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E-B Environment - Behaviour Proceedings Journal

CSSR 2017
https://www.amerabra.org; https://fspu.uitm.edu.my/cebs; https://www.emasemasresources.com
4th International Conference on Science & Social Research
The Pines, Malacca, Malaysia, 06 -07 December 2017

e-IPH e-International Publishing House Ltd., United Kingdom

A Content Analysis on Interface Design Principles and Characteristics of Tertiary Teaching Aids

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Abstract
The digital multimedia technology has transformed the tertiary education environment, changing lecturers' role who are required to develop multimedia teaching aids to sustain effective teaching and learning engagement. As interface designers, it is vital to produce good design, which effectively communicates the teaching and learning content. This paper provides an empirical evaluation on what are the interface design principles characteristics contributing to multimedia teaching aid design appearance, outlined from analysis towards interface design principles applied in Malaysian tertiary institutions' multimedia teaching aids. Although the sample of this study is locally based, the outcomes of this paper could extensively be a guideline for other countries.

Keywords: Interface design; interface design principles; tertiary education

DOI: https://doi.org/10.21834/ebpj.v5iSI1.2312

1.0 Introduction

The acceleration of Information Communication Technology (ICT) in recent years has dynamically changed the landscape of tertiary education, which replaced the role of how lesson content is delivered. The vigorous multimedia technology has speared into the daily life, increased significantly in its usage and availability in educational settings (Abdul Aziz, Abdul Salam, Ariffin, & Ismail, 2016), with educators implementing various multimedia teaching aids to achieve active learning engagement. This progress consistently reduces the challenge of complicated information delivery method effectively through a variety of screen platforms (Wang & Huang, 2015). Described as Gen Y and the millennial, the tertiary students were shaped by rapid advancement of technology, media and content. (Wang & Huang, 2015; Sharma & Pooja, 2015). They were known to be multimedia technology insistence, preoccupying themselves in multimedia technology (Mann, 2017). Significantly, this advancement within interactive multimedia teaching material in the education environment further changed the role of educators and encouraging students' exploration (Yap, 2016).

In developing the interactive multimedia teaching aids, inevitably lecturers have become the designer for multimedia teaching aids. In regards to this, lecturers and tutors, who are the interface designer encounters new challenges to design a well-designed interactive multimedia teaching aid that is capable of increasing students' learning engagement (Czerkawski & Iii, 2016).

Lecturers in creative design courses are equipped with the skills of applying the design principles foundation(Lupton & Philips, 2015), hence there should be no difficulty in preparing multimedia teaching aids with a practical interface design by them. Therefore, how do lecturers from non-creative design courses such as science, technical, business, and management fields design and develop an effective multimedia teaching aid, which further ensures effective teaching and learning engagement?

In regards to the effective multimedia design in the teaching and learning context, Czerkawski & Iii (2016) further asserted that there were no standard measurement established. Significantly, the aim of this research is to determine the implementation of the principles,

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DOI: https://doi.org/10.21834/ebpj.v5iSI1.2312

elements, and characteristics of interface design in the appearance of multimedia teaching aid. Towards meeting this objective, this paper will address the research question of 'How do lecturers from the non-creative design field design the interface for their multimedia teaching aid'? Consequently, this leads to a further suggested investigative question which is 'What are the characteristics and design principles that contribute to the appearance of a teaching and learning content interface design'.

2.0 Literature Review

In meeting the current learning requirements in a tertiary education environment, the convenience of interactive multimedia has replaced the delivery of teaching and learning content (Ismail, 2016). The usage of ICT further provides incomparable classroom experience in developing an active learning engagement (Liu, 2014) extensively through the multimedia material on an interface screen. However, a well-designed function of a multimedia teaching aid is significant as a communication tool (Czerkawski & Iii, 2016). Over the past few years, the rising popularity in various screen platform technology has increased the screen reading among the public (Wang & Huang, 2015), which changed their digital lifestyle. With the rapid development of ICT, students with various levels of technology advancement capabilities are enrolling into different cohorts of tertiary education institutions annually. In improving the students learning engagement, Wang & Huang (2015) emphasized the importance to promote a well-established multimedia teaching aid, together with the learning environment. Significantly, the central position of the outlook is now towards the lecturers in the tertiary institutions.

