Designing Special Instruction on Interactive Multimedia Object for Dyslexic Children

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Abstract: - This research is a partial process of Interactive Multimedia Learning Object (IMLO) development project. IMLO is a Learning Object that was designed using Interactive Multimedia functions to help dyslexic children to learn specific topic. IMLO development involved three phases of (1) Analysis, (2) Development, and (3) Evaluation. The development phase in particular, has three processing levels; (a) Storyboard, (b) Prototype, and (c) Maintenance. The storyboard level is broken down into small processes including identification of multimedia elements for the special instruction design, which is significant for the prototype process. The objective of this research is to identify the multimedia elements used for the special instruction. It also describes the functions of multimedia elements in learning and exercise activities. Similar research process was identified from Nor Hasbiah (2007)'s design process of D-Matematika (mathematic courseware for dyslexic children she developed) which included multimedia elements such as audio, animation and graphic as the motivational factors. Fadilahwati and Ronaldi (2009) also described the use of font setting and animation as design strategy. The method of this research used ARCS motivational model to identify suitable multimedia elements based on components of Attention, Relevance, Confidence, and Satisfaction. Prior to applying ARCS model, Elaboration theory (Reigeluth) was also used to further firming the structure of the learning content. This research revealed the use of some important multimedia elements such as cartoon characters, images, voice over, and animation as the motivational factors in the special instruction. This finding is very important in order to develop the prototype. Although the importance of motivational factors in screen design for interactive multimedia is recognized, many designers think of such factors late in the design process (Keller & Burkman, 1993). This indicates that interactive multimedia elements identification is imperative, and this is supported by Lee and Boling (1999) who reported that many designers may not have time during the development process to find appropriate guidelines in the interactive multimedia instruction. Thus, this research might provide some guidelines for multimedia elements that would improve the motivational appeal of interactive multimedia instruction for dyslexic students.

Key-Words: - Dyslexia, Special Instruction, Multimedia Elements, Learning Object, ARCS, Dyslexic children

1 Introduction

Dyslexia is a disorder manifested by difficulty in learning to read despite conventional instruction, adequate intelligence, and socio-cultural opportunity (Critchley, 1970:17). In Malaysia, Dyslexia is categorized as Specific Learning Disabled (SLD). There were about 314,000 school-going children in Malaysia who have dyslexia reported in the year 2005. With such amount of population, intervention program is in serious need. This argument is also supported by Gomez (2004:161) who reported that help for children with dyslexia has been scarce and isolated. It is believed that one of the recommended interventions is educational intervention, which involves strategies, activities, and environment (Mohd. Sharani Ahmad, 2004). Such educational intervention is proven by Nor Hasbiah (2007) who reported that multimedia courseware has the capability to motivate dyslexic children.

This research is a design process of the development of educational intervention called Interactive Multimedia Learning Object (IMLO). IMLO is a Learning Object (LO) developed with Interactive Multimedia functions. Research on IMLO development was made at Dyslexia Schools in Malaysia within mathematic inclusion classes.
IMLO contains multiplication topic; a topic that was found as the most difficult topic to learn on mathematic subject. The idea is to deliver this topic in a form of interactive story-based content using multimedia elements.

IMLO development process involves three phases including (1) analysis, (2) development, and (3) evaluation. Through its analysis phase, data from quiz results, report books, examination results, class observation and interview with teachers were obtained. These data then became guidelines in designing special instruction for IMLO content. However, designing the special instruction using interactive multimedia elements is not an easy task. Dellaporta (2007) stated that the designing task can be affected by both the look of graphical user interface (GUI) and the visual readability of the content. As a design process, IMLO special instruction describes the use of interactive multimedia elements based on the data obtained from the analysis phase. Practically, it ensured that the development process was completed properly for the dyslexic students to understand the content. Significantly, this research also contributes to the body of knowledge in providing guidelines for future similar LO developments.

2 Problem Formulation

Using multimedia elements to motivate dyslexic children is a proven approach. Spafford and Grosser (1996, p.17) stated that for the student with dyslexia, repeated readings, retellings and so on would be needed to reinforce presented materials. They recommended that structured lesson activities that incorporate a multi sensory interactive approach to be used for the full benefit of enrichment for the students of dyslexia. Furthermore, Gavin Reid (2005) suggested some teaching principles for dyslexic students, which are

1) Multi-sensory (Incorporation of visual, auditory, kinaesthetic and tactile elements)
2) Overlearning (The use of a range of teaching approaches to ensure that the same word or skills are being taught in different situations)
3) Automaticity (Consolidation of skills that learners normally achieve through practice)
4) Structure (Structured learning experiences that meet the need of dyslexia children within the classroom situation).
5) Practice (Activities to engage the students)

As IMLO comprised interactive multimedia elements, ARCS components were used to describe the interactive multimedia elements, which then identify both the designed learning activities and exercise activities. ARCS model is a proven approach for designing instruction. Shellnut, et al (1999) applied ARCS for designing interface as well as possible strategies for computer-based lessons. Reflecting to the ARCS components, Shellnut has also put emphasis on the use of pull-down menu buttons, tool buttons (like calculator and note) and their position in interface design.

