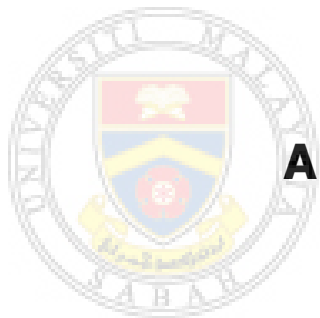


**VISUALISATION PATTERN GUIDELINES FOR
EMOTIONAL ENGAGEMENT IN E-LEARNING
WEBSITE FOR HIGHER EDUCATION
INSTITUTIONS**



ALBERTO ANING

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UNIVERSITI MALAYSIA SABAH

**FACULTY OF COMPUTING AND INFORMATICS
UNIVERSITI MALAYSIA SABAH
2023**

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EMOTIONAL ENGAGEMENT IN E-LEARNING
WEBSITE FOR HIGHER EDUCATION
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ALBERTO ANING



**THIS IS SUBMITTED IN FULFILLMENT FOR THE
REQUIREMENTS FOR THE DEGREE OF MASTER OF
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UNIVERSITI MALAYSIA SABAH
2023**

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DECLARATION

I hereby declare that the material in this thesis is my own work except for certain quotations, equations, summaries, definitions, and references, which have been duly acknowledged.

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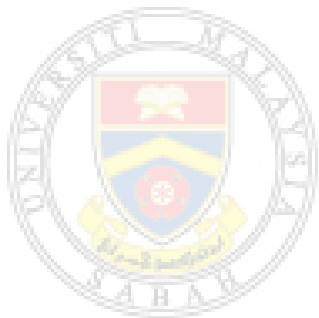
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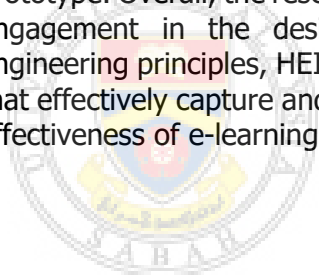
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ABSTRACT

The research focuses on the scenario of e-learning websites, particularly within the context of Higher Education Institutions (HEIs). These websites face a significant challenge in engaging students, and there is a lack of user interface design guidelines that foster emotional engagement. As a result, student disengagement becomes a prevalent issue on these e-learning platforms. To address this problem, the research proposes the application of Kansei engineering (KE), a user-oriented technology that examines the emotional needs of consumers and establishes the relationship between emotions and product design elements. By utilizing KE principles in the design process of e-learning websites, the goal is to create a positive emotional impact on users, eliciting feelings of delight, engagement, trust, and contentment. The objective of the research is to develop a guideline specifically for the user interface design (UID) of e-learning websites in HEIs. This guideline aims to assist website developers and designers in creating e-learning platforms that sustain students' interest and engagement over time. To evaluate the effectiveness of the proposed UID guideline, the research conducted an evaluation using an electroencephalogram (EEG) device. The results showed that 65% of the participants fell into the "Most Effective" category, with the highest average effectiveness rating reaching 32.6%. These findings demonstrate that the developed guideline significantly increased student engagement with the UID of the e-learning website prototype. Overall, the research emphasizes the importance of considering emotional engagement in the design of e-learning websites. By incorporating Kansei engineering principles, HEIs and website developers can create e-learning platforms that effectively capture and sustain students' interest, thereby enhancing the overall effectiveness of e-learning experiences.



