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Computer Assisted Learning based on ADDIE Instructional Development Model for Visual Impaired Students

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Abstract: With the advancement of technological innovations for ICT in education, this study focuses on building effective computer assisted learning based on the framework of ADDIE instructional development model to improve visual impaired students' conceptual learning progression on Marketing course. To examine the effectiveness of the developed computer assisted learning, an experiment was conducted by assigning twenty-four diploma students into three groups consisting of five blind students, seven partial visual impaired students, and twelve non-visual impaired students. They are permitted to select the learning instructions regarding to their vision level. The results of this study show that the developed computer assisted learning could help the students improve their conceptual learning progression. Additionally, the students reveal positive satisfaction towards the developed computer assisted learning.

Keywords: visual impairment, computer assisted learning, diploma program, ICT in education

1. Introduction

With the advancement of technological innovations for information technology and communication (ICT) in education, current research indicates a great impact on education, especially, computer assisted learning (CAL) can help improve the ability of students who have the different educational levels. (Basturk, 2005; Chang, Sung, Chen, & Huang, 2008; Denny, 2003; Ecalle, Kleinsz, & Magnan, 2013; Liu, 2010; Seo & Woo, 2010). Recently, a number of educators have attempted to study technological innovations for ICT to improve learning performance of visual impaired students (Ager & Aalykke, 2001; Douglas, 2001). There are two types of visual impaired students such as blind and partially sighted who have different learning patterns and difficulties, and may require different kinds of support (Shepherd, 2001). Several studies suggested that learning objects could engage the visual impaired students and promote their learning performance (Barak & Ziv, 2013; Basturk, 2005; Gaeta et al., 2004; Pinhati & Siqueira, 2014; Shepherd, 2001)

In Thai educational contexts, an attempt to provide learning support to the visual impaired students and non-visual impaired students has been promoted continuously. They are anticipated to be able to learn together. In addition to this context, Nakornluang Polytechnic College, one of many educational institutes in Thailand, offers educational system to both visual impaired students and non-visual impaired students learning together in the same classroom. However, it has been found that there are insufficient supplement learning materials and learning contents for visual impaired students. This is might be because of the lacking of well-designed learning materials.

Researchers have attempted to design learning objects based on instructional development models, for example, Bloom's Learning Taxonomy (Chyung & Stepich, 2003), Gagné's Nine Events of Instruction (Gagne, Wager, Golas, & Keller, 1992). Such models help educators to manage learning unit for the most effective learning environments. Among the instructional development models, the ADDIE instructional design model represent a more dynamic and flexible guidance for developing learning objects (Melanie, 2008; Ozdileka & Robeckb, 2009). Consequently, we developed a computer assisted learning environment for visual impaired students. Much than that the ADDIE instructional development model has been applied to the environment to form supplement

learning materials which are used to facilitate visual impaired students learning and promote their conceptual learning progression.

2. Development of computer assisted learning

In the process of developing computer assisted learning (CAL), we applied five steps of the ADDIE instructional development model, including Analysis, Design, Development, Implementation, and Evaluation (Melanie, 2008; Ozdileka & Robeckb, 2009). The analysis phase involves the investigation of students; we analyze content and presentation in order to design learning instruction appropriately. For the design phase; we designed the learning objects. In the development phase; the interactive instructions were created by Adobe Flash CS5.5 program, Adobe Photoshop CS5.5 program, and Nero Wave Editor program. In the implementation phase; this addresses the execution of the instructions. Finally, in the evaluation phase; the summative assessment function has been embedded.