3 Problem Solution

This chapter describes the use of elaboration theory, and the use of ARCS model.

According to Reigeluth (1999), Elaboration theory has the following values:

- It values a sequence of instruction that is as holistic as possible, to foster meaning-making and motivation.
- It allows learners to make many scopes and sequence decisions on their own during the learning process.
- It is an approach that facilitates rapid prototyping in the instructional development process.
- It integrates viable approaches to scope and sequence into a coherent design theory.

Considering these values, this research suggests the use of interactive story-based content to sequence the multiplication-of-two learning stages as a holistic approach in IMLO. A story about birthday party that requires party pack preparation was set up. The party pack preparation has become the meaning-making of multiplication-of-two concept, while the interactive function allowed the students to decide the sequence at their own pace. These approaches were believed able to motivate students to learn multiplication-of-two module.

Multiplication-of-two module is a foundation topic for year two students to learn mathematic according to the Malaysian syllabus. The learning objectives of this module were to (1) understand multiplication as repeated addition, (2) recall the multiplication table of two, and (3) use multiplication in everyday life.
In this research, the researcher used the ARCS Model of Motivational Design developed by John M. Keller of Florida State University (Keller, 1983, 1987) to apply the instructional design. It consists of four strategy elements; (1) attention, (2) relevance, (3) confidence and (4) satisfaction. Each of these elements describes in form of multimedia elements and its significant role in the special instruction.

3.2. Attention
Attention is one of elements in ARCS model to arouse and sustain of curiosity and sensation seeking. Creating attention is an important issue in developing a multimedia application. Mitropoulu and Triantafyllidis (2005) stated that researchers have shown that maintaining of students’ interests is one of the factors that should be taken into consideration during the designing of educational software. According to Keller, J. M., & Suzuki, K. (1988), attention component has three sub components, which are

(1) Perceptual arousal (gain and maintain attention by the use of novel, surprising, uncertain event in instruction)
(2) Inquiry (stimulate information seeking behaviour by posing, or having the learner generate questions or problems to solve)
(3) Variability (maintaining students’ interests by varying the elements of instruction)

Fig.3 Screen shot sample of IMLO showing Amir and friends’ cartoon characters, navigation button, text, and colour setting.

One of important multimedia elements that has attention factor is the main cartoon character of Amir; an eight year old local boy who explained the plot of the story (in a form of a journey ride). Amir played the role to show learning activities such as repeated addition, skip counting, and multiplication table. Amir was wearing school uniform and animatedly appeared, talked, and moved in every page, inviting user to participate with the activities. Amir has Perceptual arousal value because of its surprising appearance at every scene. Moreover, the use of interactive navigation buttons also provided uncertain event (Fig.3).

By having interactive navigation buttons too, students will be able to choose the ‘next button’ at every scene. The scene however, has been designed to create curiosity for the students to continue the story. The ‘next button’ provided possibilities to engage the students and proceed with more learning material. This explain the Enquiry sub component.

Despite of character, Amir also has voice over of a variety of instruction elements to maintain the students’ interests (Variability).

Thus, the multimedia elements that contribute to the special instruction for the Attention component were Amir cartoon character and interactive navigation buttons.

3.3. Relevance
Relevance has its own sub components. These sub components describes the sequence process of ARCS after Attention. It is believed that Relevance happened when the students wonder how the given material relates to their interests and goals. When relevance happens, the students can be motivated. Sub components of Relevance are;

(1) Familiarity (The use of concrete language and examples)
(2) Goal Orientation (Provide statements or examples that present the objectives and unity of the instruction)
(3) Motivate watching (The use of teaching strategies that matches the motive profiles of the students).

Having the fact that IMLO was designed for Malaysian students, there were also cartoon characters designed by different races of Malay, Indian, and Chinese. They were designed wearing school uniform and aged about eight years old (see figure 4). Similar approaches to create familiarity were from the images of candies, balloon, and cup cake. All these examples of images created
familiarity among the students on their interests and goals of completing the story content.

To ensure the Goal Orientation sub component, Amir played a role of inviting the students to participate in each activity inside the story. This invitation can be seen from Amir’s animation and voice over.

However, some dyslexic teaching strategies were also taken into consideration when delivering the whole story, especially on the use of dyslexia-friendly font and colour setting (*motivate watching*). The font setting used was white-color-Arial Black with the size than is relatively big and readable. To support the readability issue, the background colour was set as dark.

Thus, the multimedia elements that contribute to the special instruction for the Relevance component were images of birthday party situation, Amir’s invitation (voice over and animation) to the party’s activities, and the font and colour setting of the screen design.

3.4. Confidence

Confidence is the third step of ARCS model, where students have to know that they will probably be successful before completing a given task. The strategy requires students to be challenged with an easy task. The sub components of confidence are;

(1) **Learning Requirement** (help students estimate the probability of success by presenting performance requirements and evaluation criteria).