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ABSTRAK

GARIS PANDUAN CORAK VISUALISASI BAGI PENGLIBATAN EMOSI DALAM LAMAN WEB E-PEMBELAJARAN UNTUK INSTITUSI PENGAJIAN TINGGI

Kajian ini memberi tumpuan kepada senario laman web pembelajaran atas talian, terutamanya dalam konteks institusi pengajian tinggi. Laman web ini menghadapi cabaran yang besar dalam menarik minat pelajar dan seringkali kekurangan panduan reka bentuk antara muka pengguna yang dapat mengeratkan ikatan emosi. Akibatnya, ketidakberkesanan pelajar menjadi isu penting di platform pembelajaran atas talian ini. Untuk mengatasi masalah ini, kajian ini mencadangkan penggunaan teknologi Kejuruteraan Kansei (KE), teknologi yang berorientasikan pengguna yang mengkaji keperluan emosi pengguna dan menetapkan hubungan antara emosi dan elemen reka bentuk produk. Dengan mengaplikasikan prinsip KE dalam proses reka bentuk laman web pembelajaran atas talian, matlamatnya adalah untuk mencipta impak emosi yang positif terhadap pengguna, menghasilkan perasaan kegembiraan, keterlibatan, kepercayaan, dan kepuasan. Objektif kajian ini adalah untuk menghasilkan panduan khusus untuk reka bentuk antara muka pengguna (UID) laman web pembelajaran atas talian di institusi pengajian tinggi di Malaysia. Panduan ini bertujuan untuk membantu pembangun laman web dan pereka dalam mencipta platform pembelajaran atas talian yang mampu mengekalkan minat dan keterlibatan pelajar dari semasa ke semasa. Untuk menilai keberkesanan panduan UID yang dicadangkan, kajian ini melakukan penilaian menggunakan peranti elektroensefalogram (EEG). Keputusan menunjukkan bahawa 65% daripada peserta tergolong dalam kategori "Paling Berkesan", dengan purata penilaian keberkesanan tertinggi mencapai 32.6%. Penemuan ini menunjukkan bahawa panduan yang dibangunkan secara signifikan meningkatkan keterlibatan pelajar dengan UID prototaip laman web pembelajaran atas talian. Secara keseluruhannya, kajian ini menekankan kepentingan mempertimbangkan keterlibatan emosi dalam reka bentuk laman web pembelajaran atas talian. Dengan menggabungkan prinsip Kejuruteraan Kansei, institusi pengajian tinggi dan pembangun laman web dapat mencipta platform pembelajaran atas talian yang mampu menangkap dan mengekalkan minat pelajar, dan pada akhirnya meningkatkan keberkesanan keseluruhan pengalaman pembelajaran atas talian.

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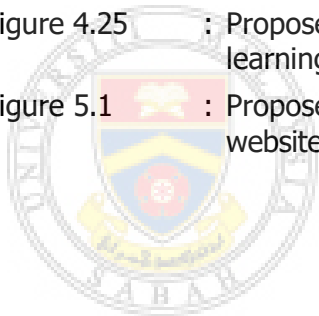
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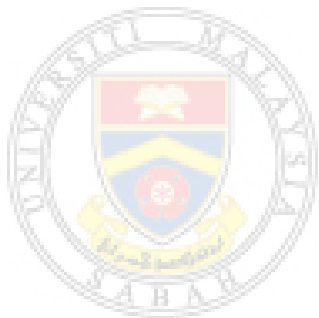
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CHAPTER 1

INTRODUCTION

1.1 Introduction

The internet and digital technologies have revolutionized the education industry, with e-learning emerging as a popular mode of education delivery. E-learning websites provide learners with the opportunity to access courses, tutorials, and other educational resources online. The rise of e-learning websites has transformed the way people learn, making education more accessible and convenient. According to Smith et al. (2022), e-learning websites are designed to provide learners with access to a wide range of courses and resources. The key features of e-learning websites include course content, interactive learning tools, flexible learning, personalization. Designing a good e-learning website (Garett et al., 2016) has become noticeably significant as countless tasks are being done over the Internet nowadays. The user interface (UI) of websites is the only bridge that connects a user to the computer applications or web environments, and therefore, it is an interactive platform for users and machines. A good design can optimize website success through the improvement of several consumer dimensions, including information gathering, intention to return to the website, trust, and performance improvement (Lindgaard et al., 2011). Whereas a poorly designed e-learning website may frustrate the users (Baharum et al., 2017) which in turn leads the users to leave a homepage of the website without visiting the internal pages (Garett et al., 2016).

