

A Preliminary Study Of Identifying The Visualization Pattern Of E-Learning Website For Heis In Malaysia Using Card Sorting Method

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Abstract

Abstract: Complex and complicated graphical user interface contributes to slow inter-action and lack of emotional engagement between users and user interface design of e-learning websites in Higher Education Institution (HEI) in Malaysia. Considering the emergence of the Industrial Revolution 4.0 concept within HEI is inevitable, the e-learning platform will be an integral component towards the realization of Universities 4.0 visions in Malaysia. This study is the extension of the previous research on the web objects visualization pattern of e-learning identified. A preliminary study is conducted to determine web objects placement of visualization pattern based on the standard web objects for e-learning websites using card sorting methods. Three different focus group; students, academicians, and IT administrators will be participating in this study. This study aims to build a guideline for developers in designing emotional engaging for the user interface for e-learning web-sites in HEI.

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I. INTRODUCTION

The arrival of information and communication technology (ICT) has reduced the popularity of the mail based and traditional distance learning method. The techno-logical innovation, the so-called web-based instruction (WBI) has made teaching, learning, and training processes delivered over the Internet [7]. Establishing a web-based education system has become a predominant belief of the current academics and educational administrators. Today, universities, training institutions, and government agencies are extensively investing in developing e-learning software, e-learning authoring tools and learning management systems, etc. The term e-learning has broadly defined as multimedia-based instruction, delivered using various instructional methods, which can be accessed by learners through their computers at their own will.

The term e-learning has also mutually used with web-based training, online learning, distributed learning, internet-based learning, and net-based learning.

According to [6], many researchers agree that human perceptions about technologies determine their attitude towards e-learning environment is not merely a technical matter; instead, it demands the consideration of several human and social factors. According to [6], choice of education technologies should not be guided by a techno-logically deterministic approach but rather by considering various contextual requirements related to a broad range of social, cultural, political and economic factors. [4] has emphasized that IT education is ineffective in India, for example, because it is too technical and not at all concerned with local contexts

and real-world problems [4]. [6] in their research have also specified that perceptions and beliefs of human beings as the significant determining factor of their practical attitude towards e-learning, thus the term emotional engagement between users and e-learning platforms are to be involved. The interface of an e-learning website considered as the entry point for the visiting learners in which the interactivity, learnability, and sustainability rely on its layout, content, information, and other attributes of the web-site. However, this study will only focus on GUI rather than content development of e-learning websites as it can have a leading effect on the success or failure of the e-learning. This study aims to produce GUI visualization pattern guideline for e-learning websites in HEI in Malaysia that will contribute ease of use between users and the e-learning system. [1] have proposed guidelines for UID based on the users' expectation of 70 respondents for the web objects of e-learning websites of Universiti Malaysia Sabah. This present study is the extension of their previous research. Based on the web objects of e-learning identified in the work of [3], and further, validate the earlier findings by using card sorting methods.

II. RELATED WORKS

The user interface (or UI) is a dire part of an e-learning course. It tends not to get much consideration after its initial design, but it can have a deciding factor on the success or failure of the class as a whole. The computer user interface is that hazy space where humans interact with the machine. It can be frustrating for users when they easily get lost in this nebulous space. Designers and developers must make sure users have smooth interactions with e-learning and performance support. Friendly user interface design is an integral part of designing learning experiences. It can influence a user's perception of an entire learning event [5]. Graphic design creates visual engagement. The fonts, layout, and even the colors used all have a high im-pact on the emotional involvement of e-learning websites users [10]. The designer's attention needs to be on putting the learner

in a fitting situation to acquire and generating an interface that supports the actions the learner can take. The result should be an interface that is spontaneous to use (though "use" may, and often should, comprise a lot more than just "navigating," or stirring around the program), but the supreme goal of interface design should not be to be navigable [8].

