

A Conceptual Framework of Interface Design Roles for Teaching aids in Malaysian Tertiary Education

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ABSTRACT— *The rapid development of technology for the past twenty years has reshaped the teaching and learning process in the current tertiary learning environment. Interactive multimedia teaching content has replaced the role on how lesson content is being delivered, consistently reducing the challenge of complex information delivery method in the tertiary learning environment through interactive multimedia on various screen platforms effectively. In designing a teaching content, teaching aid as a communication tool should be well designed and developed. In the development of the interactive multimedia teaching content, in common lecturers and tutors axiomatically become as an interface designer. As body of literature has been growing in the field of study on Multimedia in education, there is robust and established body of literature in addressing research pertaining teaching and learning material (teaching aid) in education. Interface design as a medium that communicates between user and the computer system through principles and elements of design for effective teaching aid is essential, however it is important to identify what are the principles and elements of effective interface design for a teaching aid, how it is being developed and how does it affect or effect in an effective teaching and learning process.*

Keywords— interface design, interactive multimedia, teaching aid, learning engagement

1. INTRODUCTION

The role of interface design as argued by Borchers (2001) which was reported by Kamaruddin (2012) explains that it is a medium that communicates between the user and computer system. It does not just consist of the aesthetic sense of design value towards the appearance of images, icons, title and text. In reference to this, Oh & Moon (2012) in their research has found out that user interface design should provide a direct interaction with the user and being more compelling. To compel with these relationship, it is found that the effectiveness of teaching and learning experience does not solely depends on the technology usage. As there are three design elements that facilitated the effectiveness of students' learning experience as discovered by Kamaruddin (2012) in her research which describes the three elements are 'interaction design', 'information design' and 'interface design'. The relation of the effective design elements is further explained through figure 1.

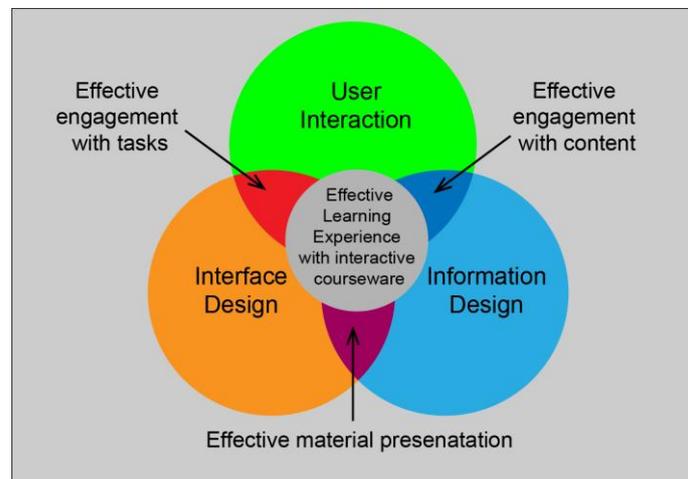


Figure 1: Relationship of design approaches for creating effective learning experiences (Kamaruddin, 2012).

The critical aspect of creativity is undoubtedly questionable in a design process and development. Creativity cannot be defined by just being original, as Runco & Jaeger (2012) strongly believes even though being original is vital; creativity is further defined by the capability of being original and effective in usage and suitability. Further to this, creativity does not only being required in creative arts field only, as emphasized by Director-general of The National Space Agency of Malaysia then and professor in astrophysics, Professor Datuk Dr. Mazlan Othman stresses that Leonardo Da Vinci’s capability in combining science and art as such perfect example. She further claims “Scientist should never ignore the aesthetic value of his work” (pg. N12, News Straits Times, July 29, 2003).

The rapid growth of technology for the past twenty years has reshaped the teaching and learning environment. The widespread technology advancement has been influenced by ICT as revealed by Faghih *et al.*, (2013) resulting in the importance of E-learning. In order to meet the rising challenges by educators in higher learning institutions in improving teaching and learning (Yang *et al.*, 2012), Faghih *et al.*, (2013) in their research emphasized that “One of the psychological matters that should be considered is User Interface (UI) in e-learning”. Digitally manipulated multimedia elements such as text, graphics, images, animation, videos and audios are controlled content delivered through an interactive interface blending the elements and navigation in an interface (Vaughan, 2011). In developing a successful user interface according to Shneiderman & Plaisant, (2010) there are three principles guidelines as explained in figure 2.