In the past, website user interface design (UID) was primarily focused on the designer's perspective, where only the thoughts and opinions of designers were taken into consideration during the design process. E-learning websites offer

numerous advantages over traditional classroom-based education (Alqahtani, 2020) which are education more accessible to learners who may not have the opportunity to attend traditional classes, allow learners to access course material from anywhere and at any time, often times more cost-effective than traditional classroom-based education and also have a global reach, allowing learners to access courses and resources from anywhere in the world. Several studies have demonstrated the significance of users' opinions and perspectives in the process of designing websites, as these factors have a direct impact on user satisfaction and overall experience (Noori et al., 2015; Garrett et al., 2016). The UI has a vital role in satisfying users and establishing enhanced human-computer interaction (HCI). Successiveness of a website depends highly on user satisfaction and the possibility of meeting users' needs in the best and most efficient way wherein turn depends on the nature of communication between the user and the interface (Flavian et al., 2009). Therefore, good web design for e-learning websites is particularly important in the development of websites. Despite their advantages, e-learning websites also face several challenges. Raza et al. (2021) highlighted these challenges which are technical issues that can affect the delivery of courses and cause frustration for learners, lack of interaction can be a disadvantage for learners who thrive in a social learning environment and e-learning websites require learners to be self-disciplined and motivated. This can be a challenge for some learners who struggle with self-motivation.

Engagement plays a crucial role in the effectiveness and quality of online learning programs (Mu et al., 2019). The cooperation, task dependence, and social interaction among learners contribute to enhancing their engagement (Wang et al. 2022). Emotional engagement encompasses the range of positive or negative attitudes and feelings that students associate with their learning experiences. These emotions can arise in response to various factors, such as the content being studied, interactions with peers, the learning environment, or the educators themselves. It is a psychological approach that needs to be considered in website design to provide the user with emotional appeal, a sense of aesthetic, or a positive impression on the website (Cyr et al., 2009). Emotional appeals are contributed to the users through the visual design of a website where it can be delivered through images or colors

(Cyr et al., 2009; Lindgaard et al., 2011). Emotional responses are triggered by an ability to engage the user in an online environment which is aesthetically pleasing, and emotions are elicited through visual design and interaction design. Earlier research argued that a website should be able to encourage emotional engagement and elicit a positive impression as it results in higher user satisfaction (Cyr et al., 2009). Inadequate interface design leads to negative user interaction and subpar user experience, resulting in heightened arousal and continuous user anxiety. This, in turn, generates feelings of dissatisfaction and negative emotions, leading users to actively avoid poorly designed websites (Lee, 2017). An emotional-based website entices the users to experience enjoyment, involvement, trust, or satisfaction besides being useful and user-friendly as emotions are essential to the interpretation of experience (Cyr et al., 2009). Hence, website designers are trying their maximum in designing websites that satisfy the users' emotional needs by enhancing the quality of user experience. With the objective of creating an e-learning website that fosters emotional engagement and delivers a positive user experience, this study seeks to explore the understanding of how UI design elements impact emotions and the potential to incorporate emotional engineering into website design (Park et al. 2021).

Higher Educational Institutions (HEIs) utilize their websites as platforms to disseminate information to various stakeholders, including prospective students, current students, faculty, and alumni (Baharum et al., 2017; Zainab et al., 2019). Presenting information effectively on Higher Educational Institutions' (HEIs) websites poses a significant challenge in terms of user exploration. Research has shown that websites of HEIs often fall short of meeting high-quality standards, highlighting the necessity for guidelines to improve the design and usability of these websites (Kurniawan et al., 2021; Sulong et al., 2018). Therefore, research on the webpage design of HEIs e-learning websites, exceptionally the appearance of the webpage is essential due to the limited studies done on HEIs websites considering the emotional needs of the users. This research's main intention is to explore users' needs and emotions while using an HEI website. Kansei engineering (KE) is known to be a successful user-oriented technology which can investigate the users' emotional requirements and specify the connection between the emotions and design features of a product. It has been widely used to develop Kansei-based products that

captivate and satisfies users as emotional products influence product evaluation, purchase decision, and product experience of users significantly. Due to an ability of improving users' emotional experience along with the successful potential in making the link between users' needs and design elements, KE has been a well-known industrial design technique in a wide range of fields. Thus, this study strives to employ KE technology into web design of HEIs in order to propose a standard Kansei-based web design that can satisfy the users' emotions by invoking emotional involvement. The proposed standard Kansei-based web design justified with a self-report emotional assessment tool and Kansei checklist. Kansei checklist includes Kansei words which can be used by users to convey their feelings. The justified Kansei-based web design can be helpful for designers to design website for Malaysian HEIs that can respond to the emotional needs of users' appropriately.

