

The E-Learning Platform for Pronunciation Training for the Hearing-Impaired

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Abstract

This paper introduces background, main contents and knowledge structure of hearing impaired student's tutorials in pronunciation practice. Its professional cites benefits for hearing impaired students that increase the opportunity to prepare themselves for greater ability and competition in a globalization. The objective of this research was to study the effects of interactive multimedia tutorials for hearing impaired students in pronunciation practice. The sample groups were 36 hearing impaired students studying in 9th grades at Satsatian School, the government's school that provides education for hearing impaired students, and divided into two groups, a controlled and experimental groups. The tutorial activities were divided two educational practice modes, the Animation Tutorial Activity mode and the Game Tutorial Activity mode. Each group of students was assigned to only one mode, and the learning outcomes of each mode were compared using the pre-test and post-test scores. Based on the one-way ANOVA method, it appeared that both group were favorable progress in learning. However, students in the Animation Activity modes showed more improvement in their emergent pronunciation levels than did in the Game Activity mode. Implications for future research and for education are discussed.

Keywords: Multimedia tutorials, Pronunciation practice, hearing impaired student.

1. Introduction

Speech communication by hearing impaired individuals suffers not only from the fact that they cannot hear other people's utterances, but also from the poor quality of their own productivity. The hearing impaired people need a special education in order to bring them in getting communication capabilities according to their rights to access education, facilities, and technology [1]. There are many studies showed that hearing impaired people in US and EU had appropriate experiences and skills because they had offered chances to access education and facilities. In evidently, these people can be educated in one of the most rigorous academic disciplines, but also one of the most financially rewarding careers such as architecture, scientist and engineer, so they can live independent and take responsibility of their family [2].

Hearing impaired people in Thailand should have those opportunities. This will be benefit for not only themselves but also their families. Unfortunately, in current circumstances, hearing impaired people in Thailand are ignored and cannot access to technology and facilities [3]. Due to the lack of adequate auditory feedback, the hearing impaired speakers produce speech with segmental and surpassed mental errors then they usually have some amount of difficulty in uttering words. Students' pronunciation practice is really needed for them to perform reasonably effective verbal communication. To learn how to utter a sound, most hearing impaired people use visual cues to understand of what is saying. With the methods named Lip-reading or Speaking-reading techniques,

hearing impaired people do not only follow the lip movements, they also take attention to the face and body cues. They benefit from this information to understand the message came from other people. Traditionally, such practice needs to be done on one-to-one and face-to-face bases, especially for children. Nowadays, there are some computer programs facilitating this type of practice but they are generally not well-matched with the phonemes of Thai language [4]. Therefore, this research aims to describe the concept of a computer-based instruction that can help hearing impaired students to learn and practice Thai words more correctly.

Today, the education technology is an impotent tool to develop innovation. Many researchers rethink the way to develop innovation for learner. Multimedia tutorials are one of the important things that create a variety of ways to deliver and provide electronic resources for learners. For example, there is a use of multimedia system to deliver text, video and animation to learners. Thus, the multimedia tutorials are professionals cite benefits to learner. Learners can benefit from the opportunity to increase their competition in globalization. The multimedia tutorials typically called Computer Assisted Instruction, CAI, also have advocates in world wide. Hearing impaired students can use tutorials to develop their skills and understanding [5] which will improve their performance in the classroom and daily life. Moreover, a big advantage of multimedia tutorials is that they also support the delivery and use of multimedia elements, such as sound, video, and interactive hypermedia [6]. Nowadays, the multimedia tutorials can provide the flexibility and convenience for their users. It can eliminate some traditional barriers such as time and place. Learners can access materials independently [7]. The multimedia tutorials do not require extensive computer skills, although familiarity with computers and software does help to reduce the intimidation factor [8]. However, tutorials focus on the basic ideas of courseware designs and developments, such as the elements of teaching system, system architecture, multimedia and interactive elements. It was not only decrease problems associated with the lack of education media of hearing impaired students for school general courses but also increase an alternative way to supplement instructors' teaching program.

