Reviews and Critiques on Learning Theories towards Proposing a Conceptual Design Model of Assistive Courseware for Low Vision (AC4LV) Learners

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ABSTRACT

This article reports an ongoing study that intends to propose a Conceptual Design Model of Assistive Courseware which specifically designed for Low Vision (LV) learners. In developing the intended model, learning theories is a part of component that has to be emphasized. So, prior to the development of that model such applicable learning theories should be reviewed. The main objective of this article is to review and critique the learning theories and their implications to the Conceptual Design Model of AC4LV. Thus, in this article five learning theories were reviewed critically and their implications towards the development of proposed model were also discussed. There is no specific methodology applied in this concept article. The researcher applied the existing knowledge to review and critique the previous learning theories.

Keywords:Learning theories, conceptual design model, assistive courseware (AC), low vision learners.

I INTRODUCTION

Learning is an epistemology issue in view of the fact that it concerns with the nature and scope of knowledge which leads to questions such as what knowledge is, how it is acquired, and who the subject is (Guney & Al, 2012). In answering those questions, it requires an in-depth research which interrelates with learning theories. Learning theories have previously been discussed by Greek philosophers, Socrates, Plato, and Aristotle before stating the era of digital age (Pange, Lekka, & Toki, 2010). It is known that, during the last decades learning theories were only applied in conventional teaching and learning.

Recently, in the era of digital age, educators work hard in attempting to absorb diverse learning theories into the concepts and process of learning that they introduce (Pange et al., 2010). Previous studies from the comparative analysis that has been carried out in the previous section have proven that the learning theories not only applied in conventional teaching and learning but also in the new concepts that are integrated together with new educational technologies. As a result, various instructional approaches and strategies have appeared from different theoretical perspectives (Pange et al., 2010), as well as empirical evidences that provide positive feedbacks (Thurlings, Vermeulen, Bastiaens, & Stijnen, 2013) have driven it into practice (Pange et al., 2010).

Not all learning theories are closed to instructional approaches but the main learning theories that underlie the educational environments are (i) behaviorism, (ii) cognitivism, and (iii) constructivism (Pange et al., 2010). Also, (iv) multimedia learning theory and (v) multiple intelligence theory are embedded to discover multimedia and children development aspects. For that reason, these prevailing learning theories that constitute the learning process through AC4LV are discussed in the next section.

II REVIEWS ON LEARNING THEORIES

A. Behaviourism

The origin of behaviorist learning theory started in early 1900's by the major precursor namely Edward Thorndike in 1913 and the Russian psychologist Ivan Pavlov in 1927 (Wu, Chiou, Kao, Alex Hu, & Huang, 2012). Behaviorist paradigm views all learners as "unreflective responder" (Boghossian, 2006) and only response to the environment through stimulation and reinforcement (Pange et al., 2010). Therefore, this theory concentrates on visible (Thurlings et al., 2013) and measurable (Pugsley, 2011) behaviorof the learner that able to be manipulated by the instructor.

The manipulation can be implemented through stimulation, which means through anything that might directly influence the learner behavior to produce a response (Guney & Al, 2012). So, this theory is actually encouraging the instructor to expose the learner to external stimulation until the desired response is received (Guney & Al, 2012).

The learner starts learning with knowing nothing (Syamsul Bahrin, 2011) then the environment forms their behavior through stimulation (as discussed previously) and reinforcement which consists of positive and negative (Pugsley, 2011). Particularly, Skinner defined reinforcement as "creating a

situation which a person likes or removing any situation that he/she does not like"(Hassan, 2011). This means that both types of reinforcement are utilized to enhance the possibility of previous behavior to occur again (Hassan, 2011). On a contrary, punishment is "removing a situation a person likes or setting up once he/she does not like" Skinner as cited in(Hassan, 2011). Both positive and negative punishment are utilized to reduce the possibility of previous behavior to occur again (Hassan, 2011). These means reinforcement will build up the learners' behavior while the punishment will deteriorate the learners' behavior. Additionally, (Hassan, 2011)also discusses the forms of reinforcement and punishment suggested by Skinner lengthily and this study summarizes it in Table 1.

