AENSI Journals

Australian Journal of Basic and Applied Sciences

ISSN:1991-8178

Journal home page: www.ajbasweb.com

A Comparative Analysis on Conceptual Design Model of Assistive Courseware (AC) for Visually-Impaired Learners (AC4VI)

[1]A. Nurulnadwan, [1]A.M. Ariffin, [2]J. Mohd Saifullizam, [1]S. Siti Mahfuzah

[1]*School of Multimedia Technology and Communication, UUM College of Arts and Sciences, University Utara Malaysia, 06010 UUM Sintok, Kedah, MALAYSIA.*
[2]*Faculty of Computer, Media, and Technology Management, TATi University College, Jalan Panchor, Teluk Kalong, 24000 Kemaman, Terengganu, MALAYSIA.*

ARTICLE INFO

Article history:
Received 20 November 2013
Received in revised form 24 January 2014
Accepted 29 January 2014
Available online 5 April 2014

Key words:
assistive courseware (AC), comparative analysis, conceptual design model, software engineering, visually-impaired (VI)

ABSTRACT

This paper reports on an ongoing study which intends to propose a conceptual design model of Assistive Courseware (AC) that is specifically designed for Visually-impaired (VI) learners. Through a systematic review and preliminary investigation, this study finds that numerous studies have been carried out related to courseware development either for normal learners or disabled learners. However, the studies interrelated with the development of conceptual design model of AC that is specifically designed for VI learners are highly scares. This is proven through analyzing ten existing models of AC. This paper aims at (i) analyzing the existing conceptual design models of AC and (ii) identifying the common components of conceptual design model of AC for VI learners. Briefly, findings of this study reveal that the conceptual design model of AC for VI learners is highly lacking. In addition, ID model, learning theories, and learning approach act as the basic components in designing a conceptual design model of AC for VI learners.

To Cite This Article: A. Nurulnadwan, A.M. Ariffin, J. Mohd Saifullizam, S. Siti Mahfuzah, A Comparative Analysis on Conceptual Design Model of Assistive Courseware (AC) for Visually-Impaired Learners (AC4VI). ***Aust. J. Basic & Appl. Sci.,*** *8(4): 75-80, 2014*

INTRODUCTION

Recently various studies have been proposed related to the development of educational content application. It can be presented in many forms including e-book, courseware, e-tutorial, and mobile learning. Most of them are developed as the additional tools to provide explicit teaching and learning activities. However, most of these applications are developed for the use of normal people.

Studies related to educational content application particularly courseware for people with disabilities (PWDs) is still lacking. This has been proven through the elicitation from literatures and preliminary investigation conducted in previous studies (Nurulnadwan *et al*., 2009; Nurulnadwan *et al*., 2011). In fact, PWDs also deserve to have a quality education similar to normal students and should not be neglected. In regards to that, VI learner is one of the PWDs populations that should get attention from the professionals and researchers to help them to have a brighter future life in education.

As discussed in previous studies (Nurulnadwan *et al*., 2009; Nurulnadwan *et al*., 2011) various aspects cause the needs of VI to the AC as one of their learning tools. For that reason, the main aim of this study is to propose a conceptual design model of courseware that particularly for VI learners, namely AC4VI. In proposing a conceptual design model of courseware, reviews and analysis on conceptual design model is important. In regards to that, to accomplish the main objective, two specific objectives were formulated as follow:

i) To review and analyze the existing conceptual design model of AC.
ii) To identify the common component of conceptual design model of AC4VI.

In accordance, the next section provides an in-depth discussion on conceptual design model of AC.

2. Analysis And Discussion On Existing Conceptual Design Model Of Ac:

Reviews and analysis of conceptual design model by previous works are used for this study to further construct the conceptual design model of AC4VI (Ariffin, 2009). Generally, a conceptual design model is

Corresponding Author: Nurulnadwan Aziz, School of Multimedia Technology and Communication, College of Arts and Science, Universiti Utara Malaysia, 06010 Sintok Kedah MALAYSIA.
E-mail: Nuruln746@tganu.uitm.edu.my

important in software development process. It provides fundamental elements and acts as the point of reference for the designers to further develop products or systems (Mazyrah *et al*., 2008).

