

Educational Software & Development for People with Special Needs

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Abstract: - Students with disabilities have the same needs as other students: opportunities to learn, to play, and to form relationships. What is different for students with special needs is the diminished access they have to these opportunities. Therefore this paper considers whether, in the classroom, multimedia system could enhance their learning and understanding of subjects. The Preliminary study indicated that the results of overall learning from multimedia system are *as good as* the results from learning by print-based method (taught by teacher).

Key-Words: - Educational Software, Software Development, Multimedia System, Instructional Technology, Instructional System Design, Special Needs

1 Introduction

The purpose of the study at the *School for the Deaf in Bangkok* is to consider whether, in the classroom, multimedia program could enhance deaf students in their learning and understanding the subjects.

In order to complete the objective above, the author need to develop a multimedia program for teaching American Finger Spelling for deaf students in Thailand. Therefore this paper will describe the design of a suitable testing tool, the *Life: Bone Numbing!* program. The discussion in this paper will also cover the methods from the field of software engineering designed to ensure the development of quality software.

2 Background

The domain of practising finger spelling was chosen because spelling is the most difficult learning task for deaf students and no one in Thailand had addressed it. According to Greene [1] spelling is a more difficult learning task than reading. Hence, deaf students who can read may not necessarily be good spellers.

Additionally, Pochanakit [2] says a large majority of hearing teachers who work in school for the deaf are not fluent in Thai Sign Language.

Pochanakit also added that it is not also the lack of the teacher in teaching Thai Sign Language that is a problem but also there are problems in teaching foreign languages. It is difficult for Thai deaf to learn a foreign language since the number of teachers and technology such as training material on CD-ROMs are still very limited. A multimedia system *Life: Bone Numbing!* will be one of multimedia programs that will help deaf students in Thailand.

3 Design & Development of a Multimedia System

A multimedia system design in this study follows the Kemp Model [3]. The Kemp Model gives the designer the sense that the design and development process is a continuous cycle that requires constant planning, design, development and assessment to insure effective instruction. The model is systemic and nonlinear. Moreover, the function of each element in the Kemp Model is clearly stated and easy to apply. Another popular instructional design model is the *Gagne's Nine Events of Instruction*. The author did not use this model because the *Gagne's Nine Events of Instruction* is best suited the development of online instruction (multimedia program) rather than the traditional print-based method. The study at Bangkok was conducted by

using two approaches of teaching and learning which are the multimedia program and the traditional print-based method. The Gagne Model therefore is not suitable for this. The author also rejects the Dick and Carey Model and ADDIE Model because those models did not state clearly on a *Pretest*. According to Greene [4] the pretest is an important task in teaching/learning activities. He pointed out that an effective approach is to pretest the students before the actual teaching/learning begins. The pretest is one of the ten elements in the Kemp Model. Whilst there is no single best way to design the instruction, the Kemp Model works just as well when applying it to the deaf students at Bangkok.

Moreover, the author selected and followed the Kemp Design Model because it takes a holistic approach to instructional design. Virtually all factors in the learning environment are taken into consideration including subject analysis, learner characteristics, learning objectives, teaching activities, pretest, resources support services and evaluation. The process is iterative and the design is subject to constant revision. This model is very flexible (the designers can start anywhere they like) and addresses any of the component concerns as long as they related to learning needs and goals. It is considered to be very learner centered and would be a good choice for IMI (Interactive Multimedia Instruction) designs where the emphasis is on learner interactivity and elemental interdependence [5]. Additionally, Mcgriff [6] said that the Kemp Model is one of the appropriate models in applying into both traditional and non-traditional classroom and in design and implementation of educational software.

Applying the Kemp Design Model into the Interactive Multimedia Learning Program: *Life: Bone Numbing!*

1. **Learning Needs:** Students can finger spell the specific words.
2. **Topics-Job Tasks Purposes:** The design & development of the multimedia system in learning environment; the use of multimedia technology to enhance special needs students in their spelling.
3. **Learner Characteristics:** A voluntary group of special needs eighth-grade high school students from *the School for the Deaf in Bangkok*.
4. **Subject Content:** *Life: Bone Numbing!* was divided into five items: Library, Dormitory, School, Winter Activities, and Run Around.