Table 1. Forms of Reinforcement and Punishment By Skinner1968

Form of Consequence	Description	Example
Positive reinforcement	Getting something pleasurable will increase the learner behavior.	A teacher rewards (e.g. praise) the student for asking question. As a result the students motivated to ask more questions.
Negative reinforcement	Eliminating something unpleasant will increase the learner behavior.	A son does the homework to remove his father nagging.
Positive punishment	Getting something unpleasant will decrease the learner behavior	A teacher scowls when his student ask questions. Consequently the student unmotivated to ask the question again.
Negative punishment	Eliminating something pleasurable will decrease the learner behavior.	Remove the ill-behaved student from the class.

From the explanation in the previous paragraph and Table 1, it indicates that this paradigm was constructed based on three hypotheses: (i) learning is able to be seen by a change in behavior, (ii) the environment forms the learner behavior, and (iii) the principles of reinforcement and punishment act as the fundamental in explaining the learning process (Wu et al., 2012).

The strength of this theory lies on its ability in inspiring the learner to constantly have a clear target to achieve if the instructor and the learning environment encourage the learner in support of that. More importantly, the learners will continuously perform the best in their learning activities once they get the reward.

Reflecting to the intended model, this theory can be applied in AC4LV by focusing on the specific learning objectives and instructions, providing appropriate multimedia elements in encouraging them to continuously use the AC4LV, and reward them with a positive response through the AC4LV itself.

B. **Cognitivism**

Cognitivism appeared in 1960's when the researchers found out that behaviorism was not considering many kinds of learning activities (Guney & Al, 2012). As opposed to behaviorism, cognitivism is about the process of thinking which means it is not as simple as stimulation and reinforcement (Wu et al., 2012). It emphasizes that the learner is information processor (Thurlings et al., 2013). In fact, cognitivism was developed based on two hypotheses which are (i) the learners' memory system is active and acts as the structured information processor, and (ii) pre-knowledge is important in learning (Wu et al., 2012). On top of that, learners are encouraged to think independently and analyze problem as well as solve the problem that related to their learning content (Pugsley, 2011).

This is highly-contrast with behaviorism that seeks to change the behavior of the learner in making sure the learner obtain the knowledge. It is more than that, whereby the cognitive theory seeks to develop the learners with analytical and critical thinking. The strength of this theory can be seen in the influence it gets from the learner to learn independently, and trained the learner to solve the learning problem on their own. Also, through the structured information processor the learner able to complete their learning task consistently.

In this study, AC4LV allows the LV learners to think analytical and critically through the multiple levels of learning content (e.g. spelling, pronunciation, and description), proposing exercise level from simple to hard, and presenting multiple multimedia elements for them to relate it with actual environment.

C.**Constructivism**

Comparing with behaviorism and cognitivism, the constructivism is more complex. It requires "the learner to construct their own knowledge"(Boghossian, 2006) rather than acquiring it (Guney & Al, 2012), which means it focuses on "constructing, creating, inventing, and developing the knowledge"(Büyükduman & Şirin, 2010) rather than transmitting the knowledge (Obikwelu & Read, 2012). Although there are many types of constructivism theories such as social

development by Vygotsky in 1962, Problem-based Learning (PBL) developed in 1960's, and actor-network theory developed by Latour in 1987 (Wu et al., 2012), still all of them share similar foundation that to what extend the learners are actively participating in seeking for meaningful knowledge (Boghossian, 2006). According to this theory, the starting point of learning is through the pre-existing knowledge (Pugsley, 2011) and experience (Guney & Al, 2012).

The above constructivism analysis can be concluded into three major hypothesis which also have been agreed by many constructivist creators (Büyükduman & Şirin, 2010).

- Learning is the active formation of knowledge which acquired through prior experience and environment contact.
- Knowledge is build by the learner itself through their own experience and existing knowledge to find out a meaningful context.
- Meaningful knowledge is closely with experience. So the learner would practice that knowledge in their life.

This paradigm is accepted as the successful learning process (Syamsul Bahrin, 2011) because it is natural and applicable to be applied in accordance with the technology advancement (Büyükduman & Şirin, 2010). Another advantage of this theory is it is able to generate the learner to be explorative which is good for mental development particularly for people with disabilities (PWDs) (Dube, Ahearn, Lionello-DeNolf, & McIlvane, 2009).

In relation to this study, the constructivist theory impacts the AC4LV in terms of the navigation of the learning content which is designed with appropriate multimedia elements that enable and encourage the LV learners to explore the AC4LV enthusiastically during the learning process.