From multimedia perspective, conceptual design model provides a basic function of the represented product. (Churchill, 2007) puts forward that a conceptual design model as a particular type of learning object, which is represented in the form of visual or interactive manner.

By considering that facts, this study selects ten models of AC which have been outlined in the past five years (i.e. 2009-2012) from various countries and respectable journals. They are listed in Table 1.

Table 1: Previous Conceptual Design Model of AC

No.	Researcher	Name of Conceptual Design Model
1.	(Ellis, 2009)	*Auslan Children*
2.	(Norfarhana *et al*., 2010)	*Komputer Saya*
3.	(Morfidi *et al*., 2010)	*LT125ThinkingMind*
4.	(Sampson & Zervas, 2010)	*eAccess2Learn*
5.	(Seo & Woo, 2010)	*Math Explorer*
6.	(Siti Zaharah & Nor Azan, 2011)	*MudahKiu*
7.	(Savita & Nur Athirah, 2011)	*eBIM*
8.	(Nurulnadwan *et al*., 2011)	AC for VI learners
9.	(Rahmah and Tengku Nazatul Shima, 2012)	*MEL-SindD*
10.	(Rahmah *et al*., 2012)	Digital Storytelling for Remedial Students

***Auslan Children*:**

Auslan Children by (Ellis, 2009) is a multimedia application, built to assist hearing-impaired children in learning Australian sign language. This model consists of three components which are learning theories, modules, and multimedia elements. The modules of *Auslan Children* were designed by absorbing multiple intelligence (MI) theory and constructivist theory to cater the Australian hearing-impaired children with multiple skills similar to normal children. Therefore, the AC was built by inserting a signed song, a memory game, an interactive storybook, a series of questions, and the most importantly is vocabulary instruction. All of these modules were develop by integrating text, image, audio, and video to support the multimedia presentation. On the other hand, the developed model also includes character to be a magnet for children to facilitate them in learning activities. Although this model is point to disabled children and resulted that majority of that children enjoyed learning *Auslan Children*, it does not enable the VI learners to join the learning activities because the visualization aspects do not match with VI needs.

***Komputer Saya*:**

Komputer Saya is a model of AC designed for slow learners (Norfarhana *et al*., 2010). There are seven components incorporated in the *Komputer Saya* which is technology, learning theory, approach, level of learners, holistic development, interactivity, and technique. Meanwhile, Cognitivism, Behaviorism, and Constructivism act as the root in the development of *Komputer Saya*. Besides, to attract the learners participating in each of the learning activities, three learning approaches are adopted which are learning through playing, learning through experience, and mastery learning. On the other hand, cognitive, affective, and psychomotor aspects appear in *Komputer Saya* for their holistic development. It is important to develop the thinking skills of slow learners who also have limited cognitive abilities. As usual, text, graphic, audio, and animation are exploited to match with the needs of slow learners. Conclusively, the design model of this AC is comprehensive, according to their second study (Norfarhana *et al*., 2012) the evaluation of the prototype have yielded to positive results. It was proven that the design model is applicable to develop AC for slow learners. However, the visual and audible aspects are still not fulfilling the needs of VI learners.

***LT125ThinkingMind*:**

LT125ThinkingMind by (Morfidi *et al*., 2010) is an application developed to support the needs of children with severe learning disabilities particularly in learning pre-mathematical concepts such as position of objects, directionality, and object classification. The interface was designed differently for the use of educator and student. There is no discussion about the component, learning theory or learning approach in the model. However, the model deals with cognitive processes (i.e. recognize an object, sort objects, and classify objects by colors, sizes, or positions). This indicates that the study has adapted cognitive theory, which is important for the children with severe learning disabilities. Apart from that, it is very crucial to educate the teachers about the effectiveness of the model. Thus, the study considers the teachers' perspectives. Overall, a mathematical courseware could improve the children mental development. However, without considering the aspects of visual, audible, and interactive features it means nothing to VI learners.