Hearing impaired students in the present situation have access to numerous types of software developed by commercial or educational designers. One of t software is electronic tutorials. Regarding the insufficiency of success in reading and writing skills of the hearing impaired people, educators and researchers realize that information and communication technologies attract attention for supporting hearing impaired students' literacy and pronunciation development. Parallel to the developments realized in the informatics technologies, computer-aided educational systems are also attractive for the education of hearing impaired people. Yet, the extant portion of research on the efficiency of tutorials as a support for pronunciation development is neither consistent nor satisfactory. When consideration on the efficiency reported of an available electronic tutorial, the great potential of software is the first priority to be concerned. Then in this research we focus and develop an educational electronic tutorial to support hearing impaired students' emergent pronunciation development.

There are research evidences that hearing impaired students' pronunciation knowledge starts in the early school years and the gap between normal and hearing impaired students' pronunciation makes this be an important focal issue for educators and researchers. Defective speech and hearing loss frequently lead to so many frustrations in conversation that the student may become withdrawn, isolated or, in some cases, overly aggressive. Sometimes, students defend themselves from embarrassment and humiliation by talking uninterruptedly in order to avoid difficult questions. Some investigators have, on the other hand, studied the behaviors and attitudes of the hearing toward the hearing impaired as seen by people with impaired hearing. The investigators have pointed out that the hearing impaired may exaggerate or misinterpret the behavior of people with normal hearing that innocuous and situation. Nevertheless, the research's evidences also support

that all of the troubles can be managed when the hearing impaired students can access the appropriate facilities and supported tools.

Our purpose in the current study was to examine whether the computerized educational tutorials we developed can serve as a supporting tool in developing hearing impaired students' emergent literacy. In addition, we were interested in studying the degree of improvement in hearing impaired students' pronunciation levels after the use of these tutorials.

2. Related Work

Human speech production mechanism relies on the placement as well as the movement of many organs in the vocal tract. These speech production-related organs are called articulators. Major articulators associated with the production of Thai speech include the tongue, the soft palate, the hard palate, the jaw, the teeth and the lips. These articulators are placed and moved according to the sounds the speaker wants to produce. The position of these articulators manipulates the airflow supplied from the lungs so that the manipulated airflow sounds as desired when coming out of the lip opening [4].

Apart from pronunciation practice, efforts have been spent in research and development of computer programs aimed to help hearing impaired and hard-of-hearing individuals learn how to utter sounds in different languages. Chaisanit *et al.* [9] reported that a computer base tutor for the hearing impaired students auditory and speech training system was illustrated both internal and external articulators as well as their physiology and speech recognition. The program has three modules consist of: speech recognition, animation, and self-assessment. Soleymani *et al.* [10] accomplished a trainer of English pronunciations for hearing-impaired children, called Speech Illumina Mentor (SIM). This program presented the English pronunciation speech training in the form of computer games. Witsawakiti *et al.* [4] described the concept of an e-training tool that helps hard-of-hearing children learn and practice to utter simple Thai words more correctly. This concept emphasized on the use of technologies, such as speech recognition and computer animation, to eliminate limitations of the traditional therapist-based speech training on three aspects: Teaching, Training, and Tracking. Chaisanit *et al.* [7] presented a Learning Management System (LMS) which offered Thai Sign Language videos in correspondence to every text in the learning environment. The system was designed notably for hearing impaired adults for the purpose of their lifelong vocational and educational training. Jiang *et al.* [11] developed a program called STODE (Speech Training for Oral Hearing impaired Education) which aimed to reduce the intonation confusion and pronunciation timing errors in Mandarin. Bälter *et al.* [12] reported a speech training aid utilized 3D computer animation called ARTUR that was developed in Swedish language. Massaro [13] showed the research's result of English pronunciation learning computer program called BALDI, in which a 3D model of a human head was used to demonstrate an appropriate locations of articulators associated with each pronunciation to be uttered. Kirschning *et al.* [14] developed a tool called ICATIANI applied the BALDI engine for the training of five Mexican Spanish pronunciations.

3. The Present Study

In the research, we examined another way of reading to hearing impaired students the tutorial, and investigate the extent in which the educational tutorials can use to support hearing impaired students' pronunciation practice. It should be noted that we do not view the emergence of the tutorial in the hearing impaired students' world as diminishing an importance of adults reading to children, an activity which we, as researchers and educators, focused on was a paramount cognitive and emotional event. Nevertheless, we believed it was warranted to examine how and whether such software, whose operation usually arouses motivation and curiosity and which can be operated by the student

themselves independently, can provide additional literacy support to young student. Therefore, going beyond its potential for being amusing and enjoyable, the question that needs to be asked is whether pronunciation practice tutorial software, if developed specifically for use by hearing impaired, can contribute to their pronunciation development or not.