As distinguished by the visual communication theory, interface design is a product's front-end in facilitating content communication in a multimedia teaching aid (Kamaruddin, 2012; Wood, 2014), and in this research context, enhances the elements of effective teaching and learning process. In regards to this, designers need to acquire a better understanding of an interface design that accommodates audience understanding through quality content presentation (Park, 2012). Text, colour, graphic, video, animation and audio are the six elements of interface design, identified as a contained component delivered though an interface design (Faghih, Azadehfar, & Katebi, 2013). Towards meeting the learning curve, Railean (2017) asserted the importance of a good function interface design is required. Before gaining a better understanding in accommodating the audience's view towards the quality of content presented on a multimedia screen, an interface should be understood, which further facilitates interpretation of the medium through the way the user perceives the communication process (Kamaruddin, 2012; Fang & Lu, 2015).

Towards this, on-going research has been investigating the repetitive process of human-computer interface implementation by addressing the user needs and examining the scope of usage (Starcic, Cotic, & Zajc, 2013). Significantly, Starcic et al. further identified that students facing learning difficulties were capable of benefiting from effective User Interface design. Researchers further asserted that the visual design of a multimedia teaching aid interface significantly affect students' learning engagement (Ang & Mohamad, 2014). They further asserted the need of future research towards the visual design in a multimedia teaching aid for a better learning engagement. Significantly, researchers determined that Graphical User Interface (GUI) Aesthetics' was the crucial immediate factor in establishing effective user interface usability (Zen & Vanderdonckt, 2016).It is where the determination of user accessibility effectiveness through 'User Experience' (Kłoda, Piwiński, & Nowak, 2016), through the support of combined various senses during the process (Fang & Lu, 2015).

In organizing the content to be displayed in an interface, it is significant to have certain guidelines of design principles accordingly for display design in Human-Centered Interaction (Eskridge, Still, & Hoffman, 2014). Towards the vital relation in ensuring an effective learning process, Tomlinson (2012) further asserted that multimedia teaching aids are lacking in the literature and suggested more in-depth investigation. Despite the increasing focus on arguments towards students' engagement at tertiary institution level (Vaughan, 2014), focus on the contribution of multimedia interface design principles towards learning engagement is still lacking (Mulqueeny, Kostyuk, Baker, & Ocumpaugh, 2015). In regards to the need on focusing the design principle guidelines of multimedia teaching aid, there were five interface design principles identified by scholars namely consistency, hierarchy, contrast, balance and harmony (Kamaruddin & Sulaiman, 2016). In addressing this problem statement, it is crucial to distinguish what are the characteristics and design principles applied by the lecturers from a no creative design field that contributes to an effective multimedia teaching and learning content interface design?

3.0 Method

An initial contextual document analysis towards literature among international scholars has established a set of principles and elements guidelines of the six elements of interface design for an effective multimedia teaching aid (Kamaruddin & Sulaiman, 2016). Data collected and analyzed from samples of multimedia teaching aid will allow this research to gain a broad overview of how non-creative design field lecturers design their multimedia teaching aids interface. Samples of multimedia teaching aids collected through snow ball sampling method from respondents of tertiary institution throughout Peninsula Malaysia with no specific non creative deigns field of studies is determined. This study is limited to multimedia teaching aid from non-creative design field of studies, which includes Medical and Health Sciences, Information Technology and Engineering clusters. This process will provide an empirical evaluation of the interface design principle applied in multimedia teaching aids in comparison towards the recommended principles and elements guidelines of the literature. It will lead to answer the research question what are the features of design principles that contribute to the appearance of a teaching and learning content interface design?

From the samples gathered, an extensive content analysis was carried out individually towards 12 samples of multimedia teaching aids from 12 different lecturers of various fields of studies from various tertiary institutions in Malaysia through a snowball sampling method. They consist of teaching aid slides for undergraduate studies with each lecturer providing one multimedia teaching slides

sample from one of their lessons. The total number of slides range from a minimum 13 slides and a maximum 87 slides of each sample. The summary of the twelve teaching aid slides is as listed in the following Table 1.

Table 1. Details of multimedia teaching aids sample

Samples	Module Title	Faculty & institutions	Total slides
Sample 1	Pharmacology	Medical & health sciences: Biomedical science. Institution A	57
Sample 2	Basic Computer Technology	Information technology: computing & multimedia. Institution B	13
Sample 3	Environmental Chemistry	Science: Chemistry. Institution C	87
Sample 4	Internet	Mathematics, science & computing: Information technology. Institution D	25
Sample 5	Laboratory Animal Management	Medical & health sciences: Biomedical science. Institution A	51
Sample 6	Cement & Concrete	Civil engineering: structural material. Institution E	76
Sample 7	Manufacturing Material	Engineering & IT: Mechanical engineering. Institution C	21
Sample 8	Human Computer Interaction	Information technology: Multimedia computing. Institution F	35
Sample 9	ICT Driven Revolution in Society	Information technology: Computing & multimedia. Institution B	26
Sample 10	Personal Health Management	Nursing & Allied Health Science: Health Science. Institution C	54
Sample 11	Thermodynamics & Fluid Mechanics	Engineering & IT: Mechanical Engineering. Institution C	43
Sample 12	Critical Issues and Evolution in Multimedia	Information Technology: Computing & Multimedia. Institution B	24