5. **Learning Objectives:** Students can finger spell the specific words.
6. **Teaching/Learning Activities:** Students in group one learned from multimedia system (CD-ROM *Life: Bone Numbing!*). Students in group two were taught by the teacher.
7. **Instructional Resources:** Interactive Multimedia program *Life: Bone Numbing!*
8. **Support Services:** Macromedia Director, ASL/Finger Spelling Dictionary, and Internet.
9. **Learning Evaluation:** Posttest and Pretest.
10. **Pretesting:** Pretest is at the first meeting.

Thus in this study, the author was the knowledge engineer for this investigation. The knowledge engineer is one who participates in building expert systems [7]. Knowledge engineers are specialists in eliciting knowledge from experts rather than necessarily being experts in the domain itself. A new professional specialty has emerged from the development of expert systems. The term *knowledge engineers* has been coined to describe the people who work with experts in a field to assemble and organize a body of knowledge and then design the software package that makes it possible to train someone to become skilled in the area or to enable anyone to call upon the skills of experts to solve the problem [8].

Additionally, knowledge engineering is a general term for processing involved in building expert systems: planning, knowledge acquisition, system building, system installation, and system maintenance [9]. It was the author's experience in expert systems and knowledge engineering that led to the view that the instructional design goals could be applied using a software engineering perspective in developing the *Life: bone Numbing!* software. The following terms should also be defined (1) knowledge acquisition, and (2) knowledge elicitation. Knowledge acquisition is the way to obtain knowledge for use in the knowledge base of an expert system. Sources of knowledge are from (1) documents: textbooks, journal articles, case histories and (2) human experts. In the study at Bangkok, the human experts are two instructors in eighth grade and one computer instructor at the *School for the Deaf in Bangkok*. Simultaneously with the knowledge acquisition process, a knowledge analysis process takes place. The knowledge engineer (the author) uses the data from the knowledge acquisition sessions to build a suitable multimedia program (CD-ROM *Life: Bone Numbing!*). The important branch of knowledge acquisition is knowledge elicitation. Knowledge elicitation is the transfer and transformation of

problem-solving expertise and domain knowledge from a source into a program.

Knowledge elicitation involves (1) finding at least one expert in the domain who *is willing* to provide his/her knowledge, *has the time* to provide his/her knowledge, and *is able* to provide his/her knowledge, and (2) interviewing the experts. The author used phone interviews with three instructors and later on used the method of *Face-to-Face* interview [10]. The author chose this method because it is useful to see the reaction of the teachers while interviewing. If there is a point that is not clear, the author can ask the teachers at the time of the interview. After several discussions with the instructors, a decision was made to divide the content of the lesson into five categories which were a combination of easy categories and difficult categories (However, in each category also contains words that are 'easy', 'medium', and 'difficult'). Easy words were defined as words that the students were already familiar with, as well as the English vocabulary for these words, such as book, bedroom, hat, and pond. Medium words were such as newspaper, washroom, scarf, and church. Difficult words were defined as words that the students were unfamiliar with as well as the English vocabulary for these words, such as stool, kitchen, snowman, and gas station. After consultation with the instructors about the purpose of the research and the content of the multimedia learning material (CD-ROM *Life: Bone Numbing!*), the instructors decided that the CD-ROM would be suitable for special needs eighth grade high school Thai students. The students were all given pseudonyms to protect their anonymity.

The followings results were obtained during the interviews with the three instructors

The students:

- Most of the students in eighth grade at the *School for the Deaf in Bangkok* have hearing ability of 80-90%.
- Some of the students prefer using sign language with their family, some prefer using both sign language and speaking with their family.
- Most of the students do not like to use a hearing aid. The teacher said that they feel uncomfortable with them.
- The instructors find that some words are more difficult for the Thai students to learn than others. The most difficult words are the ones for which the meaning of the word is

unfamiliar, for example stool, snowman, and gas station.