(2) **Success Opportunities** (Provide challenge that allow meaningful success experience under both learning and performance condition).

(3) **Personal Control** (Provide feedback and opportunities for control that support internal attributions for success).

IMLO was designed with consideration of Learning Requirement. All counting activities involved more than one element to help the students to estimate the probability of success; images, numbers as well as voice (see figure 4). These multimedia elements helped the students’ estimation when they read and calculate. The same voice over also challenged the students to read and count individually (*success opportunities*). They practically just need to repeat the same statement following the animation showed. In any case the students wanted to repeat the scene, they can click repeat button to repeat, or back button to start from the previous screen (*personal control*).

Thus, the multimedia elements that contribute to the special instruction for the Confidence component were images that symbolize amount, numbers, voice over and navigation buttons.

The images, numbers and voice over helped the students to recall the multiplication table (second learning objectives), and the button functions helped the students to answer the exercise questions (the third learning objectives) confidently.

3.5. Satisfaction

Satisfaction is the last component of ARCS. When it established, students will remain motivated. There are three subcomponents of Satisfaction.

(1) **Natural Consequences** (Provide opportunities to use newly acquired skills in real or stimulated setting)

(2) **Positive Consequences** (Provide feedback and reinforcement that will sustain the desired behaviour)

(3) **Equity** (Maintain consistent standards and consequences for task accomplishment).

Natural consequences in IMLO were set at the exercise scene, where students need to solve new problem using new scenario and by utilizing new multimedia elements. The scenario was the moment where the birthday has come to the climax scene. Amir needed to blow the candles, while the students needed to count the number of candles. Here, the students no longer use the previous scenario (party pack preparation for calculation concept). Thus, the multimedia elements used for Natural consequences sub component were new images (candle and balloon images).

To solve this problem, students need to answer from the given options. Positive feedbacks were provided for both correct and incorrect answers. Multimedia elements used for correct answer were Voice, sound effects, and texts, and for incorrect answer, the elements were replay-able animation (of calculation technique), text and voice. Chinn (2009) also suggested praising the work, not the learner, because dyslexic tends to blame themselves for any feedback given.

Lastly, to provide the equity sub component, students will be acknowledged for what they have achieved using text, voice, and song.
Thus, the multimedia elements that contribute to the special instruction for the Satisfaction components were new images, interactive functions on positive and corrective feedbacks, animation, text and voice over song and sound effects.

4 Conclusion

It was revealed that student needed to be motivated and engaged by using multisensory approach such as animation, audio graphic and text. These multimedia elements were applied in ARCS motivational model, hence there could be more potentials for different types of cartoon characters, graphics, screen design, navigation button designs, voice over, sound effects, as well as animation.

However, the researcher believes that the attention component can be improved by putting humorous elements such as humourous story content or humourous supporting cartoon character. Keller & Suzuki (1988) believed that humour can break up monotony and maintain interest by lightening the subject. Further study can be conducted in identifying specific cartoon character by preference. Better cartoon character may contribute to better attention and relevance factors. Moreover, specific images, graphics, and screen design can also be studied further. Story-based content might also be designed in a form of comic strips (if the students prefer comic), since it might include humorous elements and specific cartoon characters.

To improve the Relevance component, students can also experience new learning. IMLO has provided narrative content, with little exploratory interactive options. More interactive options can be employed to support the Goal Orientation in the learning process. These interactive options for example, may explore on how repeated addition concept could be applied in real life situation. There might be small quizzes, information links to websites, or showing videos. All these explorations might help better Goal Orientation and keep the students motivated.

Confidence component were described with images that symbolize amount, numbers, voice over and navigation buttons. Even though these multimedia elements can provide imagination of successful probability in the given task, some interactive functions might also help. There could also be some constructive feedbacks given in every image clicked. These feedbacks might be presented in a form of special effect music, voice, and simple animation to explain further possible challenge. The same approach was also reported by Keates (2000), who stated that dyslexic students use ICT because it is an area where they generally have not previously failed.

Nevertheless, dyslexic students were also described as Automaticity (Consolidation of skills that learners normally achieve through practice) (Reid, 2005). This means, consistent approach of using similar cartoon character, images, buttons, colour setting, and screen design might also contribute to satisfaction component. Such consistency might also contribute to more IMLO-type products in the future.

The multimedia elements used for the special instruction can be used as a guideline for any similar learning material development for dyslexic students. Chin (2009) also believed that it is unlikely that there will be a definitive programme for dyslexia with numeracy problem; nevertheless any future programme will have to incorporate support for memory. Available guidelines in this literature for implementing multimedia elements were organized based on learning theory and model. Hence, these findings are appropriate and may be kept for discovering strategies used by relevant people in charge such as graphic designers, multimedia designers, Subject Matter Experts, as well as instructional designers to enhance the motivational aspects of Interactive Multimedia content development for dyslexic children.
References:


