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The Application of Mayer's Multimedia Learning Theory to Digital Presentation Tools: Prezi for Industrial Design Programme in Higher Education

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Abstract

This paper will discuss the application of Mayer's multimedia learning (MML) theory into digital presentation tools: Prezi. The discussion will be focusing on Industrial Design (ID) education. The MML theory use different media like text, pictures, video, animation, and sound to serve as a guideline for designing Prezi. Recently, the rapid development of digital products has changed the way of teaching and learning. Therefore, the objectives of this paper are to develop a prototype of Prezi with MML for ID programme as lecturing tools and to investigate the effect of integrating MML in Prezi on student's engagement in the learning of Industrial Design process. This paper compiles secondary data on a topic by accredited scholars and researchers; reviews existing research on the topic; and theoretical approaches. A prototype development of Prezi will be created with requirement analysis according to the content of ID programme. During the process, the six design principles (Coherence principle, Signaling principle, Redundancy principle, Spatial contiguity principle, Segmenting principle, and Modality principle) which is derived from cognitive theory of multimedia learning was analyzed and used as a guideline for designing the prototype. In the finding, a significant difference was determined in the formative, summative, and delayed summative evaluations of the combination of Prezi and MML theory.

Keywords: Mayer's Multimedia Learning Theory, Digital Presentation Tools, Industrial Design, Higher Education

Introduction

The concept of Industrial Design (ID) refers to innovation in all its forms, and some examples of how it contributes to innovation are enhancing products with minor additions, differencing products with different looks and functions, or using technology to create products (Dumas, 2000) (Paula et al., 2017). Students and lecturers in design education should be exposed to the complexities of professional practice, yet the educational process of ID is difficult and complicated (Meyer & Norman, 2020). Furthermore, students have no prior knowledge of ID in their first year of study at the institute.

Background of Research

Traditionally, the design process is considered as one of the most essential teaching materials and is presented through traditional presentation tools with little interaction, students are less engaged (Thomas, 2015). Design process can be improved by using multiple forms of media, such as multimedia presentation: pictures, video, animation, sound, text, and animation. Chou et al (2015); Chloe (2018) pointed that students' engagement has been proven to increase when using digital presentation tools in the lecture. Lecturers able to use tools like Prezi to develop more interactive and user-friendly presentation tools. It poses a challenge to design lecturers to stay up to date with the changes in design education.

There are different formats available for presentation tools; however, most educators create their slides with bullet points and present information that is directly copied form the textbook. As a result, students may become bored and tired during lectures (Issa et al., 2011). MML theory is a set of design principles that is derived from cognitive theory of multimedia learning (Mayer, 2005). It is serves as a guideline for designing an effective presentation tool, refers to learning from the use of different media: text, pictures, video, animation, and sound. Therefore, applying MML theory in Prezi is a potential method to improve information delivery and teaching especially for ID education.

Objectives

The objectives of this study are:

1.) To develop a prototype of Prezi with MML for ID programme as lecturing tools.
2.) To investigate the effect of integrating MML in Prezi on student's engagement in the learning of Industrial Design process.

Definition of Prezi

One of the best ways to get students learning technology in classroom is through presentations. Creating interesting slideshows and engaging materials will helps students get their point across and gives them a change to learn best practices for using software to help them organize their thought (Elizabeth, 2019). Prezi is a web-based tool for creating presentations. It is similar to other presentation software like Microsoft PowerPoint, but it offers some unique features that make it a good alternative. As a web-based application, Prezi gives users with a learning opportunity to collaboratively edit slides online with their peers (Perron & Steaens, 2010).

According to Andreja (2015), Prezi enables both linear and free-flowing presentations. All elements of the presentation are visible on one large canvas, where the user creates a presentation. The Prezi presentation does not require advanced skills in information technology or communication. Users can create highly engaging virtual portfolios by interacting online.

Definition of Mayer's Multimedia Learning (MML)

Richard Mayer has devised a theory called Mayer's Theory of Multimedia Learning, which he lists 12 principles of multimedia learning. In computer-aided instruction, multimedia learning refers to the use of two modalities simultaneously. Combining visuals like pictures, animation, text, and videos with audios to make learning more effective. In this research, a prototype of Prezi is being created using the 6 principles.

Coherence Principle – Based on this principle, learners' working memory is clogged with irrelevant details that hinder the learning process. In such a situation, the learner may be exposed to a concise narrated animation or a similar lesson alongside interesting, but irrelevant, video clips and graphics. The Cognitive Theory of Multimedia states that human memory is very limited, making it difficult for instructional designers to create E-Lessons that contain excessive audio. Nonetheless, music can be used to get learners' attention at the beginning of a class and to score correct and incorrect responses during internal assessments. (Moreno & Mayer, 2000).