The program:

- According to the experts, the CD-ROM *Life: Bone Numbing!* is suitable for eighth grade high school students at the *School for the Deaf in Bangkok*.
- The CD-ROM should also contain pictures because it will help the students to understand better.

The tests:

- Pretest: Pretest A (in the Preliminary Study): one of the instructors informed the author that the test was very easy for the students in eighth grade. So the author solved the problem by providing another pretest: Pretest B.
- Qualitative test (question): Qualitative test # 1 required the students to write the answer in Thai language. The instructor told the author that it is very difficult for deaf students to write the sentence in Thai. However, she was prepared to try. The author was also concerned about the result of qualitative test # 1 but later on noticed that the students could answer the questions very well. They understood the question and could write in Thai sentences. For the qualitative test # 2, the students were asked to draw pictures that match their feelings instead of writing long sentences.

Furthermore, the software used in teaching had to meet standard for *good learnability* and *ease of use*. Therefore Nielsen's usability testing [11] and Shneiderman's rules for designing the user interface [12] were applied in developing and testing the interactive multimedia learning program *Life: Bone Numbing!*

To test the usability of this program *Life: Bone Numbing!* a questionnaire was developed and given to ten computer science students who had taken a CS100 (Computer Science 100) class. The author was not able to carry out usability testing with the end-users in Thailand. Therefore she developed a questionnaire that would enable computer users to perform heuristic evaluation which based on Nielsen's usability testing and the Questionnaire for user interaction satisfaction (QUIS) (in Shneiderman's designing the user interface). The author did not apply all of the QUIS into the

usability questionnaire because the omitted items were related to website design and videoconferencing. The software *Life: Bone Numbing!* was a CD-ROM format and was designed for special needs students in Thailand.

After fixing all of the problems and errors, the *Life: Bone Numbing!* was suitable to use in an actual experiment.

4 Initial Test Results

Figure 1 illustrates a comparison of the mean performance of the study groups on Pretest A, Pretest B, and Posttest

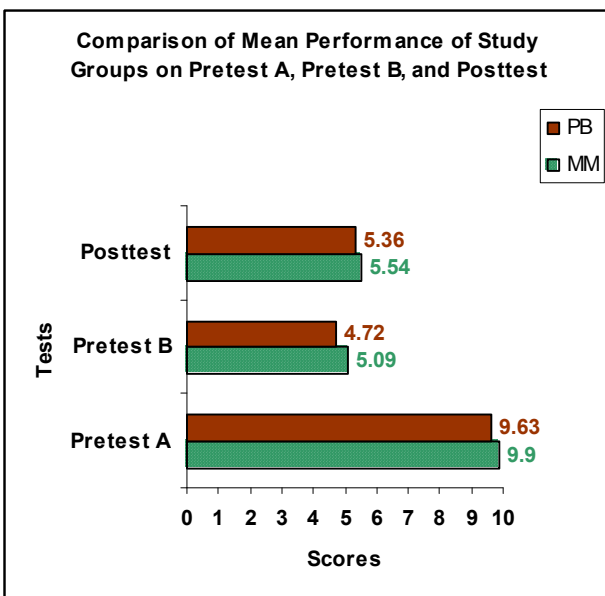


Fig.1 Pretest A, Pretest B, and Posttest

The results from Preliminary study indicated that:

- The average score of the multimedia learning group was 5.54 for the posttest up from 5.09. Therefore the improvement in learning was 0.45.
- The average score of the print-based method group was 5.36 for the posttest up from 4.72. Therefore the improvement in learning was 0.64.
- There was only a 0.19 mark difference between the two groups.

5 Conclusion

Since the multimedia technology is new to deaf students in Thailand, the author expects that the students who learn by the multimedia system will

gain their scores at least as good as the student in print-based method.

Therefore from the Preliminary study evidence indicated that:

- The multimedia system *Life: Bone Numbing!* enhances deaf students in their learning.
- The score from the students in multimedia learning group is as good as the score from the students in print-based method group (taught by teacher).

Finally, in order to confirm the findings from the Preliminary study, future studies will be conducted and to investigate multimedia suitability in more detail.

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