***eAccess2Learn*:**

By considering the accessibility issues in web-based educational system, Sampson and Zervas (2010) come out with the *eAccess2Learn* framework which adopts the current Learning Technology Specifications and Web Accessibility Standard. This framework is quite complicated to understand. The main aim of *eAccess2Learn* framework is to provide tools and services that support the design and development of accessible eTraining resources and courses to be used among different disabled user group. Briefly, the tools and services in *eAccess2Learn* framework include (i) *eAccess2Learn* learning design toolkit for designing eTraining course templates and eTraining courses, (ii) *eAccess2Learn* guidelines and style sheets for developing accessible web-based training content, (iii) *eAccess2Learn* accessible learning objects metadata authoring toolkit, and (iv) *eAccess2Learn* web repository. Among these four, this study concerns on the guidelines of developing accessible web-based training content. More specifically, this service includes a set of W3C Web Content Guidelines 1.0 and a set of Cascading Style Sheets (CSS) for HTML-based content. In addition, these two sets of guidelines would transform the presentation of HTML elements such as text size, background and foreground color of the existing eTraining resources to be understandable and navigable by low vision, color blind, and motor disabled people. In summary, the analyzed framework has potential to further extend in providing eTraining resource and course that match with the learner accessibility preferences. However, the presented framework is more to web-based educational system which highly contrast with the needs of VI children in Malaysia. Furthermore, it is applicable for those (low vision, color blind and motor disabled) who need an access for training resources and courses.

***Math Explorer*:**

Seo and Woo (2010) introduced *Math Explorer* for early elementary students with learning disabilities (LD) after identifying the critical user interface design features of computer-assisted instruction (CAI) programs in mathematics. Cognitive development is important for students with LD. Therefore, by analyzing the previous research this model adapts four steps of cognitive (i.e. reading (step 1), finding (step 2), drawing (step 3), and computing (step 4)) and three steps of meta-cognitive strategies (i.e. do activity, ask activity, and check activity) in *Math Explorer*. Besides cognitive development, the more important part in producing this model is the user interface design features which are embedded into *Math Explorer*. The identified user interface design features and guidelines are listed as follow (Table 2):

Table 2: Interface Design Guidelines of *Math Explorer*

•	Instruction-driven interface
○	Controlling the amount of mathematics instruction in *Math Explorer*
○	Using visual representations, animations, and graphics in *Math Explorer*
•	Manifest structure interface
○	Having simplicity and consistency in *Math Explorer*
○	Selecting appropriate fonts and colors in *Math Explorer*
○	Highlighting and color-coding texts in *Math Explorer*
•	Adaptive interaction interface
○	Providing interactive and ability/effort feedback in *Math Explorer*
○	Having adaptive multimedia in *Math Explorer*

In response to that, some of the guidelines are appropriate to be embedded in developing the conceptual design model of AC4VI, such as the use of animated character to foster the students' motivation and attention. This guidelines is appropriate for children but for students with VI the character must be created carefully to avoid them confused with the desired information (Nurulnadwan *et al*., 2011). Consequently, *Math Explorer* still requires a large modification to suite VI learners.

***MudahKiu*:**

MudahKiu is a framework of AC developed by (Siti Zaharah and Nor Azan, 2011) special for children with hearing-impaired to help them learn independently. The framework was developed incorporating nine components, which are (i) universal design principles, (ii) ID model, (iii) user interface design, (iv) teaching and learning technique, (v) approach of literacy teaching, (vi) learning activities, (vii) multimedia elements, (viii) interactivity, and (ix) navigation. Based on the analysis, the model of *MudahKiu* is still in planning, however based on the developed framework it still requires more specific and structured design so that the developer would not confuse which part they need to focus. Nevertheless, the framework of *MudahKiu* is highly contrast with the needs of VI learners since it was developed special for hearing-impaired children.

***eBIM*:**

A model of AC called *eBIM* project by (Savita and Nur Athirah, 2011) is specializes for hearing-impaired children in Malaysia. There is a little discussion on the main components of the model, either in terms of learning approach or learning theory embedded in the AC. However, based on the screen shot in Figure 1 it can

be conclude that static graphics and animations have been utilized to attract the young deaf children utilizing the courseware.

