E-LEARNING ENVIRONMENT FOR HEARING IMPAIRED STUDENTS

Hisyamuddin HASHIM (hisyamuddinhashim@yahoo.com)
Zaidatun TASIR (p-zaida@utm.my)
Siti Khadijah MOHAMAD (dieja_80s@yahoo.com)

Faculty of Education, Universiti Teknologi Malaysia, Malaysia

ABSTRACT
The usage of technology within the educational department has become more vital by each year passing. One of the most popular technological approaches used is the e-learning environment. The usage of e-learning environment in education involves a wide range of types of students, and this includes the hearing impaired ones. Some adjustment or enhancement needs to be implemented within the e-learning environment, based on the needs or the adaptability of the hearing impaired students accordingly. This paper reviews some of the past researches on the usage of the e-learning environment for hearing impaired students for the past decade or so.

INTRODUCTION

There are a lot of disabled individuals who have the right to get the best education as they can get, just like their normal peers. Hearing impaired (HI) individuals are among those of people with disabilities that deserve the same rights. Hearing impaired individuals, particularly hearing impaired students, usually acquire the same level of mental capability as the normal hearing students in terms of studying. The term *'deaf and dumb'* is not practically to be used since the hearing impaired students are only lacking of their hearing capability not their intelligence level (Schwartz, 2002). Therefore, they will be undertaking the same subjects or courses in any education departments or institutions as those taught to the normal hearing students of the same age. However, a problem could occur for the hearing impaired students if the technique used by the teachers or instructors in teaching them is as the same used for normal hearing students. Thus, the usage of technology is vital in preparing the HI students with appropriate learning environment, since by using technology, the HI students could access sound in their own suitable way (Berndsen & Luckner, 2010).

E-learning environment is one of the most used techniques for educational purpose and this includes the education for HI students. However, most e-learning environment available does not particularly can be useful to those students due to its feature which is lacking in terms of adaptability. They often encounter problem in accessing the information available in terms of understanding it and using it in a proper manner (Fichten, Ferraro, Asuncion, Chwojka, Nguyen, Klomp & Wolforth, 2009). Therefore, in order to assist these HI students in accessing the information adequately, the e-learning environment needs to be developed and designed according to the needs of the HI students by adding or enhancing some features within the e-learning environment.

DISCUSSION ON SELECTED PAPERS

In this section, we present the review of past researches on the usage of the e-learning environment for hearing impaired students starting from the year 2005 until the year of 2012. Table 1 below shows the list of the studies related to the issue concerned. We begin the review with the brief explanation on the each study, followed by the approaches, limitations and also some valuable directions for future studies.

Table 1: List of studies on the hearing impaired e-learning environment

Author(s)	Year	Participants	Contents	Approach Techniques
Drigas, A.S., Kouremenos, D.	2005	Deaf adults	E-commerce and Technologies of Internet	Virtual classroom, Animation, Video streaming (sign language) and conference, Chat rooms
Straetz, K., Kaibel, A., Raithel, V., Specht, M., Grote, K., Kramer, F.	2005	Deaf adults	Mathematics and Reading / Writing	Video streaming (sign language) and conference, Chat rooms, Enhanced visualization, Template Block
Bueno, F.J., Fernandez	2007	10 profound prelingual	Basic Computing	Knowledge database,

del Castillo, J.R., Garcia, S., Borrego, R.		deafness, 1 severe prelingual deafness, 1 HOH (all secondary school level)		Text adaptation, Image, Video streaming (sign language)
Ng, C.K., Liew, Y.T., Saripan, M.I., Abas, A.F.	2007	Blind and deaf students	General Education	Video conference, Voice-to-text
Khwaldeh, S., Matar, N., Hunaiti, Z.	2007	Deaf students	Mathematics	Virtual classroom, Video conference, Image, Subtitles, Chat rooms
Al-Osaimi, A., Alfedaghi, H., Alsumait, A.	2009	42 deaf and HOH students	Kids' Education	Enhanced user interface
Al-Bayati, M.A., Hussein, K.Q.	2009	HI students	General Science Topic	Video streaming (sign language and finger spelling), Image
Nasr, M.M.	2010	Deaf / HOH students	Chinese Sign Language	Virtual classroom, Interactive and social tools, Video conference, Chat rooms
Hastie, M., Dornan, D., Chen, N.S., Smith, R.	2011	HI children fitted with hearing technology	Language (listening and speaking)	Auditory-Verbal Therapy (A-VTs)
Debevc, M., Stjepanovic, Z., Holzinger, A.	2012	22 deaf and HOH people	Computer Literacy	Video streaming (sign language and subtitles), Animations