Guidelines	Principles
1) Navigating the interface	1) Determine users’ skill level
2) Organizing the display	2) Identify the task
3) Getting the users’ attention	3) Choose an interaction style
4) Facilitating the data entry	

Figure 2: Successful user interface principles and guidelines

In delivering a teaching and learning material, text and other elements of multimedia plays an important role in an interactive interface design. As artistry to outlay text on a screen through aesthetic for readability, the choice of the typography settings by the designer is able to influence the comprehension of the teaching and learning material through visual perception (Kelly & Gregory, 2011). Soleimani & Mohammadi (2012) further demonstrates that readability does affect the speed of reading as a legibility indication where reading speed can be further explained by the speed that is affected more by typography design.

Teaching aid as a communication tool should be well designed and developed as explained by Gao, Coldwell-Neilson, & Goscinski (2013) where student engagement will absolutely improve. In significant to this, typography as one of its elements plays an important role in delivering the content in an interface through various media screen platforms. Within educational context, greater importance of text emerge as an issue as claimed by Stoop, Kreutzer, & Kircz (2013) where it has to deal with over strain intergration among still and moving images, graphs and complicated technical information. In regards to this, the content is not only being consumed by the students as the receiver, where on the other hand should be able to be internalized and replicated (Stoop, Kreutzer, & Kircz, 2013). This further rises the need to ascertain the ability and applicability of the principles and elements of design on interface value enhancement in delivering complex technical education material.

2. KEY ELEMENTS OF EFFECTIVE LEARNING EXPERIENCE

In relation to the importance of teaching and learning aid in ensuring students’ engagement, it is found that there is lack of literature exists in regards to teaching aid developments. This is mentioned by Tomlinson (2012) where there is lack of literature documenting the actual effect of various types of teaching aids. He further reported that Richards (2005) stresses, “There is very little research into the design and effects of materials” which suggest further investigation to be carried out towards teaching aid development. There are three important elements contributing to the effective learning experience namely; effective teaching aid, effective interface design of the teaching aid and effective interaction design (engagement and participation) of users (Kamaruddin, 2102).

2.1 Effective Teaching aid

Rapid growth of technology is seen penetrating into the society with technological advancement of infrastructure in the learning environment. Growing teenagers into tertiary education institution today has become apparent in technology gap generation. These unique generation as elaborated by Doiron & Asselin (2011) has surfaced in blended media convergence of education and entertainment. This rapid technology advancement has developed ubiquitous learning by

providing ‘adaptive supports’ learning material for student where limitations in surroundings has been eliminated to facilitate learning experience (Shih & Tseng, 2009).

As reported by Ferrarini & Mateer (2014) in their research ‘Multimedia technology for the next generation’, current student generation appears to be multimedia technology insistence and they choose to preoccupy themselves in multimedia technology. Lecturers are opened to affix into this stimulating fascination providing wider variety options in delivering teaching content and sustaining a stimulating teaching and learning material. The crucial component of ICT in developing a learning engagement in an effective teaching aid is described by the extensive multimedia materials manifold, combining them on an interface screen providing incomparable traditional classroom experience (Liu, 2014).

2.2 Effective Interface Design

The development of technology and various developments of contents in multimedia have shaped a new landscape of interface design. Difference in user’s experience and global demand of products and services has influenced the design and usability of interface in which interface designers focuses on functions mostly used by majority users as the basis in designing the interface (Lee, Chao, & Lin, 2010). In designing an interface, it is important for the designer to understand the needs of the audience. Prior to the development, it is a required insight to have a better understanding to accommodate the audience’s view towards the quality of the content presented in an interface (Park, 2012). As reported by Kamaruddin, Park, & Nam (2009), interface is ‘the surface of screen facilitating certain interpretation of the medium on the way that user perceives the communication process’ as defined by Rogers and Sharp (2002). They further explained that there are four types of interface as defined by Weiss (1993), which is: -

- 1) The presentation of interface controls the way in which the user perceives the information (seeing the information).
- 2) The conversation of interface controls the way system is communicating with the user and communication between user and system (method of communication).
- 3) The navigation of interface controls the way in which the user moves from one part of the information to another (movement from one screen page to another screen page).
- 4) The explanation of interface controls the way in which the user controls the different activities (use of icon) including performance support.

During the process where a user interact with the multimedia content in an interface, Wu & Guan (2011) describes this dynamic relativity as ‘behavior sequence’ in human behavior towards interaction design which involves human reaction towards the multimedia product. In addressing this issue, Chase (2012) in her research furthermore emphasized the importance in providing a well-functioned user interface, which meets the learning curve. She further emphasized the familiar design pattern adapted in designing interfaces, which can be described as: -

- 1) Who it’s for?
- 2) What it is?
- 3) When it should be used?
- 4) Where it can be used?
- 5) Why it works?
- 6) How others use it?

