint of 237 students selected from two faculties (Information Technology and Administration) from one of the universities in Jordan. The results showed that content and navigation were the first and second most important design categories, respectively in the evaluation of 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 major / specialisation.

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APPENDIX 1: ANOVA results which show the impact of gender on the relative importance of the categories of the developed usability criteria.

Categories	ANOVA Results					
		Sum of Squares	df	Mean Square	F	Sig.
Navigation	**Between Groups** **Within Groups** **Total**	37.785 20169.025 20206.810	1 235 236	37.785 85.826	0.440	0.508
Organisation / Architecture	**Between Groups** **Within Groups** **Total**	24.643 13542.673 13567.316	1 235 236	24.643 57.628	0.428	0.514
Ease of Use and Communications	**Between Groups** **Within Groups** **Total**	0.702 17592.749 17593.451	1 235 236	0.702 74.863	0.009	0.923
Design	**Between Groups** **Within Groups** **Total**	142.332 30390.892 30533.224	1 235 236	142.332 129.323	1.101	0.295
Content	**Between Groups** **Within Groups** **Total**	570.222 25352.141 25922.363	1 235 236	570.222 107.881	5.286	0.022

APPENDIX 2: ANOVA results which show the impact of specialisation (faculty) on the relative importance of the categories of the developed usability criteria.

Categories	ANOVA Results					
		Sum of Squares	df	Mean Square	F	Sig.
Navigation	**Between Groups** **Within Groups** **Total**	273.894 19932.916 20206.810	1.00 235.00 236.00	273.894 84.821	3.229	0.074
Organisation / Architecture	**Between Groups** **Within Groups** **Total**	0.610 13566.706 13567.316	1.00 235.00 236.00	0.610 57.731	0.011	0.918
Ease of Use and Communications	**Between Groups** **Within Groups** **Total**	37.793 17555.659 17593.451	1.00 235.00 236.00	37.793 74.705	0.506	0.478
Design	**Between Groups** **Within Groups** **Total**	63.360 30469.863 30533.224	1.00 235.00 236.00	63.360 129.659	0.489	0.485
Content	**Between Groups** **Within Groups** **Total**	366.465 25555.897 25922.363	1.00 235.00 236.00	366.465 108.748	3.370	0.068

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