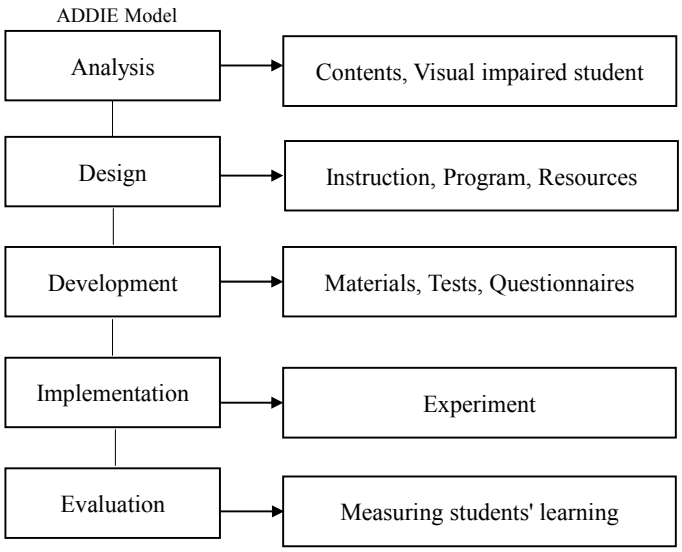

Figure 1. Development of computer assisted learning based on the ADDIE model

This paper presents CAL to help the visual impaired students and non-visual impaired students to learn together in a Marketing Course. The learning contents were separated into three units consisting of Unit 1: the importance of selling and marketing concepts; Unit 2: the types and characteristics of the selling; and Unit 3: the basic of products and business.

From analysis, we found the non-visual impaired students can learning normally while partial visual impaired students can see in certain conditions but they take longer to read it. The blind students like to have to rely on listening rather than watching. Therefore, the researchers developed instructional materials appropriately each student' types.

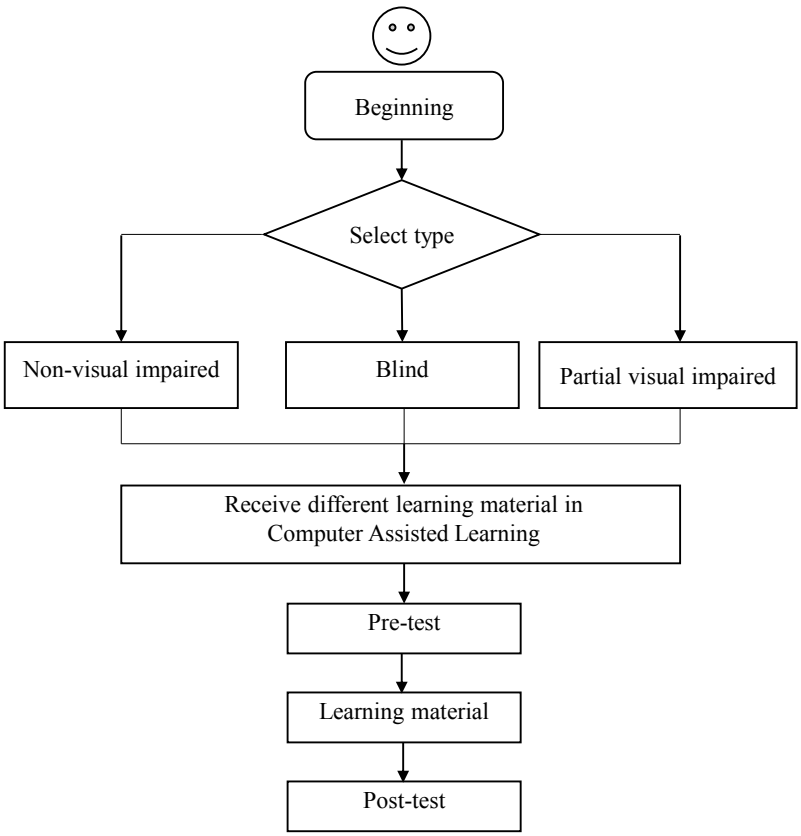

Figure 2. Design model of computer assisted learning system

Figure 2 shows that the students can select the appropriate instruction fit with their level of vision. Non-visual impaired students participated in instructions which are normal texts, pictures and sound, in which they can interactive via monitor as shown in Figure 3. The partially visual impaired students participated in instructions which are larger texts, pictures, and sound in which they can interactive via monitor as shown in Figure 4. On the other hand, the blind students participated in instructions which are only sound in which they can only interactive via keyboard; if they want to link to other pages, they can press button on keyboard following the listening instruction. Every type of instruction has different activities to enhance students' remembering as well.

3. Research design and method

Twenty-four visual-impaired Thai students from a University of Technology were recruited in this study to examine the effectiveness of the developed CAL. They were diploma students and were divided into three groups consisting of five blind students, seven partial visual impaired students, and twelve non-visual impaired students. They are permitted to select the learning instructions regarding to their vision level. One group pre-and post-test research design was used in this study. Before participating the developed CAL, they took a pre-test to measure whether they had equivalent prior knowledge. After taking the developed CAL, they took a post-test to evaluate learning performance, followed by the satisfaction questionnaire toward the developed CAL.