In describing this pattern however, there are four principles for designing a good user interfaces as explained by Sethumadhavan (2013) which is minimum scrolling, appropriate feedback display usage, capitalize on multiple modalities for time critical tasks and appropriate color scale usage. These principles are essential in designing an extensive user interface.

2.3 Effective Interface Design

As revealed by Thomassen & Ozcan (2010) interaction design is comparably a developing area as proposed by Bill Moggridge and has broaden into digital media information design. As content and information is being displayed in an interface, it is important to have a certain guidelines in organizing the content in an interface according to its design principles for display design in Human-Centered Interaction (Eskridge, Still, & Hoffman 2014). Human Computer Interaction (HCI) according to Rosinski & Squire, (2009) occur in intersected fields of science computing, design arts and social sciences where its goal should improve the human experience interaction with a device (Rosinski & Squire, 2009). Rosinki & Squire further explained there are three principles in developing human-computer interaction design principles that is: -

- 1) Know The User
- 2) Reduce User's Cognitive Requirement
- 3) Test and Iteratively Redesign

Reduce User's Cognitive Requirement is further break down into three sub principles, which is: -

- 1) Perceived affordance
- 2) Navigation design Designing
- 3) Visual & content organization

3. PRINCIPLES AND ELEMENTS OF INTERFACE DESIGN FOR EFFECTIVE TEACHING AID

A design activity is described as 'interwoven process' where the elements are to be imposed instead of being disconnected through common prevalent as revealed by Dooren et al., (2013), even though it is arguable that there is no specific gradual arrangement, a guiding theme is used as in framing the design elements. The development of interface design exercise is a vital process where attentive forethought should be focused and designers eventually should be attentive towards end users' needs (Kamaruddin, N. 2012). She further concluded that in designing an effective interface design, the understanding of the user need 'Will impact on the capacity to produce effective interface design'.

Educators faces new challenges in meeting the needs of students in an extensive technology development seeking new technology exertion making this challenge an opportunity to improve on effective interface design for teaching aids (Killion & Hirsh, 2011). In the design process frame-work, Killion & Hirsh (2011) further specified that there are seven attributes of the professional learning standards which further can be described as follow: -

1. **Learning communities:** Committed to continuous improvement, collective responsibility and goal alignment.
2. **Leadership:** Develop capacity, advocate, and create support systems for professional learning.
3. **Resources:** develop capacity, advocate, and create support systems for professional learning.
4. **Data:** To plan, assess, and evaluate professional learning. Uses a variety of sources and types of student, educator, and system data
5. **Learning designs:** Integrates theories, research, and models of human learning to achieve its intended outcomes.
6. **Implementation:** Applies research on change and sustains support for implementation of professional learning for long- term change.
7. **Outcomes:** Increases educator effectiveness and results for all students aligns its outcomes with educator performance and student curriculum standards.

4. INTERFACE DESIGN ROLES IN TEACHING AIDS

The digital content in education has been around for the past thirty years with the information technology (IT) rapid advancement for the past ten years, transferring reading from paper to digitized screen display (Huang, Chen, & Ho, 2014). This rapid advancement in media, content and technology has developed and shaped the current tertiary learning environment. Described as 'Generation Y' (Gen Y) by Steenkamp & Rudman (2013) where they grow up with boundless capacity of technology using various IT gadgets allegedly and are visually more literate. In relation to this, the gen Y which is also described as "digital natives" according to Yang et al. (2012) which compared with the previous generation known as "digital immigrants" which faces the challenge in dealing with technology development as explained by Marc Prensky (2001). In teaching and learning, multimedia is capable in elevating teaching and learning process where according to Ferrarini & Mateer (2014) "a connection between students' knowledge and learning objectives is bridged together" through students learning engagement. In relation to the advancement of media and technology in ICT, educators are able to practically design and develop teaching aid increasing the efficiency of imparting teaching and learning content. As described by Kozik, Lukáčová & Bánesz (2012) in their research, this useful communication tool produces abounding capabilities. This is further supported by Kim et al. (2013) in their study which emphasized that multimedia technology in education provides educators the capabilities in expanding their aptitude towards an extensible possibilities to facilitate the teaching and learning process which is found to consolidate efficient and competent learning engagement.