4. The Approach

4.1. Method

This study compared instruction in pronunciation skills delivered by interactive tutorial with “Content with animation” mode and interactive tutorial with “Content with game” mode and increase the accuracy of the test statistics, negative control group (the student in regular program of the hearing impaired school) in every task of experiment is used. The interactive tutorial consisted of a multimedia tutorial developed by the researcher. This program used a game format to develop the following pronunciation skills: (a) movements of both internal and external articulators, (b) movement of lips and mandible's front view articulators and (c) actual sound and waveform.

Pronunciation practices were measured by 25 items of pronunciation skills developed by the researcher with an internal consistency alpha of .95. This scale assesses cognitive, attitudinal, and behavioral changes in the three pronunciation skills.

The experiment design used the effectiveness educational practice program as research tools, and adopted the design of pretest and posttest to collect data and make statistical analysis. Participants consisted of undergraduate students enrolled in pronunciation practices courses. The control group (n=36) includes all students enrolled in a pronunciation practice. The two educational practice program groups consisted of all students enrolled in two sections of the course in interpersonal and group processes. Students from all courses were first asked in the experience of computer used. Since most students (95%) in all sections of the courses had some computer literacy, students from the interpersonal and groups processes course were randomly divided into the content with animation (n=18) and the Content with game practice group (n=18). The pretest was quizzed on the first day classes and the posttest was quizzed on five days after the educational practice program.

4.2. The Interactive Multimedia Tutorials for Hearing Impaired Students in Pronunciation Practice

Interactive multimedia tutorials in pronunciation practice make for visual assistant method for supported learning and developing the speech ability of hearing impaired students. Researcher used the technique of dynamic computer graphics to establish an animation display system. The system can display the relation among the basic element of the articulators. The position and the change of nose chamber, mouth chamber, tongue, pharynx, velum and lip during a speech will be shown from different profiles. These can confirmed that the subject with hearing impaired students can catch up with the accurate speech technique [17]. This tutorials was developed based on the Participatory Integrated Design Process (PIDP) [15] consists of four design phases: needs analysis, conceptual design, development, and formative evaluation. Each of those phases has its own design processes. These corroborate that the subject with hearing impaired students understand the accurate speech technique and can be utilized the pronunciation skills: (a) movements of both internal and external articulators and (b) movement of lips and mandible's front view articulators, and (c) actual sound and waveform.

4.3. Main Functions of Interactive Multimedia Tutorials

The introductory screen of tutorial looks just looks like a game. The different options for the activation of the story are explained by an animated figure, that of internal and external articulators. The tutorial offered two modes or options: “Content with animation” and “Content with game”. It is important to note, as mentioned earlier, that all activities offered in the “Content with game” mode were presented only after the learner had completed reading the content on each page. Each tutorial mode contains an oral reading of the content by a learner who reads the story. Also included were automatic dynamic visuals shows those movements of internal and external articulators, movement of lips and mandible's front view articulators, and actual sound and waveform. In addition, an overview screen is available to show all optional screens in reduced format and each screen is numbered. This enables the users to choose the screen they would like to re-read/re-listen to. These functions may contribute significantly to a tutorial orientation, as well as to their concepts of print and emergent reading knowledge, all of which have been reported as important for children during early literacy development [18-19].

The “Content with animation” mode contains an oral reading of the printed text and animation by the actor together with automatic dynamic visuals that content scenes as well as extra animation and effects. This mode was aimed at enhancing hearing impaired student’s to understand the movement of pronunciation and their phonological awareness. It includes interactive functions that allow the children to activate the tutorial by clicking on hotspots. As see in Figure 1.