Fig. 1 below shows the screenshots of the first screen, from the samples collected from lecturers of various tertiary institutions for further analysis. In detail, the majority of the samples explains that the first screen of the teaching aid contents consist of the institution name, institution logo or emblem, program of studies, course or subject name and code. Some samples show that it contains the lecturer's name.

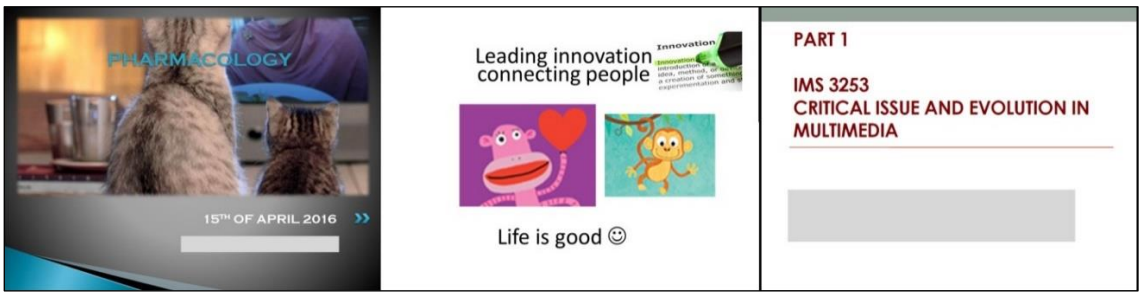

Fig. 1: Some samples of the multimedia teaching aids' first screen

A further analysis conducted towards the individual sample of multimedia teaching aids against the 38 characteristic guidelines of established principles and elements guidelines of interface design for an effective multimedia teaching aid (Kamaruddin & Sulaiman, 2016). This analysis is to determine the characteristics of principles and elements of multimedia interface design applied based on the earlier established characteristics by international scholars. The range of the principle guidelines characteristics then categorized into a Likert scale: from very high, high, medium, low, very low, and not applied.

4.0 Results and Discussions

Table 2 below explains the summary of the common principles identified from the content analysis of the 12 multimedia teaching aid samples.

Table 2. Summary of interface design principles applied towards multimedia teaching aids

Principles	Element	Characteristic Guidelines	Very High	High	Medium	Low	Very Low	None
Consistency	Text	Consistent font, size, placement, colour	50%	25%	17%	0%	8%	0%
	Colour	Consistent throughout pages	67%	25%	0%	8%	0%	0%
	Graphic	Consistent placement throughout pages	17%	50%	25%	0%	8%	0%
	Animation	Consistency throughout the content	17%	25%	25%	0%	0%	33%
	Video	Visible Placement, minimize usage	17%	0%	0%	0%	0%	83%
	Audio	Consistency throughout	0%	0%	0%	0%	0%	100%
Hierarchy	Text	Cluster, structured and Hierarchical	83%	8%	0%	0%	8%	0%
		Animate underline only for attention	75%	8%	8%	0%	0%	8%
	Colour	Groups contents, Hierarchical, functional	75%	8%	8%	0%	8%	0%
	Graphic	Hierarchical to show importance, to emphasize	33%	58%	8%	0%	0%	0%
	Animation	Should not interfere with other contents	33%	25%	8%	0%	0%	33%
	Video	Mostly used for introductions	0%	0%	0%	8%	8%	83%
		Incorporate user control button	8%	8%	0%	0%	0%	83%
		Breakdown videos by sub topics	8%	8%	0%	0%	0%	83%
Contrast	Text	Short paragraph, avoid all Capital Letters	92%	8%	0%	0%	0%	0%
		San serif body copy, no decorative, script, black letter	83%	17%	0%	0%	0%	0%