As information communication technology develops rapidly, tertiary education institutions receive different cohorts of students yearly with new level of technology advancement capabilities. In order to improve learning engagement as reported by Gao et al. (2013), it is important to promote a well-established teaching aid as it is described as one of the two way factors together with students, lecturers, peers and learning environment. This is important, as supported by Zepke, Leach, & Butler (2009) where a students' first experience is governed will ensure their engagement in tertiary

education environment. With such advancement of education scenario, lecturers in tertiary institutions are now in the central position of the outlook. As emphasized by Handal, MacNish, & Petocz (2013) in their research, lecturers are driven to review their teaching and learning material as recommended by Ting (2012) and the way they are being designed and their method of delivery. In order to design and develop the digital teaching and learning content that accommodates the forth-coming education focus towards ‘Student Centered-Learning’, Salmon & Wright (2014) stressed that academicians in tertiary institutions are required to revolutionize their method in delivering the teaching content.

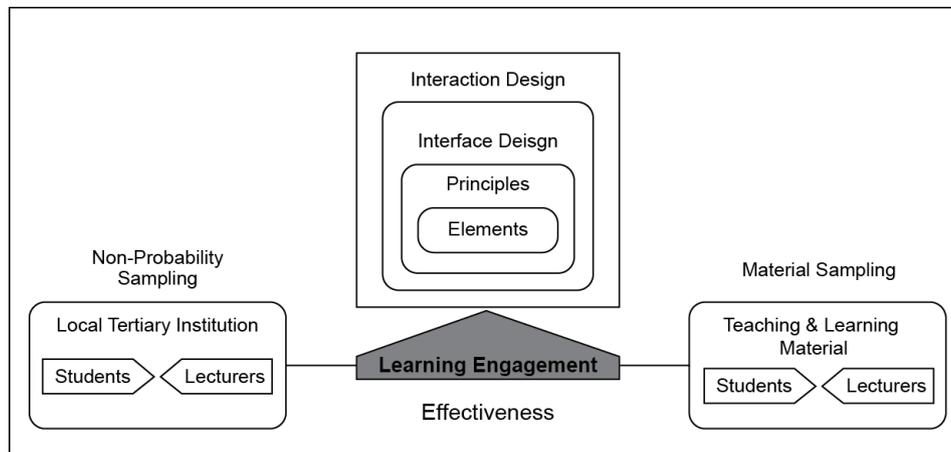


Figure 3: Effective learning engagement in an interactive multimedia teaching aids

The conceptual framework in figure 3 shows the primary components of an effective learning engagement where both students and lecturers as the user of an interactive multimedia teaching and learning aid. The effective learning engagement in an interactive multimedia teaching aid also consists of the elements and principles of interface design and interaction design. Primarily, it is critical to analyze the applicability and ability of the multimedia elements in an interface design of teaching aids within the tertiary education. Although there are various elements of the interface design, focus is given specifically towards the relation of the principles and elements of interface design application as an important contributing element towards the teaching and learning aid interface design in ensuring effective student-learning engagement. This can be achieved by investigating towards what extend does the effectiveness of the elements in an interface design of a multimedia teaching aid is applicable and able to enhance the interface value of a teaching and learning aid within the tertiary education. Focusing on two areas where firstly to identify what are the contributing factors towards the appearance of the teaching aid interface design and secondly how do the elements and principles of interface design affect the appearance of the interface design in teaching aids by investigating of data gathering on tertiary teaching and learning aid which is principles of interface design elements, the design process practices and challenges and the learning experience. This conceptual framework will allow the identification of the interface design concept of a teaching aid within the Malaysian tertiary education through the characteristics and principles of screen interface design. It is important to sustain the learning engagement of the Gen Y in the tertiary institutions as it contributes to the growth of challenges among lecturers in developing a good teaching aid.

5. CONCLUSION

This paper is intended to look into the importance in identifying what are the principles and elements of effective interface design for a teaching aid, how it is being developed and how does it affect or effect in an effective teaching and learning process. Development of ICT has contributed to the changes in teaching and learning process for the new generation and boundless advancement in multimedia for the past is capable in elevating teaching and learning process. This transferred teaching aids to digital screen where various studies being carried out in regard to this development. However there is lack of literature exists in regards to effective interface design principles and elements on teaching aids in Malaysian context. While interaction design has been researched for quite some time, effective interaction design of teaching aids however is still developing and there is suggested improvement from existing literature in human experience within cognitive learning process. Even though literature on interface design has developed for quite some time, focusing on technical and aesthetic aspect, effective interface design for effective teaching aid is found to have areas for further investigation especially from the aesthetic aspects of visual communication design principles.

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