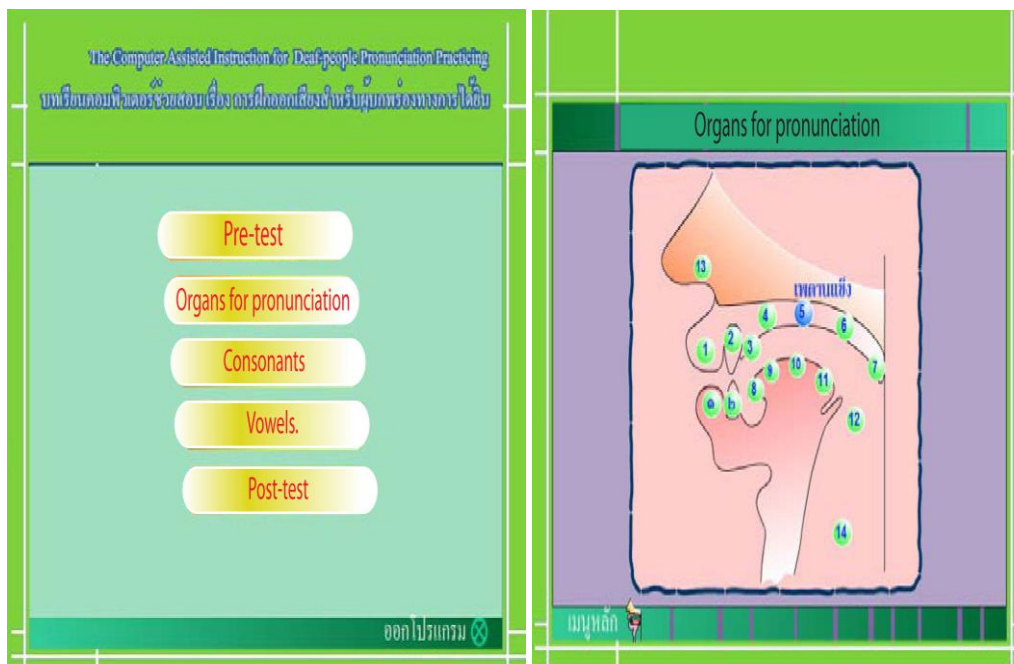


Figure 1. Main Menu and Organ Vote Chapter of the Tutorial

In addition the Content module display animation and demonstrated movements of both internal and external articulators. The former will display and demonstrate animation of the normally hidden structures such as tongue, palate, pharynx, velum animation and the anterior view of lips and mandible. The latter will display and demonstrate the movement of front view of learner’s lips and mandible like a webcam captured this movement and display on the screen continuity as see Figure 2.

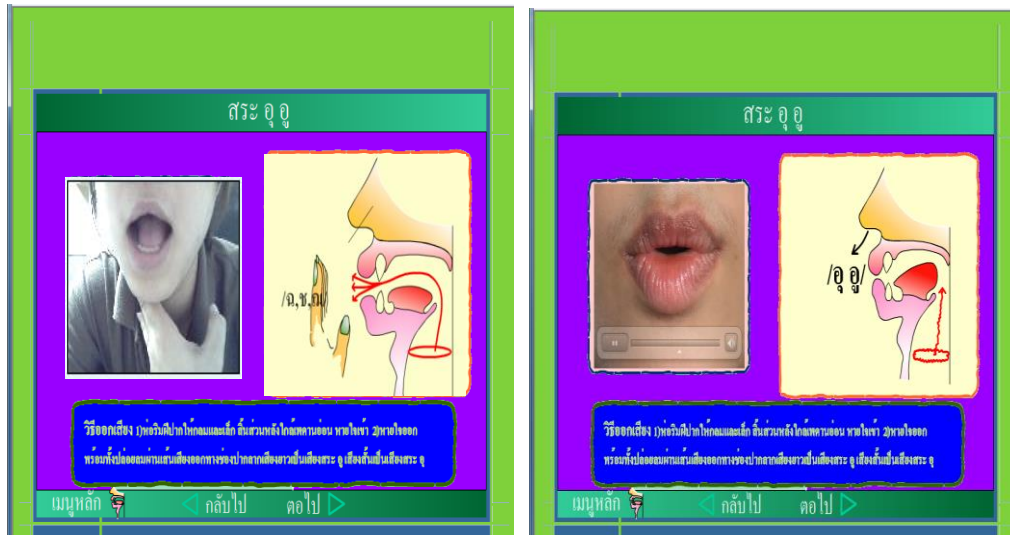


Figure 2. Content of the Tutorial for the Hearing Impaired Students' Pronunciation Practice

Although there was some similar context between the two educational practice program, and the tutorial option activity more obviously appear in 'Content with animation' than 'Content with animation' modes of practice program. In the other hand, the game activity of this tutorial such as memory game matching game and card game was only appeared in 'Content with game' mode of practice program.

The "Content with game" mode was aimed at enhancing learner understanding and their phonological awareness. It includes interactive functions that allow the learner to activate the game by clicking on hidden hotspots as they appear on characters or objects. However, as question in pretest and posttest, the tutorial provide question like a game. It includes interactive functions like a wizard as appear on tutorial such as replacement functions (Change the question) Cutting options (Choice cut), this function was programmed so that the wizard could be activated only after reading/listening to the question on each page.