D. **Multimedia Learning Theory**

With the work carried out by Sweller's Cognitive Load Theory, Pavio's Dual-Coding Theory and Baddeley's Working Memory Model, (Mayer, Heiser, & Lonn, 2001) a framework called Cognitive Theory of Multimedia Learning as presented in Figure 1(Doolittle, 2002) has been proposed.

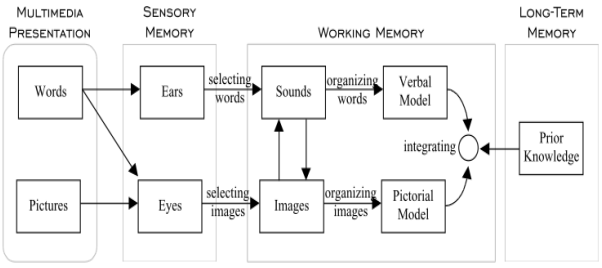

Figure 1. Framework for Cognitive Theory of Multimedia Learning

This model focuses on auditory/verbal channel and visual pictorial channel. (Mayer et al., 2001) address that this model has been developed based on three hypotheses below:

i) Information of visual and auditory is process via different channels.
ii) Each different channel is limited in its ability to process the information.
iii) The channels of processing information are an active cognitive process which designed to construct coherent mental representations.

Mayer et al. (2001) andMayer and Moreno, (2003)also detail the model into five steps, including (i) selecting relevant words for processing in verbal working memory, (ii) selecting relevant images for processing in visual working memory, (iii) organizing selected words into a verbal mental model, (iv) organizing selected images into visual mental model and (v) integrating verbal and visual representations as well as prior knowledge.

Besides, Mayer and his friends have investigated the nature and effects of multimedia presentation to human being (Mayer & Moreno, 2003). From that they come out with thirteen principles together with the sample example of practical application (Table 2).

Table 2. Principles of Multimedia Learning Theory

Principles	Examples of Practical Applications
Multimedia Principle: Students learn better from words and pictures rather than words alone.	Combination of block of text with still image or animation on a screen is more efficient rather that oral text or graphic alone.
Spatial Contiguity Principle: Student learns better when the combination of words and pictures on the page or screen are presented near rather than far from each other.	Placing the text under the image is sufficient. However placing the text within image is more effective.
Temporal Contiguity Principle:	When presenting text and image they should be presented

Student learns better when combination of words and pictures that presented simultaneously rather than successively.	simultaneously, but when presenting animation and narration the use of them is more coincide meaningfully.
Coherence Principle: Students learns better when extraneous words, pictures, sounds are excluded rather than included.	Multimedia presentations should be focus, clear and concise. Presentations that add extraneous information such as the sound of bell or whistle with the reason to increase the student interest is actually impede the student learning and focus.
Modality Principle: Student learns better from animation and narration rather than animation and on-screen text	The use of words should be presented as spoken words or using auditory, rather than present as written text to accompany the graphics.
Redundancy Principle: Student learn better from animation and narration rather than animation, narration and on-screen text.	The multimedia presentations that involve combination of words and pictures should present text either in written form, or in auditory form, but not in both on a screen.
Individuals Difference Principle: Design effects are stronger for low-knowledge learners rather than for high knowledge learners and for high spatial learners rather than low spatial learners.	Example of low-knowledge learners is novice learners and high spatial learners are for visually style learners. Well-structured multimedia presentations should be created to be more accessible.
Signaling Principle: Student learn better when cues that highlight the organization of the essential material are added.	Providing cues to the learner on how to organize the materials.
Segmenting Principle: Student learn better when a multimedia lesson is presented in user-paced segments rather than as a continuous unit.	The modules or exercise provided are present sequentially and logically from easy to hard. Allows the user to control the presentation.
Pre-training Principle: Student learns more deeply when they receive pre-training in the names and characteristics of key components.	Create low level exercise/problem solving to the learners before they can proceed to the larger and more complicated exercise.
Personalization Principle: Student learns better from a multimedia presentation when the words are in conversational style rather than in formal style.	Example of conventional style text is Comic Sans.
Voice Principle: Student learn better when the words in a multimedia message are spoken by a friendly human voice rather than a machine voice	Create a teacher character in multimedia presentation.
Image Principle: Student does not necessarily learn more deeply from a multimedia presentation when the speaker's image is on the screen rather than not on the screen.	Use a voice of teacher character. No image of teacher is presented.