Figure 3. Illustrative examples of instructions for non-visual impaired students

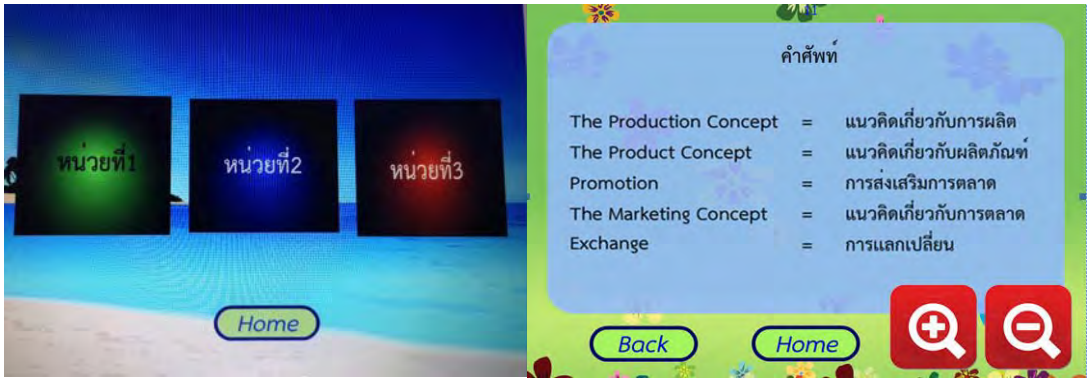

Figure 4. Illustrative examples of instructions for partial visual impaired students

4. Results

Table 1 shows the mean scores and standard deviations of the pre-test scores of non-visual impaired students, partial visual impaired students, and blind students, which are 9.67, 9.43, and 9.8, respectively. The researchers have found that three groups of students had equivalent prior knowledge before participating in the learning activity. After finishing the learning activity, the post-test scores were 20.67, 22.71, and 23.6 for non-visual impaired students, partial visual impaired students and blind students, respectively.

The normalized gain (<g>) (Hake, 1997, 2002) is employed to investigate students' conceptual learning progression. The range is that if the (<g>) $\geq$ 0.7 meaning High progression, while 0.7 > (<g>) $\geq$ 0.3 meaning Medium progression, and (<g>) < 0.3 meaning Low progression. Observing the Table 1, the results shows that all groups of students gained better conceptual knowledge after participating in the developed CAL and the progression of their knowledge was reasonably medium, indicating that they gain conceptual knowledge of the importance of selling and marketing concepts, the types and characteristics of the selling, and the basic of products and business in the medium size.

Table 1: The student scores in this study

Group	N	Tests	Mean	SD	Normalized gain	Interpretation
Non-visual impaired	12	pre-test	9.67	2.96	<g> = 0.54	Medium progression
		post-test	20.67	3.39		
Partial visual impaired	7	pre-test	9.43	2.23	<g> = 0.65	Medium progression
		post-test	22.71	2.56		
Blind	5	pre-test	9.80	2.59	<g> = 0.68	Medium progression
		post-test	23.60	2.61		

Moreover, when we asked the participating students to report their own satisfactions about the developed CAL, we found that they had positive satisfaction toward the developed CAL which fit with their learning as shown in Table 2.

Table 2: The students' satisfactions toward the developed CAL

Non-visual impaired students	
Student A	"I like the CAL, I can learn and repeat instruction every time."
Student B	"It makes the learning interesting."
partial visual impaired students	
Student C	"CAL, it is convenient for me to learning, I can zoom in and zoom out the pictures and texts."
Student D	"I enjoy the CAL."
Blind students	
Student E	"I think I can learn instruction seem my friends and it easy for me to use computer."
Student F	"Normally, I don't have instruction. I like it, CAL."

5. Conclusions

This study developed the computer assisted learning (CAL) based on the five phases of ADDIE instructional model: Analysis, Design, Development, Implementation, and Evaluation for non-visual impaired students, partial visual impaired students, and blind students on marketing course of Diploma program. The results showed that the developed CAL has been considered as a critical factor not only to improve the students' conceptual learning progression but also promote positive satisfaction. This is because the instruction reminds the students (readers) what has been remembering and helps them learning together.

With the suggestions from the students to improve CAL for example using game-based learning, cleaning sound noise, embedding more multimedia, the enhanced CAL has been developing. The experiment with larger size of participants is going to be conducted as well. The successful of this study might be an alternative way for educators/ researchers/ practitioners to develop CAL for visual impaired students in which the CAL is used to improve their conceptual learning progression.

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