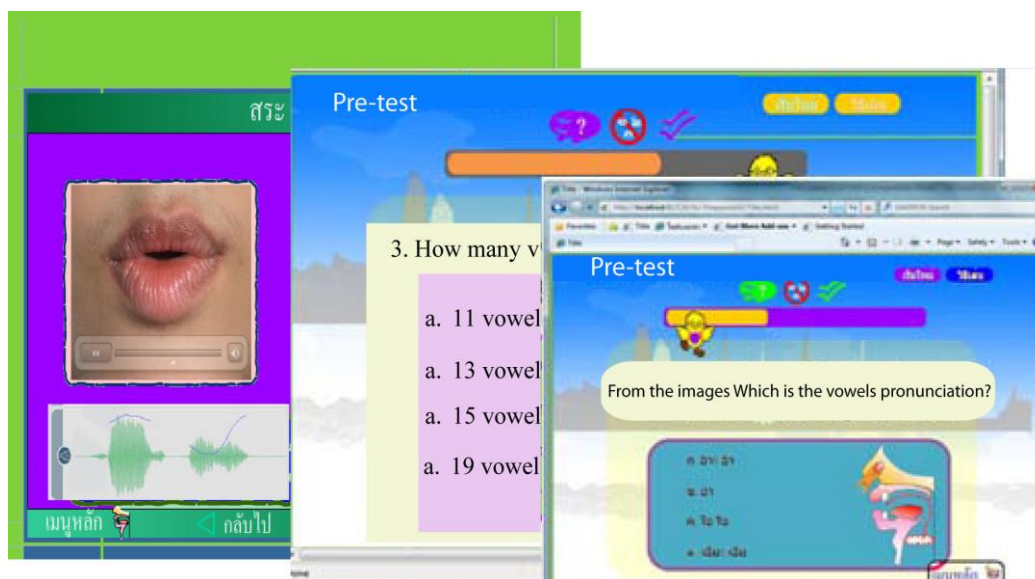


Figure 3. "Content with game" Mode

5. Experimental Results

The purpose of this research was to study the effects of interactive multimedia tutorials for hearing impaired students in pronunciation practice. The sample groups of this study consisted of 36 hearing impaired students. The effects of an interactive multimedia tutorial on hearing impaired student's tutorials in pronunciation practices were divided in two groups. In each group students were randomly assigned work individually in one of two tutorial activity modes: "Content with animation" or "Content with game". Based on the result of the pre-test and post-test scores using the One-Way ANOVA method, there appeared to be favorable progress in learning of this course for both group.. One-Way ANOVA on the differences between the pre and post-tests showed a significant relationship between both tutorials interventions and the difference in pronunciation score $F(2, 106) = 0.04, p < 0.05$ as shown in Table 1.

Table 1. One-way ANOVA on pronunciation Scores between Pre and Post-Tests for tutorial "Content with animation", "Content with game" mode and Control Groups

Source of Variance	D.F	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	2	245.1157	122.5578	3.2918	.0423*
Within Groups	79	2941.2868	37.2315		
Total	81	3186.4024			

* $p < .05$

Table 2 showed the differences of overall mean and standard deviations between the pre and post-tests for all groups on the pronunciation scale. The differences mean between the 'Content with animation' and 'Content with game' modes of practice program represent positive changes in pronunciation skill scores. A pst hoc calculation of the least significant difference (LSD) Procedure showed a significant level of 4.31, $p < 0.05$, with significant differences between the pre and post tests for the "Content with animation" and "Content with game" mode and showed no significant difference for the control group. Additionally, there was no significant difference between the groups of "Content with animation" and "Content with game" mode of practice programs.

Table 2. Least Significant Difference Post Hoc Analysis of Social Behavioral Scale Difference Scores for Computer-Assisted Instruction, Face-to-Face Instruction and Control Groups

Group	Pretest-Posttest Mean Difference Score	Standard Deviation
'Content with animation' mode	2.44*	5.86
'Content with game' mode	2.94*	7.65
Control	-0.8108	5.41

*significantly different from control group at $p < .05$

Form table 3 show that the statistic result of the interactive multimedia tutorials for hearing impaired students in pronunciation practice. The data were collected by using questionnaires to observe the satisfaction of learning environment. Research methods were applied to collect quantitative data using questionnaires. The data were analyzed using basic statistical tools, frequency, mean (X), and standard deviation (SD). The levels of student' satisfaction was determined as 4.51 – 5.00 means definitely agree, 3.51 – 4.50

means strongly agree, 2.51 – 3.50 means quite agree, 1.51 – 2.50 means quite disagree and 1.00 – 1.50 means strongly disagree.