Brief explanations of each study

Generally, all the studies stated in Table 1 cover a wide range of educations or subjects taught for different types of hearing impaired students and how the approaches used to design the e-learning platform changed according to the needs, usability and adaptability of these special students. The study conducted by Drigas and Kouremenos (2005), concerned about a learning management system (LMS) which offered the Greek Sign Language videos for each text block in the learning environment. The system satisfied the deaf learners' needs by providing the bilingual information (text and sign language), high level of visualization and learning with peers through the video conferencing. Straetz, Kaibel, Raithel, Specht, Grote and Kramer (2005) implemented the same approaches as in Drigas and Kouremonous's (2005) study, plus the use of content template in order to convey the knowledge efficiently to the deaf students. An intensive research on e-learning content adaptation for deaf students has been studied by Bueno, Fernandez del Castillo, Garcia and Borrego (2007). The problems faced by deaf students when reading text are compiled and tested with several recommendations to adapt text in an e-learning Computing course which eventually showed a promising result on the level of understanding among those students.

Ng, Liew, Saripan and Abas (2007) have come out with friendly flexi e-learning system which enables both blind and deaf students to study together with the normal ones to support the "Education for All" objective. The system can assist the bidirectional communications among different kinds of students. Furthermore, there is also a research in Jordan where, this is the first time the centralized e-learning system for deaf ever implemented in that country and it focusing on how the ICT technologies can assists in bringing the interactivity to the deaf classroom (Khwaldeh, Matar & Hunaiti, 2007). Next, Al-Osaimi, AlFedaghi and Alsumait (2009) reported on some guidelines in designing e-learning programs for deaf children aged between seven to thirteen years old, which based on deaf children and their teachers' feedbacks. There is a need for these guidelines since the existing e-learning programs were not age-appropriate and cause difficulties for children to interact with.

Instead of focusing on the e-learning tools alone, Al-Bayati and Hussein (2009) have studied about the impact of e-learning modules of tutorial lessons for HI students towards their motivation in learning the subject. Seven experimental tutorial e-lessons were developed and tested which resulting in some positive outcomes towards enhancing HI students' motivation. Study done by Nasr (2010) revolved around enhancing the e-learning environment for deaf and HOH pupils by steering many learning facilities like interactive and social set of tools. The proposed paradigm is hoped to increase the usability and interactivity within virtual learning environment

for disabled users. Hastie, Dornan, Chen and Smith (2011) have taken the technology a step further by inventing an e-learning system which able to train children with cochlear implant to listen and speak, which in the end can lessen the role of trained and accrediated Auditory-Verbal Therapist (A-VT) in teaching those children. Last but not least, Debevc, Stjepanovic and Holzinger (2012) have developed an adapted e-learning environment for people with disabilities. The usability and pedagogical effectiveness of the e-learning course are evaluated using a Software Usability Measurement Inventory and Adapted Pedagogical Index method.

Approaches

The needs, usability, and adaptability always take presidency every time a researcher wants to develop an appropriate e-learning platform for HI students to learn efficiently. The technologies and techniques used must in line with these three aspects and among the popular approaches used in all ten studies mentioned above are video streaming, chat rooms, video conference, text adaptation, and interactive and social tools.

The video streaming application is the core medium for knowledge transfer to happen, mainly by using the sign language. Hence, several specifications like the resolution, frame format, file format, and frame bit rate must be taken into account in ensuring the quality of the sign language video presented to the HI students are clear enough to be recognized by them (Khwaldeh et al., 2007). The accessibility of e-learning also found to be increased when spoken text and other sound information are presented together inside the video. Besides its potential in improving the reading skills among deaf students, it will also enable them to learn independently (Debevc et al., 2012).

An integrated communication component consisting of chat and video conference enables the HI students to communicate and involve in the collaborative task (Drigas & Kouremenos, 2005; Straetz et. al.; 2005). This is the medium where HI students can clarify their ideas and share information (Khwaldeh et al., 2007). The interface of the e-learning environment itself plays a vital role in shaping the contents to be easily understood by the HI students. A familiar and interactive yet effective interface of the e-learning environment could boost up the learning experience of the HI students hence their performance (Al-Osaimi et al., 2009). Straetz et al. (2005) used a designed templates block for different parts of each page included in their developed e-learning environment. The parts of the page are for example the header or the content layout. The template blocks used are fixed throughout the e-learning environment so that the users will be familiar with the environment

A knowledge database system is an approach proposed by Bueno et al. (2007) in their e-learning. Knowledge database can be described as a dictionary mainly focusing on translating any difficult terms to be understood by the HI students to the easier form to be understood by them. Finally, a rather unorthodox approach used by Hastie et al. (2011) by using an A-VT to be cooperated within an e-learning environment was found to be worked out well especially in terms of helping children who used to have knowledge of language they used to use during their lives before the loss of their hearing.