Fig. 1: Screen shot of *eBIM*

On the other hand, 3D character has been created to show the alphabet sign where the student can pause, stop, and rewind the show. There is also a search engine function provided in the AC that allows the students to search the Malay word stored in database. Overall, *eBIM* seems interesting in terms of its functions; however there is no enough discussion in terms of the components which then make this model seems similar to other courseware model that are designed for deaf people. Additionally, the analyses on the empirical evidence provided in evaluation part are also found prosaic, which then show that this model does not impact positively to the user. Also, the interface design features such as in terms of formatting style and text, combination of colors between the desired information and the background were found highly poor for the use of VI learners.

AC for VI learners:

AC for VI learners has been explored by (Nurulnadwan *et al*., 2011). Figure 2 depicts the screen shot of the model.

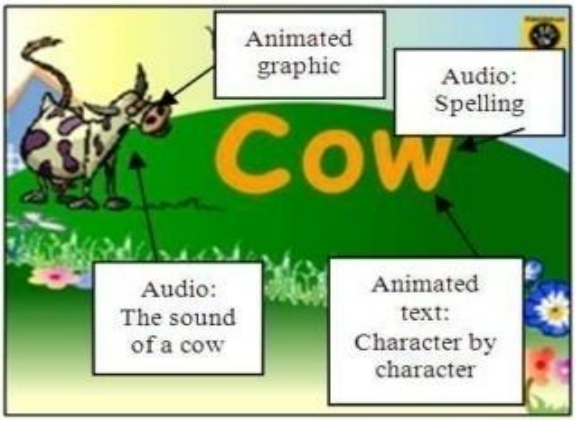

Fig. 1: Screen shot of AC for VI learners

Although it is special designed for VI learners, it was found that there is no illustrative and structured conceptual design model presented in the study. Additionally, discussions on specific component to form the prototype as well as learning theory, learning approach, and instructional strategies, are also highly poor. On the other hand, the model stresses on characteristics on developing the prototype of AC for VI learners which are divided into (i) audio, (ii) formatting style and text, (iii) graphics and animation, and (iv) general interaction. Although this courseware highlights the VI learners as the main user, it still requires much more works particularly in terms of components such as ID model, approach, and theories. Also, the evaluation could be further carried out.

***MEL-SindD*:**

The scaffolding concept is reinforced in the courseware called *MEL-SindD* to assist the down syndrome (DS) children in learning activities. (Rahmah and Tengku Nazatul Shima, 2012) introduced three types of scaffolding models which are designed to support the DS children in using the *MEL-SindD*. The models are (i) scaffolding models to explore the courseware module, (ii) scaffolding models to hear and read stories, and (iii) scaffolding models using sub-modules to explore the minds. The basic elements contained in each of the scaffolding models are screen/module/sub-module, scaffolding strategy, guideline, and action. The important element is scaffolding strategy which refers to a form of assistance to support the learners to perform the tasks. There is no learning approach or theories applied in this model. The characteristics of the content are also not well-discussed, which automatically means this model is irrelevant to be applied for developing an AC4VI learners.

Digital storytelling for remedial students:

The framework of digital storytelling for remedial students is proposed by Rahmah *et al*. (2012) with the aim to identify the background color that present affection to remedial students in reading environment via storytelling approach. This framework has been developed based on previous studies by analyzing the user characteristic in relation with affective engineering, color psychology, and digital storytelling. There are several components that surround the framework. It includes educational theories (i.e. cognitive, behaviorist, and motivation), holistic development (i.e. cognitive and affective), storytelling elements (i.e. fun and engagement), development (objects and 2D background), design (i.e. task design, interface design, interaction design), and learning activities (i.e. play with the characters). This is an interesting framework, in which the remedial students' motivation and feeling were researched based on their color psychology. Meanwhile, language, educational theories, and holistic development are the key aspects in designing the framework. Although this framework serves as the guideline and reference for the developer to develop digital storytelling applications and for teachers in teaching remedial students still the framework ignores the VI learners to be a part from them.

Conclusion And Future Work:

The previous literatures suggest that the development of conceptual design model of AC should include ID model, learning theories and learning approach as the basic components. It would be unreasonable to ignore these three basic components in an endeavor to create any learning application (Syamsul Bahrin, 2011). On top of that, applicable learning approach is really important to motivate and attract the learners especially children in making sure they participate in using the courseware.