1.2 Problem Background

Creating a web-based education system has emerged as a prevailing conviction among contemporary academics and educational administrators. Presently, universities, training institutions, and government agencies are making substantial investments in the development of e-learning software, e-learning authoring tools, learning management systems, and other related technologies (Alshurideh et al., 2020; Soomro et al., 2020). The term e-learning has been broadly defined as multimedia-based instruction, delivered using various instructional methods, which can be accessed by learners through their computers at their own will.

According to Kundi et al. (2010), many researchers agree that human perceptions about technologies determine their attitudes towards e-learning environment is not simply a technical matter; rather, it demands the consideration of several human and social factors. The researcher has also found that choice of education technologies should not be guided by a technologically deterministic approach but rather be guided by considering various contextual requirements related to a broad range of social, cultural, political, and economic factors. Ezer (2006) has emphasize 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 (Ezer, 2006). Kundi et al. (2010) in their research have also specified that perceptions and beliefs of human beings as the major determinants of their practical attitude towards e-learning, thus the term emotional engagement between users and e-learning platforms are to be involved. Positive beliefs inspire users to take interest while negative feelings motivate them to stay away. They found out that developers of e-learning platforms must possess technical skills as well as soft skills of interpersonal communication and understanding of human motivation problems. Despite e-learning technology presenting a number of benefits, it still has challenges for educationalists, particularly on attracting learners to their e-learning services (Liao & Lu, 2008).

The interface of an e-learning website is considered as the entry point for the visiting learners whose interactivity, learnability and sustainability totally rely on its layout, content, information, and other attributes of the site. However, this research will only focus on UID rather than content development of e-learning websites as it can have leading effect on the success or failure of the e-learning as a whole. This research will try to produce UID visual pattern guideline for e-learning websites for HEIs that will contribute to positive emotional engagement between users and the e-learning system. Baharum et al. (2017) has 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 research is the extension of their earlier study. Based on the web objects of e-learning identified in the work of Baharum et al. (2017), this research will propose new guidelines by using card sorting methods. After that, a prototype website for e-learning will be designed based on the proposed guidelines and evaluated by using Kansei engineering method.

Kansei-based e-learning websites have the potential to significantly improve the learning experience for users (Hadiana, 2016). By incorporating Kansei engineering principles into their design, these websites can create a more engaging, personalized, and effective learning environment. Kansei engineering is a Japanese term that means "sensory design" or "affective design." It is a design philosophy that focuses on understanding and incorporating human emotions, preferences, and

subjective responses into product design. Usability of the e-learning website will open the door for flourishing delivery of teaching and learning activities. Therefore, this study has been carried out to examine the corresponding influence of usability attributes and finally contribute to visual pattern guidelines and e learning website design that promote efficiency and emotional engagement.

1.3 Problem Statement

i. Slow interaction between users and user interface design (UID) of e-learning.

The user interface is vital to any application or software, as it can affect the user experience. Learning effectiveness and interface design are intricately interwoven, making the design of e-learning interfaces particularly crucial (Guralnick, 2006). When users of an e-learning platform or website find it challenging to interact with the UID, it can impede their job flow. Slow interaction between users and the UID of the e-learning website can result in low utilization of the HEI e-learning website. According to a study by Baharum et al. (2017), delayed interaction between users and the user interface is caused by a limited standard web of objects (text, graphics, URLs, etc.) and users' expectations.

ii. Complex and complicated e-learning UID because there are no standard web objects.

The complex and complicated UID significantly contributes to the slow interaction between users and UID in e-learning. Users who see the e-learning website less frequently or for the first time are unable to navigate the site without difficulty. People prefer known paths when pursuing a goal whenever possible instead of venturing into unfamiliar ways (Johnson, 2020). On an e-learning website, the absence of standard web objects could demotivate users from completing a task. Students of this generation are accustomed to using the Internet at a young age; consequently, they are more adept at acquiring the characteristics and getting familiar with an e-learning website. Traditional educators accustomed to face-to-face lectures have difficulty with the advanced UID, discouraging them from using the e-

learning platform (Bhongade & Sarode, 2018). When educators supply fewer learning materials on the e-learning website, students become less engaged in e-learning because they have fewer compelling reasons to access it. In addition to educators, students can become confused when faced with a UID that has less information shown for them to navigate, decreasing their motivation to complete or even start a task on the e-learning platform.

iii. Limited guidelines for proper user interface design for e-learning websites of HEI in Malaysia that promotes emotional engagement.