		Contrast against background	58%	42%	0%	0%	0%	0%
		Use upper lowercase, limit length line	92%	8%	0%	0%	0%	0%
	Colour	Contrast, foreground and background	67%	33%	0%	0%	0%	0%
	Graphic	Legibility, contrast, avoid picture as background	67%	33%	0%	0%	0%	0%
		Clear, contrast avoid clutter for visibility	42%	42%	17%	0%	0%	0%
	Animation	For attention, comprehension & reminder	17%	25%	8%	0%	8%	42%
	Video	Contrast, clarity on background	8%	8%	0%	0%	0%	83%
Balance	Text	Paragraphed in grid column, flush left	92%	8%	0%	0%	0%	0%
	Audio	Suit content & atmosphere, synchronize	0%	0%	0%	0%	0%	100%
Harmony	Text	Limit number of font type	83%	17%	0%	0%	0%	0%
		Integrate text & diagram appropriately	42%	42%	8%	8%	0%	0%
	Colour	Consider Culture, field Associate	75%	8%	8%	8%	0%	0%
		Avoid bright colours for long text	100%	0%	0%	0%	0%	0%
		Aesthetically pleasing, appealing	75%	17%	0%	8%	0%	0%
	Graphic	Functional text & diagram appropriately	50%	33%	8%	8%	0%	0%
		Consider Audience Level	75%	17%	0%	8%	0%	0%
		Appropriate to content, understandable	50%	33%	17%	0%	0%	0%
	Animation	Identify user, needs and function	33%	25%	0%	0%	0%	42%
		Simple, minimal, speed not too fast	33%	25%	0%	0%	0%	42%
		Aesthetically appealing, appropriate	33%	25%	0%	0%	0%	42%
	Video	Understandable, simple, accompany audio	8%	8%	0%	0%	0%	83%
	Audio	Pleasant, coherent and consistent	0%	0%	0%	0%	0%	100%

From the interface design principle analysis towards the 12 multimedia teaching aids, it can shows that one characteristic each from the principle of consistency, balance and harmony in the interface design principles is not applied. In addition, only one characteristic from the principle of harmony has a 100% very high frequency of occurrence reported. Secondly, in regards to the principle of contrast, only an average of 50% towards the element of text in the 12 samples and 67% towards the element of colour were discovered to have a very high frequency was. In contrast, the element of text in the principle of harmony has shown 83% of very high rate and 17% of a high frequency of occurrence. Finally, all three specific guidelines for the element of colour reported to have a high percentage of 100%, 75% and 75% of very high frequency of occurrences with 8% and 17% of high frequency occurrences. Further discussions of the findings from these data gathered are in the following section.

From the data analysis, the most important principle of interface design, which is the principle of consistency, was not effectively applied towards the multimedia teaching aids samples analyzed was discovered. Through visual communication and multimedia design theory of interface design, the element of text determined as the most important element, with the principle of contrast identified to be the most important principle of design (Wood, 2014; Lupton & Philips, 2015). However, the principle of text showed a poor application in the principle of consistency, and shows an effective application in the element of colour. Another exciting result reported is that the principle of harmony, established to be the least important principle of design by scholars, has shown an average of moderate to and effectively applied in the multimedia teaching aid samples. Significantly, this shows that the principle of harmony, even though being the least important, was the second most compelling principle of design affecting the overall multimedia teaching aids' appearance. In addition, the principle of hierarchy that is the second most important principle of design reported to be less effective in affecting the appearance of the multimedia teaching aids in comparison towards the principle of contrast and harmony as stated earlier.

5.0 Conclusion and Recommendations

Lecturers in the tertiary institution are facing the challenge to design and develop effective multimedia teaching aid, to sustain effective teaching and learning engagement among the Gen Y students. These Gen Y students with a digital lifestyle, known as the digital natives, enrolled into different cohorts in the tertiary education with varying levels of technology capabilities. With this challenge faced, an extensive content analysis conducted to identify how lecturers among the non-creative designers apply the valid principle and elements in designing the multimedia teaching aid. From the study, it shows that the lecturers did not apply all aspects from the significant principle of consistency in the multimedia teaching aid interface. Secondly, the principle of hierarchy established to be the second most cited important principle of design by scholars showed a low number of occurrences of very high frequency towards its specific guidelines. In contrast, the characteristic of the least essential principle of design, which is harmony, shows a high percentage of a very high frequency of occurrences. These findings are alarming as it has the potential to interrupt the active learning engagement, where a multimedia interface design should be well functioned compelling to meet the challenges among the Gen Y tertiary students.

However, with the finding from this preliminary study, the interface design applied towards the multimedia teaching aids required further studies. This is in significant to investigate the level of understanding among the lecturers on these effective principles and elements of interface design in developing the multimedia teaching aid. This is through the basis on how the individuals from a non-creative design field designs the interface of the multimedia teaching aids, and how it supports the delivery of the teaching content.

Acknowledgments

The Fundamental Research Grant (FRGS) 2017, under the Ministry of Higher Education, Malaysia, supports this research.

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