Moreover, the analysis clarify that all the reviewed models have come out with certain guidelines to ensure it matches with their target learners. However, it was found highly lacking that the conceptual design models or prototypes address the VI learners to be the main user. Only two models draw attention to VI learners, yet there are still much more to be filled-in in producing a conceptual design model of AC4VI. The content aspects are also poorly emphasized for the needs of VI learners.

Hence, it ought to be noted that this is the research gap that should be the important point to extend this study in deeply. Future work of this study will be focused on the development of conceptual design model of AC4VI.

REFERENCES

Ariffin, A.M., 2009. "Conceptual design of reality learning media (RLM) model based on entertaining and fun constructs". thesis, Universiti Utara Malaysia, Malaysia.

Churchill, D., 2007. Towards a Useful Classification of Learning Objects. Educational Technology Research and Development, 55(5): 479-497.

Ellis, K., 2009." Multimedia for Primary School Children Learning Sign Language". In the Proceedings of the 21st Annual Conference of the Australian Computer-Human Interaction, pp: 97-104.

Mazyrah, M.N., W.A. Wan Fatimah, M.N. Shahrina and S. Suziah, 2008. "A Conceptual Framework for English Language Courseware Using Storytelling Approach ": Case Study In University Teknologi Petronas. In the Proceedings of Information Technology Symposium, pp: 1-6.

Morfidi, E., N.M. Papachristos and T.A. Mikropoulos, 2010. "Teachers' Implementation of a Hypermedia Application for Children with Severe Learning Disabilities". In the Proceedings of 2010 International Conference on Intelligent Networking and Collaborative Systems, pp: 267-273.

Norfarhana, A., W.A. Wan Fatimah and P.A. Emelia Akashah, 2010. "Multimedia Design and Development in " *Komputer Saya* " Courseware for Slow Learners". Second International Conference on Computer Research nad Development, pp: 354-358.

Norfarhana, A., W.A. Wan Fatimah and P.A. Emelia Akashah, 2012. "Development and Usability Study of Multimedia Courseware for Slow Learners: "*Komputer Saya*."". In the Proceedings of 2012 International Conference on Computer & Information Science (ICCIS), pp: 1110-1114.

Nurulnadwan, A., M.R. Nur Hazwani and A.M. Ariffin, 2009. "Assistive courseware for visually impaired". In Lecture notes in computer science,visual informatics: bridging research and practice, Eds.B. Z. Halimah Berlin, Germany: Springer-Verlag Heidelberg, pp: 905-915.

Nurulnadwan, A., M.R. Nur Hazwani and A.M. Ariffin, 2011. "Visually Impaired Children's Acceptances on Assistive Courseware". American Journal of Applied Sciences, 8(10): 1019-1026.

Rahmah, L., A. Hafiza and T.P. Tengku Nazatul Shima, 2012. "Affective Engineering of Background Colour in Digital Storytelling for Remedial Students". Procedia - Social and Behavioral Sciences, 68: 202-212.

Rahmah, L.Y. and T.P. Tengku Nazatul Shima, 2012. "Reading Activities Using the Scaffolding in *MEL-Sindd* for Down Syndrome Children". Procedia - Social and Behavioral Sciences, 35: 21-128.

Sampson, D.G. and P. Zervas, 2010. "Technology-Enhanced Raining for People with Disabilities: The *eAccess2Learn* Framework". In the 2010 International Conference on Intelligent Networking and Collaborative Systems, pp: 244-251.

Savita, K.S. and A.P. Nur Athirah, 2011. "Malay Sign Language Courseware for Hearing-Impaired Children in Malaysia". World Applied Sciences Journal, 12: 59-64.

Seo, Y.J. and H. Woo, 2010. "The Identification, Implementation, and Evaluation of Critical User Interface Design Features of Computer-Assisted Instruction Programs in Mathematics for Students with Learning Disabilities". Computers & Education, 55(1): 363-377.

Siti Zaharah, M. and M.Z. Nor Azan, 2011. "Accessible Courseware for Kids with Hearing Impaired (MudahKiu): A Preliminary Analysis". In the Proceedings of 2011 International Conference on Pattern Analysis and Intelligent Robotics, pp: 197-202.

Syamsul Bahrin, Z., 2011. "Mobile game-based learning (mGBL) engineering model". thesis. Universiti Utara Malaysia, Malaysia.