Signaling Principle- In this principle, it is noted that multimedia learning materials are more effective when cues are added that direct students' attention toward relevant components of the material or note how the content is organized. Additionally, the effects of using students' or experts' eye movements as cues, and the design of cues based on eye movements of successful students (Gog & Tamara, 2014). Cambridge Press (2001) asserted that students learn more effectively when the essential material is presented in an organised manner.

Redundancy Principle- Mayer (2005) argues that students learn better when the same information is not presented in multiple formats. Accordingly, redundant information interferes more with learning than facilitates it. The term redundancy refers to the presentation of identical information in multiple forms or excessive elaboration (Richard E. Mayer, 2014).

Spatial Contiguity Principle – This principle suggests that when students are exposed to related words and pictures close together rather than far apart, they are more likely to learn more deeply (Mayer, 2005). It is better for students to learn from presentation slides when the associated words and pictures are near each other rather than far apart on the page or screen (Cambridge Press, 2001). This study talks about the physical distance between text and images on the screen, stating that humans learn best when relevant text is near images.

Segmenting Principle – In Mayer (2009)'s study, learners performed better on recall tests when they were able to control their pace. By breaking down the teaching materials into smaller pieces, the lesson can be pacified by learners themselves. In order to ensure that there is not too much information packed into one lesson, it is best to create multiple short videos or slides instead of one long video or slide.

Modality Principle (Split-Attention Principle) – Basically, if there are too many visuals and too much text, learners will become overwhelmed, however, if they see visuals and hear spoken words or animation, they will learn better. A subsequent problem-solving transfer test revealed that students who viewed an animation depicting the formation of lightning with text with the same words as the narration produced about 50% more useful solutions than students who viewed the same animation without the text (Mayer & Moreno, in press). This phenomenon is known as the split attention effect (Chandler & Sweller, 1991; Mousavi, Low & Sweller, 1995; Sweller et al., 1990).

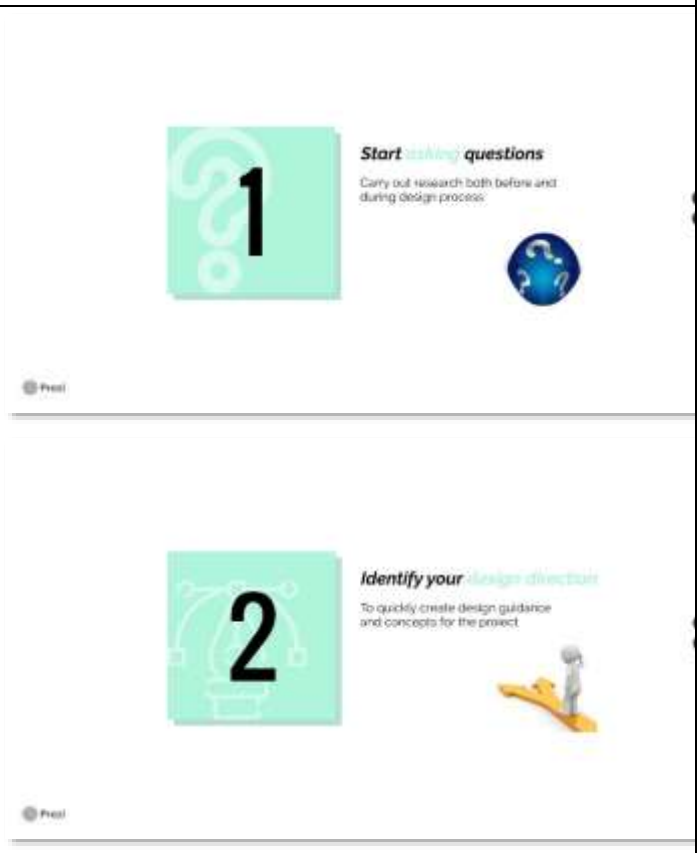
Method

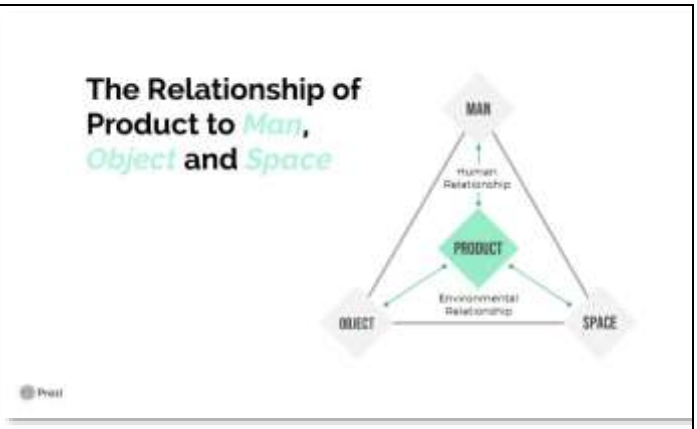
Prototype Development

The development of the digital presentation tool (PREZI) prototype started with requirement analysis. In this stage, the content of the lecture was reviewed in order to define the requirements. During the process, the six design principles (Coherence principle, Signaling principle, Redundancy principle, Spatial contiguity principle, Segmenting principle, and Modality principle) which is derived from cognitive theory of multimedia learning was analyzed and used as a guideline for designing the prototype. After that, the design principles