Table 3. The Satisfaction of the Interactive Multimedia Tutorials for Hearing Impaired Students in Pronunciation Practice

Topics	\bar{x}	<i>S.D.</i>
1. Course content	4.58	0.54
2. Course presentation	4.53	0.55
3. Tutorials Motivation	4.53	0.54
Overall satisfaction	4.55	0.54

Form table 3, the overall satisfaction of the tutorials was also conducted to identify a way of evaluating the quality of students. The level of satisfaction was determined through three categories: Course content, Course presentation and tutorials motivation. These showed the means results at 4.58 ($SD = 0.54$), 4.53 ($SD = 0.55$), and 4.53 ($SD = 0.54$). The overall tutorials' quality was estimated as very good, and the degree of clarity of system was rated higher than target levels.

5. Conclusion and Discussion

The results of this study showed a high level of efficacy support of the interactive multimedia tutorials for hearing impaired students in pronunciation practice. Both 'Content with game' and 'Content with animation' practice programs presented an excellent efficiency to supported pronunciation skills of hearing impaired students. When compare between groups, the 'Content with game' showed significantly more effective than 'Content with animation' practice programs.

The benefits of utilizing tutorial for training in pronunciation skills are numerous. One benefit is the standardized property of computers, which eliminates instructor characteristics (teaching style, personality, etc.), as an intervening variable in the efficacy of instruction. In addition, less dependence on face-to-face instruction (e.g. scheduling a time and place for a class) allows for greater access to social skills instruction through tutorial. Accessibility is further enhanced by the cost effectiveness inherent in utilizing computers in place of teachers where appropriate. The cost of specialized training for teachers alone is substantial.

Another positive aspect of pronunciation skills training through tutorial is the integration of a problem-solving dimension throughout the program. The structure of the interactive exercises is such that a number of game based learning techniques are employed. These include connecting experiences with social concepts, prioritizing and planning ahead for compromise, and the ability to see from different perspectives. These skills are not only necessary for the mature development of pronunciation skill; they are also valuable for problem-solving in general.

Yet, there are unique gains that are derived from face-to-face interaction. While the computer may bring with it advantages such as flexibility in scheduling, cost effectiveness, and standardization, it can never replace the intrinsic value of human interaction. Despite the positive implications which flow from this study, it is important to note that the effectiveness of a tutorial intervention may vary for different populations. Effectiveness may vary according to learning style, cultural characteristics, or a medley of other factors. Further studies examining the effectiveness across different groups of people are necessary to validate its effectiveness for populations outside of the school system.

An interactive multimedia tutorial for hearing impaired students in pronunciation practice was an exciting venture into a new use of an already existing medium. Future developments of interactive experiences have the capacity to reach more people in a host

of settings. Variations of a tutorial program such as this can be used as a cost effective method to teach people of all ages to better mediate conflicts with their peers, co-workers or family members. A follow-up study to examine the lasting effects of tutorial of social skills would help to determine the true value of this educational too. Recently, The interactive multimedia tutorials for hearing impaired students in pronunciation practice was becoming a new form of interactive content, worthy of exploration for learning purposes. Universities are also looking for a new positioning in the changing setting of lifelong learning. Universities need to develop innovative forms of learning in order to provide concepts for lifelong learning to their prime customers, students.

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An interactive multimedia tutorial for hearing impaired students in pronunciation practice was an exciting venture into a new use of an already existing medium. Future developments of interactive experiences have the capacity to reach more people in a host of settings. Variations of a tutorial program, such as this work, can be used as a cost effective method to teach people of all ages to better mediate conflicts with their peers, co-workers or family members. A follow-up study to examine the lasting effects of tutorial of social skills would help to determine the true value of this educational too. Recently, The interactive multimedia tutorials for hearing impaired students in pronunciation practice was becoming a new form of interactive content, worthy of exploration for learning purposes. Universities are also looking for a new positioning in the changing setting of lifelong learning. Universities need to develop innovative forms of

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