Each of the principle can be considered in combination as AC4LV content. Example of works that adapt the multimedia learning principles is (Churchill, 2011). He has proposed a conceptual model to design learning materials for small screen application. Similarly, (Domagk, Schwartz, & Plass, 2010) also utilized multimedia learning principles in designing an integrated model of multimedia interactivity called INTERACT. The aim of this model is to clarify the concept of interactivity and further act as a reference to other studies in developing interactive multimedia presentation. There are four components underlying this model which are user, learning environment, system of connection and concepts to make up the interactivity. This shows the importance of concerning the multimedia aspect in designing multimedia learning content to make it usable to the intended user.

In the context of this study, all principles are applicable to be applied in AC4LV at a time since AC4LV is multimedia learning content application. However the connection must be carefully applied since the intended user are LV learners in order to make it usable in terms of information accessibility, navigationability, and pleasure.

E. **Multiple Intelligence Theory**

The theory of MI was proposed by Howard Gardner in 1983 and further updated in 1993 and 2000. MI theory has produced a great implication to the world of education (Niroo, Nejhad, & Haghani, 2012). This can be seen when many educational institution including pre-schools and elementary schools have utilized this approach as their philosophy. In fact, it is not just a philosophy but all the nine intelligence put emphasis on the learning content and its intra relation (Niroo et al., 2012). On top of that, the MI theory enables the educators to develop their repertoire of methods, equipments, and approach beyond those that are commonly used in the conventional teaching (Zatul Amilah, Nurulnadwan, Ariffin, & Mohd Saifullizam, 2011). Accordingly this could develop the children to be confident with their natural abilities.

In conjunction, several projects have been found applying MI theory into their applications. As an example (Bushro & Halimah, 2008) proposed MI-Maths for learning mathematics. Another work is the development of educational game based on MI theory by (Li, Ma, & Ma, 2012). Both of these

application utilize the MIT to develop the mathematics learning content that matches with the students' preference particularly in verbal linguistic, logical mathematical, and visual spatial.

In relation with that, the development of AC4LV also considers the nine MI theory (Table 3) for the reason that it is important to reveal the implicit intelligence and ability of LV children in attempt to make AC4LV is usable. Although not all of nine intelligences can be adapted in a time, a few of them are relevant.

Table 3. Multiple Intelligence Theory

Intelligence	Description
Verbal-Linguistic Intelligence	The ability to learn languages in spoken and written, and the capacity to use that language to accomplish certain goals.
Mathematical-Logical Intelligence	The ability to analyze problems logically, carries out mathematical operations, and investigates issues scientifically.
Visual-Spatial Intelligence	The ability to recognize and manipulate patterns of wide space as well as patterns of more confined areas.
Intrapersonal Intelligence	The ability to understand oneself, to have an effective working of oneself including one's own desire, fears and ability to use such information effectively in regulating one's own life.
Bodily-Kinesthetic Intelligence	The ability to use one's whole body or parts of the body to solve problems.
Interpersonal	The ability to understand the intentions, motivations and desires of other people and ability to work effectively with others.
Naturalist Intelligence	The ability to recognize and classifies of numerous species of flora and fauna of his or her environment.
Musical-Rhythmic	The ability to have skills in performance, composition musical patterns and appreciation of musical patterns
Existential	The ability to have sensitivity to existence surrounded complex issues and curiosity to ask deep questions.

III IMPLICATION OF LEARNING THEORIES TO CONCEPTUAL DESIGN MODEL OF AC4LV

Developing the instructional materials requires this study to embed learning theories during the development process. Behaviorism, cognitivism, and constructivism are the three established learning theories that act as the root of learning environment. Since this study intend to propose a kind of multimedia-based learning application so it is important to consider the multimedia learning theory as the approach to attract the LV learners. Meanwhile, MI theory is a perfect theory for the development of children ability due to the main subject of this study is LV children. More importantly, both of these theories are adapted to make the AC4LV usable particularly in terms of information accessibility, navigationability, and pleasure. Although these five learning theories have their own hypotheses and principles, not all of them are inserted into the development of proposed model. They are selected based on applicability, which particularly relate to LV learners.

IV CONCLUSION AND FUTURE WORKS

Overall, the objective of this article has been achieved. Five learning theories has been reviewed and critiqued in ensuring they are the significance theories to be adapted in the Conceptual Design Model of AC4LV. The detailed connections of learning theories with the Conceptual Design Model of AC4LV are planned to be discussed in future works.

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