According to the work of [13], a significant problem of e-learning emotional engagement almost always lies in the complexity of the content and that there isn't a great model for a truly "responsive" e-learning design. However, it has been traditionally designed to a specific height and width and almost always designed to a single specific size which usually small enough to fit in the typical user's display, but big enough to make good use of whatever space is available. E-learning project can be built at dimensions that are a little smaller than 1,400 x 900px [13]. Both the value of the educational software and interfaces are related and to improve users learning rate, interface such as pop-up window and web framed base are better than with browser scroll interface.

Visual pattern process aims to adapt a product or a service to a language or culture so that it reflects the 'look-and-feel' expected by local users (country-specific) [1]. Their study also states that the primary goal of the visualization pattern concept in GUI is to improve the website by providing a natural platform in terms of culture, technology, and linguistics, while at the same time producing a framework that combines content and functionality for users with various cultural targets.

Visualization pattern enables developers to gain a better understanding of user preferences for the elements of the website experience. From this process, element-based guidelines established for web designers. According to [11], the critical requirement in the construction of website content is to understand the ordinary user's mental model or schema for the visualization of objects on the web interface. The layout of the interface used by various regional and international sites may influence users' expectations.

By using gaze analysis, an eye-tracking study of Moodle (the open-source course management system) by [11] also find outs that the breadcrumb navigation and the “My courses” area were the most exploited navigation elements. In addition to that, by analyzing gaze structure, results indicate that some users had significant difficulties when searching for their profile page and the logout button. It found that the layout of the GUI must be following the users’ expectations of where they will find regular web objects. This finding is consistent with previous studies on the localization of web objects for typical websites. These show that there is a significant pattern to be applied as a guideline for web-based GUI. Few studies have systematically examined the users’ priorities concerning various web design features. With the increasing diversity of the multicultural online community, there is a need for future research in the field of design and object localization [2].

As a conclusion, most of HEI in Malaysia provide their e-learning platform to be made available for their users which mainly consists of students and academicians. While there are specific guideline and policy from the authority regarding e-learning infrastructure development to be adhered by HEI in Malaysia, there are no particular or current standard and guidelines for the developer in terms of structures, layout, and GUI designs of e-learning websites. This literature review has unfolded that GUI is vital in every aspect of e-learning system development, and there needs to develop by taking into considerations of emotional engagement aspect between the user and the user interface. The visualization pattern is an integral part of the visual design phase for the development of e-learning websites.

III. METHODOLOGY

This study has been carried out by analyzing and adapting previous research methodology used by [3] to find the most appropriate web object visualization pattern for e-learning websites.

The first phase is to identify visualization pattern of standard web objects of the e-learning websites based on previous research [3]. According to [3], there are 14 standard web objects based on UMS E-Learning websites that arranged to 7x6 inches geometric grid square with nine (9) location to identified as localized area. The following tables 1 shows the 14 standard web objects as determined by [3] and 7x6 geometric grid square with nine (9) location to identified as localized area (Fig. 1):

Table 1. Standard Web Object for E-learning Website

No	Standard Web Object
1	Logo
2	Navigation
3	Faculty Categories
4	Course Categories
5	Search Course
6	External Links
7	Home
8	News & Announcement
9	Helpdesk
10	Feedback
11	Main Menu
12	Login
13	Calendar

14	Advertisement
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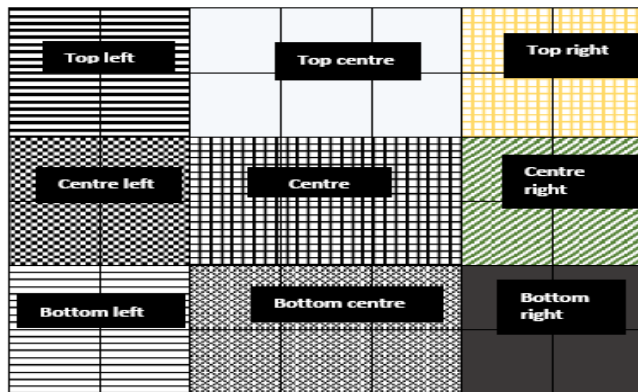


Fig. 1. 7x6 geometric grid square with nine (9) location

Based on previous research standard web objects, this study administers card sorting methods to determine visual pattern guidelines. Card sorting is a method used to aid design or evaluate the information architecture of a site [15]. In a card sorting session, participants are separated individually to sort and organize web objects in the form of physical cards into the grid square provided that makes sense to them. The data then analyzed using matrix percentage analysis.