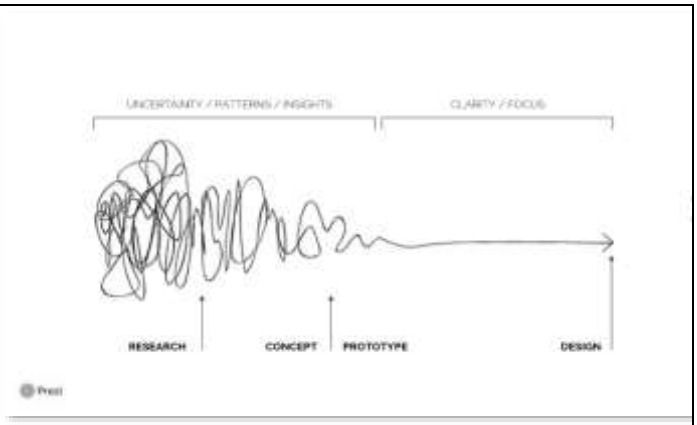
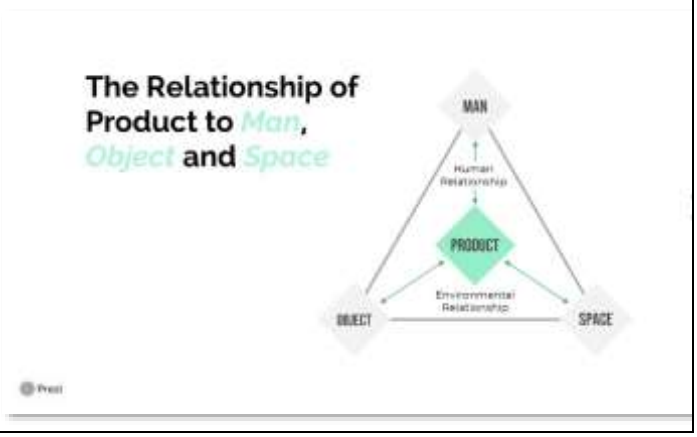
were applied according to the features of PREZI as it is different from the perspective of use of different media: text, pictures, video, animation, and sound. The prototype of the lecture was designed by the lecturing faculty member and final design of the prototype was refined according to the contents of the ID program until all the requirements were achieved. Presentation content order of the lecture was remained the same, the only difference is the slide formatting.

Finding

	Principles of Mayer's Multimedia Learning (MML)	**Explanation**	**Example**
1.	**The Coherence Principle**	To avoid unnecessary and distracting content, it is recommended that user use simple, direct visuals that relate directly to the learning topic.	
2.	**The Signaling Principle**	Audience learns best when they are taught what to pay attention to on a screen. It is often helpful to highlight important words on the screen.	

			 
3.	**The Redundancy Principle**	Combining narration and graphics is the best method for learning, not just narration, graphics, and text alone. Make the text minimal when including graphics and text.	 

4.	**The Spatial Contiguity Principle**	Placing printed words next to corresponding graphs or tables enables the learners to have a better understanding about the topic.	
5.	**The Segmenting Principle**	Breaking the complex content into distinct chunks of information to assist the learners in learning.	  

6.	**The Modality Principle**	Presenting words as narration instead of printed text. Therefore, just present the key words on the slide to limit the amount of text and rely more on visuals.	 

Conclusion

A summary of the findings is presented in this section, which are based on the objectives of the research. According to the results, the objectives of the research have been met. The discussion primarily focuses on literature review and prototype identification. Digital presentation tools: Prezi is created with six principles of MML theory to discuss as lecturing tools for ID process. Based on the findings, six principles are explained with prototype images. A significant difference was determined in the formative, summative, and delayed summative evaluations of the combination of Prezi and MML theory. The result of the analysis indicated that Prezi was more effective on visual effects and information acquisition tends to attract the ID student's interest. For higher education, it is new idea of teaching tools; new idea of digital presentation tools; new idea of student's engagement in ID process; and improvement of student's engagement in design education. Researchers hope this research can help ID educators conduct the teaching and learning in order to improve the engagement of ID students in higher education.

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