Even though e-learning is gaining prominence in education, there are few studies on the guidelines for effective user interface design for e-learning websites of Malaysian higher education institutions. Therefore, fewer proper user interface design guidelines foster emotional engagement. A well-designed interface is essential since it can increase user productivity (Galitz, 2002). For instance, a user interface design that adheres to proper principles can shorten the time it takes for a user to process the information on their screen.

Baharum (2017) studied the basic principles, user interface design guidelines, and challenges of integrating e-learning higher educational institutions. However, the study results indicate no specific design standard for e-learning in Malaysian higher educational institutions. Instead of adopting uniform guidelines, each institute's website is developed following the institute's guidelines. Students, who are the key users of HEI e-learning websites, may become confused when accessing the website without a consistent guideline, as not all students have the same experience with e-learning websites. Some students are familiar with well-known e-learning websites such as Schoology, Edmodo, and Google Classroom, while the remaining students are using e-learning websites for the first time.

The involvement of emotions in the teaching and learning process is crucial (O'Regan, 2003). Students engage less with e-learning websites (Alsubhi et al., 2019). Not all guidelines specify how the e-learning website should be structured to encourage emotional engagement. The organization or person in charge of the e-learning website should review the e-learning interface often to promote interaction

between students and the e-learning system (Nordin et al., 2021). The way to fix the students' emotional disengagement of the e-learning website is to follow a user interface design guideline with the design principles for engaging students to utilize the e-learning website more. Most design principles are intentionally vague to be broadly applicable, but this leaves their precise meaning and application in specific design contexts subject to interpretation (Johnson, 2020). Based on the three problem statements, it can be said that the current UID of the HEIs websites does not have consistent or fixed guidelines set by the government or an entity responsible for HEIs website design. Even if each HEIs website follows a custom guideline that the university makes up on its own, the website UID harbors navigation difficulties from its users, resulting in a bad user experience. Hence, a thorough investigation should be done on how much the UID of the HEIs websites can provide an easy and good experience to their e-learning website users and what can be done to improve the experience by using card sorting to identify UID visual pattern and integrating Kansei engineering principles in its design.

1.4 Research Question

The main research question is:

- i. How to develop a Kansei-based visualisation pattern?
- ii. Does the developed e-learning website prototype ease the users in navigating through the e-learning websites to the users?

1.5 Research Objectives

There are two main research objectives:

- i. To develop a visualisation pattern as a guideline for emotional engagement in e-learning website for HEIs.
- ii. To evaluate the effectiveness of developed prototype using electroencephalogram (EEG) device.

1.6 Research Scope

To accomplish this objective, the study has outlined the following research scope stated below.

Phase I:

The card sorting is done with six universities in Malaysia with three different groups of university members which are students (25), academicians (11), and IT administrators (2) from each university. A manual card sorting has been done with one of the universities involved which is Universiti Malaysia Sabah (UMS) while the other five universities are Universiti Teknologi Mara (UiTM), Universiti Malaysia Sarawak (UNIMAS), Open University (OUM), Universiti Kebangsaan Malaysia (UKM), and Universiti Sains Malaysia (USM) did online card sorting.

Phase II:

In the second phase, three universities which are Universiti Pertahanan Nasional Malaysia (UPNM), UMS, and UiTM are involved with 154 participants being the respondents of the online questionnaire survey (Google Form). The purpose of Phase II is to evaluate the emotional engagement between users and the visualisation pattern of the HEI e-learning website by using the Kansei Engineering Method. E-learning websites from eight different universities in Malaysia are used as specimens.

Phase III:

The guideline that is proposed based on the results from Phase II is used in Phase III to evaluate the emotional engagement user experience. An electroencephalography (EEG) device is used to measure the emotional engagement of 16 participants from UMS while using the prototype of an e-learning website developed based on the guideline proposed from the results of Phase II.

The research is limited to the Malaysia region and specifically to the users of the HEIs e-learning website users especially university members.