A. Participants

Students are the primary users to be tested to evaluate the visual pattern of web objects in E-Learning systems; however, the studies also involved academician and IT administrator as the participants. Most of the participants are from Universiti Malaysia Sabah (UMS). The number of participants involved in this study is determined based on an invitation and accept the request method. The initially proposed numbers of participants are 38 and above based on the previous reviews from [9]. However, this study has gained so far 14 respondents consisting of various categories of UMS's community member.

B. Procedure

Participants were requested to complete a demographic (background) questionnaire regarding their computer use, internet use, language use on websites, and educational background [9]. The participants were then asked to organize and place the cards in the grid-square from [1] based on the location that made sense to them. They will be asked to perform close card sorts. 2x5 cm magnetic card represents the 14 standard web objects; meanwhile, the 25x20 cm magnetic whites board represents the interface of the website. The participants were given 15 minutes to sort the cards into groups [9]. The result recorded with a digital camera [5]. Submit your manuscript electronically for review.

IV. RESULTS

Findings of this study discussed in detail on two sections. The first one is the findings on the demographic part and followed by a qualitative method of card sorting.

A. Demographic Analysis

From the total of 14 participants were involved in this study. Nine of them were female, and five of them were male participants. The participants were from different age groups, as 50% of them, where most of the participants are from the age group of 20 - 24 years old. 21.4% of them were from the age group under 35-39 years old. 14.3% of the participants involved were from the age group 30-34. Both participants on the age group of 35-39 and 25-29 shares the same percentage of 7.1%. The participants involved were from different races in Malaysia. 14.3% of the participants were Malay, while the majorities 85.7% were others. Those who selected the options as others were Kadazan, Dusun, Bidayuh, Buginese, and Brunei. This shows that the majority of the participants involved were of Sabah aboriginal. The participants of this study were from a different educational background. The majority, with 28.6%, is shared between both participants with a bachelor's degree and less than a diploma or equivalent as their educational background. Both participants of

Diploma or equivalent and master's degree holder, each have a similar percentage of 21.4%. Majority of the participants are mostly students, with 50% counts, followed by IT administrator/officers with 28.6% of the participants. The academicians were the lowest percentage among the participants with 21.4%. The participants involved were from various HEI in Malaysia. 71.4% of the participants were from Universiti Malaysia Sabah (UMS), 21.4% of them were from Universiti Teknologi MARA (UiTM), 7.1% from Universiti Malaysia Sarawak (UNIMAS). This studies so far has managed to collect data from three various HEIs in Malaysia. Apart from that, the participants involved in this study come from multiple faculties and departments. The highest recorded participants are from the Faculty of Computing and Informatics with 28.6%; meanwhile, the Library Department and Faculty of Science and Natural Resources both comes second with 21.4%. The lowest of the participants were from Department of Information Technology and Communication, Faculty of Computer and Mathematical Science, Faculty of Engineering and Faculty of Business, Economics, and Accountancy, where each recorded 7.1%. The majority of the participants, with 92.9% agreed that they have seven years and above of ability in using the internet. Whereas, 7.1% have said they can use the internet for 4-6 years. The participants have several purposes of using the internet as. The purposes options were searching for information, product search, and purchasing, e-mail/e-card/ other communication (i.e., chatting), game/ music/ program downloading/ entertainment and online banking/ pay bills. Game/music/program downloading /entertainment purpose was the lowest chosen by the participants as their personal use of the internet, which is 42.9%. Searching information was the highest with 57.1%. Most of the participants who involved in this survey agreed that they visit the HEIs E-learning website 2 – 3 times a week with 50%. 42.9% of the participants visit the HEIs E-learning website daily. Whereas, 7.1% of them agreed they visit the E-learning website 2 – 3 times a month.