Limitations

There are several limitations allocated in terms of the usage of e-learning environment for HI students. First of all, it involves the teachers or instructors knowledge regarding the e-learning technology itself. During these modern times, most of them are probably adequate with the knowledge however there are several groups who might not acquire this kind of knowledge. Secondly, in terms of the necessary infrastructure needed in making sure the usage of e-learning environment for HI students to be succeeded as certain schools or institutions might not be enriched with the infrastructure needed in developing the e-learning environment. Finally, in terms of the users itself, the HI students would probably find it difficult to cope with a new learning environment since they are very used to the usage of conventional classroom learning environment. They will have to be taught first on how to use technology generally in their daily learning activities so that it can be effective.

Future Directions

The implementation of e-learning within the HI learning environment is hopefully to be broaden up by years not only in terms of the technology itself but also in terms of the awareness level of how this approach could be very effective and useful to the HI students generally. E-learning designers should be aware of the existence of the users with hearing impairment and will try to develop an e-learning environment which will be effective to both normal hearing users and hearing impaired users. Finally, the usage of technology for HI students in terms of learning should be widen up not only by using an e-learning environment but also other available technology that is seemed appropriate to be used according to their disability.

CONCLUSIONS

The usage of technology should be capitalized especially for educational purposes, not only for normal students but for the disabled students as well, particularly the HI students. Their difficulties in using the conventional learning method should be taken as an opportunity for the e-learning developers and researchers in helping them by creating a learning environment that could help them in a variety ways. The development of any e-learning environment should help them in boosting their motivation level and at the same time enhancing their performance in learning any subjects or courses available in schools or learning institutions.

ACKNOWLEDGEMENT

The authors would like to thank the Universiti Teknologi Malaysia (UTM) and Ministry of Education (MoE) Malaysia for their support in making this project possible. This work was supported by the Research University Grant [R.J130000.7810.4L093] initiated by UTM and MoE.

REFERENCES

Al-Bayati, M. A., & Hussein, K. Q. (2009). Effects of tutorial e-lessons for hearing impaired persons on motivation towards learning (general science topic as case study). *European Journal of Scientific Research*, 38(2), 189-198.

Al-Osaimi, A., AlFedaghi, H., & Alsumait, A. (2009). User interface requirements for e-learning program designed for deaf children. *Proceedings of the first Kuwait conference on e-Services and e-Systems* (p.7), ACM.

Berndsen, M., & Luckner, J. (2010). Supporting students who are deaf or hard of hearing in general education classrooms: A Washington state case study. *Communication Disorders Quarterly*, 33(2), 111-118. doi:10.1177/1525740110384398

Bueno, F. J., Fernández del Castillo, J. R., Garcia, S., & Borrego, R. (2007). E-learning content adaptation for deaf students. *ACM SIGCSE Bulletin* , 39(3), (pp. 271-275), ACM.

Debevc, M., Stjepanovič, Z., & Holzinger, A. (2012). Development and evaluation of an e-learning course for deaf and hard of hearing based on the advanced Adapted Pedagogical Index method. *Interactive Learning Environments*, 1-16.

Drigas, A. S., & Kouremenos, D. (2005). An e-learning management system for the deaf people. *WSEAS Transactions on Advances in Engineering Education*, 1(2), 20-24.

Fichten, C. S., Ferraro, V., Asuncion, J. V., Chwojka, C., Nguyen, M. N., Klomp, R., & Wolforth, J. (2009). Disabilities and e-Learning problems and solutions: An exploratory study. *Educational Technology and Society*, 12(4), 241-256.

Hastie, M., Dornan, D., Chen, N. S., & Smith, R. (2011). An Australasian e-Learning solution to overcome the global pandemic that is paediatric hearing loss. Retrieved from http://iclll2011.oum.edu.my/extfiles/pdf/AnAustralasianE-LearningSolutionToOvercomeTheGlobalPandemicThatIsPaediatricHearingLoss.pdf.

Khwaldeh, S., Matar, N., & Hunaiti, Z. (2007). Interactivity in deaf classroom using centralised E-learning system in Jordan. *PGNet*, ISBN, 1-9025.

Nasr, M. (2010). An enhanced e-learning environment for Deaf/HOH pupils. *2nd International Conference on Computer Technology and Development (ICCTD)* (pp. 724-727). IEEE.

Ng, C.K, Liew, Y. T., Saripan, M. I., & Abas, A. F. (2007). Education for all: disabled friendly Flexi e-learning system. *Proceedings of AEESEAP regional symposium on engineering education* (pp. 120-124).

Schwartz, M. (2002). Disability Studies for Teachers: Terminology Used to Refer to Deaf Students. Centre of Human Policy. Syracuse University

Straetz, K., Kaibel, A., Raithel, V., Specht, M., Grote, K., & Kramer, F. (2005). An e-learning environment for deaf adults. *Conference proceedings 8th ERCIM workshop*.