Table 2. Demographic findings summary

Demographic Information	Findings (%)
Gender	
Female	64.3
Male	35.7
Age Group	
20-24	50.0
25-29	7.1
30-34	14.3
35-39	21.4
40-44	7.1
Race and Ethnicity	
Malay	14.3
Others	85.7
Education Background	
Less than a diploma or equivalent	28.6
Diploma or equivalent	21.4
Bachelor's degree	28.6
Master's degree	21.4
Employment status	
Student	50.0
Academician	21.4
IT Administrator/ Officer	28.6
Participant's HEI	
UMS	71.4
UNIMAS	7.1
UiTM	21.4
Participant's Faculty/Department/Centre/Unit	
Faculty of Computing and Informatics	28.6
Faculty of Engineering	7.1
Faculty of Business, Economics and Accountancy	7.1
Faculty of Science and Natural Resources	21.4
Library	21.4
Department of Information Technology and Communication	7.1
Faculty of Computer and Mathematical Sciences	7.1
Ability to use internet	
7 years +	92.9
4-6 years	7.1
Primary access of the internet	
In your room/ door room / apartment /work office	92.9
Public facility (library, computer lab, etc.)	7.1
Preferable language use of the internet	
English	92.9
Malay	7.1
Primary personal use of the internet	
Searching information	57.1
Game / music / program downloading / entertainment	42.9
How often participants visit a university e-learning website	
Daily	42.9
2 – 3 times a week	50.0
2 – 3 times a month	7.1
Participants experienced e-learning website of other university	
Yes	50.0
No	50.0

Card Sorting Analysis. There are 14 web objects selected to identify visualization pattern in this research based on the [3]. The 14 web objects were the predetermined closed card to be sorted to nine grids represented nine (9) primary locations for the interface categories. Table 5 shows the visualization pattern by the distribution of web objects by card sorting according to respondent number. Table 6 shows the visualization pattern by the distribution of web objects by card sorting according to the percentage of respondents' number. The highest counts and percentage highlighted according to frequencies of nine primary locations across the board. However, they are divided majority for both Helpdesk and Feedback menu are tied between Bottom Left and Bottom Right with 28.6% distribution for each location. There are only three web objects has over 70% majority which is Logo

(70% selected on Top Left), Home (71.4% selected on Top Left), and the highest is Login with 78.6 % selected on Top Right location.

Table 3. Matrix Table distribution of Web Object by respondents' number (* same value in two locations)

	Top Left	Top Centre	Top Right	Centre Left	Centre	Centre Right	Bottom Left	Bottom Centre	Bottom Right	Total (%)
Logo	10	1	1		1			1		14
Navigation	5	1	2	3		1	2			14
Faculty Categories	2	4		8						14
Course	1	2		6	4	1				14
Search Course	1	3	4	6						14
External Links	1	2	1		1	1	2	2	4	14
Home	10	2	1		1					14
News & Announcement	1	3	1		2	6	1			14
Helpdesk			3			1	4*	2	4*	14
Feedback		1	2				4*	3	4*	14
Main Menu	9	2	2	1						14
Login	2		11			1				14
Calendar	1	1	4		1	3		2	2	14
Advertisement			2	1	1	1	2		7	14

Table 4. Matrix Table distribution of Web Object by percentage (* same value in two locations)

	Top Left	Top Centre	Top Right	Centre Left	Centre	Centre Right	Bottom Left	Bottom Centre	Bottom Right	Total (%)
Logo	71.4	7.1	7.1	0	7.1	0	0	7.1	0	100
Navigation	35.7	7.1	14.3	21.4	0	7.1	14.3	0	0	100
Faculty Categories	14.3	28.6	0	57.1	0	0	0	0	0	100
Course	7.1	14.3	0	42.9	28.6	7.1	0	0	0	100
Search Course	7.1	21.4	28.6	42.9	0	0	0	0	0	100
External Links	0	7.1	14.3	7.1	7.1	7.1	14.3	14.3	28.6	100
Home	71.4	14.3	7.1	0	7.1	0	0	0	0	100
News & Announcement	7.1	21.4	7.1	0	14.3	42.9	7.1	0	0	100
Helpdesk	0	0	21.4	0	0	7.1	28.6*	14.3	28.6*	100
Feedback	0	7.1	14.3	0	0	0	28.6*	21.4	28.6*	100
Main Menu	64.3	14.3	14.3	7.1	0	0	0	0	0	100
Login	14.3	0	78.6	0	0	7.1	0	0	0	100
Calendar	7.1	7.1	28.6	0	7.1	21.4	0	14.3	14.3	100
Advertisement	0.0	0.0	14.3	7.1	7.1	7.1	14.3	0.0	50.0	100

The web objects arranged according to the highest to lowest value order in every distributed location based on the matrix percentage values, [14]. Based on the results, by the majority, only six areas have been identified as the participants' preference, as shown in Fig. 2. According to the findings, there are five web objects share the same matrix percentage; thus, its visual pattern is still not confirmed.

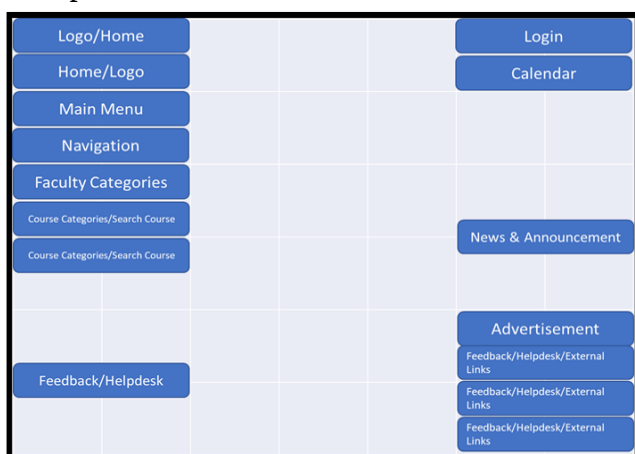


Fig. 2. Visual Pattern Guideline Results Based on Matrix Percentage

The next method used to identify visualization pattern of selected web objects was collected using a

7x6 geometric grid method proposed by [3]. The established web objects were those that appeared three or four times on each e-learning website of the comprehensive universities. The darker the shade in the grid region, the higher the number of times that the particular web objects placed on the grid by respondents (refer to Fig. 3). Fig. 4 shows that web object for External Links and Helpdesk does not have a singular concluded location; therefore, External Links, are not included in the final result in Fig. 6. The results of the visualization pattern of web objects are shown in Fig. 4 to Fig. 5.

<1	1-2	3-4	5-8	9-16	17-24	25-32	33>
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Fig. 3. Shades' scale

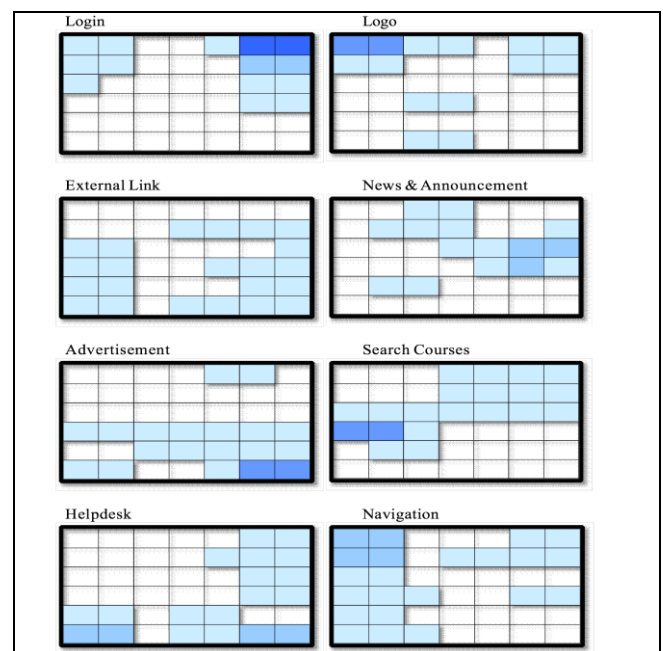


Fig. 4. 7x6 Geometric Method Result (1)

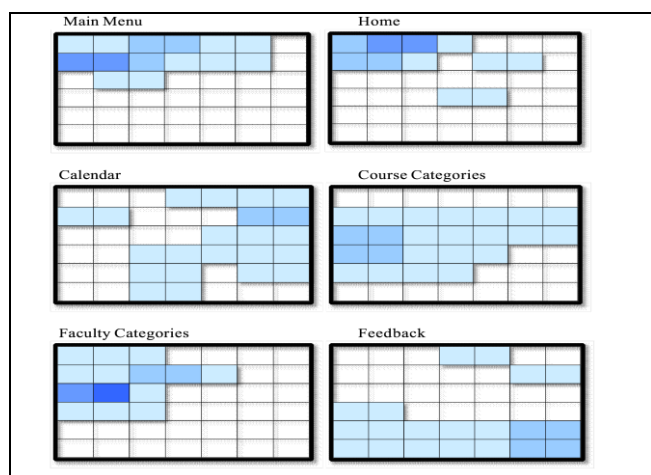


Fig. 5. 7x6 Geometric Method Result (2)

Matrix Percentage Analysis and 7x6 Grid Analysis Results Comparison. The results comparison between matrix analysis and 7x6 grid analysis (refer to Fig. 6) shows that both methods produce near-identical visual pattern guidelines. Both results show that participants preferred left and the right location to be placed web objects. However, both analyses came out with a few unconfirmed visualization patterns for web objects, due to lack of respondent numbers.

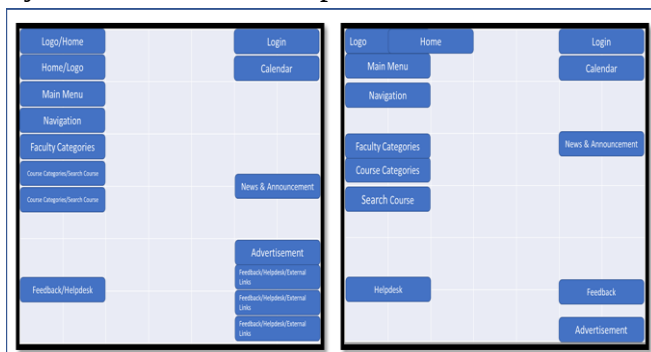


Fig. 6. Matrix Percentage Analysis and 7x6 Grid Analysis Results Comparison

V. CONCLUSION

As a conclusion, the result comparison between the two methods of analysis (refer figure 19), visual patterns and potentially confirmed guidelines can be produced. Both results also show similar primary location for e-learning websites web objects. It is essential to consider user expectations in designing e-learning GUI, to enhance users experience in using e-learning websites [3]. It is also anticipated, that by studying visualization patterns of e-learning GUI, it will help users effortlessly access the information and details that they need. It is also imperative that the

guidelines enable users without difficulty to engage in learning tasks. Future research can focus on evaluating visualization pattern of e-learning websites by using tools such as Kansei Engineering Methods which are based on [12] measure and verify emotional engagement elements on the proposed guidelines.

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