

## MOBILE APPLICATION TO ENHANCE HEARING IMPAIRED STUDENTS' LEARNING ABILITY

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**Abstract:** Hearing impaired (HI) students typically suffer from learning difficulties at school, due to their inability to hear. The emergence of mobile technological devices has promised HI students with a new way of learning. Mobile devices such as smartphones and tablets have facilitated HI students to experience the world and to access knowledge resources, anytime and anywhere. This study proposes a One Group Pre-test – Post-test research design that aims to determine whether implemented mobile applications enhance the learning ability of HI students at schools. There were a total of seven HI students selected to participate in this experiment. The results of the experiment indicate that HI students demonstrated active participation in learning through mobile application. They demonstrated better scores in post-tests compared to pre-tests. Students' feedback indicated that they desired to use the mobile application in their future learning. The results also showed a significant impact on teachers to develop more innovative mobile applications to enhance HI students' learning abilities.

**Keywords:** Hearing Impaired student, Mobile technology, mobile application.

### INTRODUCTION

Hearing impaired (HI) students typically have learning difficulties at school, mainly due to their inability to hear. One's hearing ability is crucial for one to develop cognitive processes and learning skills in order to comprehend information and knowledge from various resources. In this context, HI students obviously lack of this advantage, and are thus hindered from learning effectively and academic achievement. Consequently, the field of HI students' education is becoming increasingly challenging. Traditionally, teachers of HI students struggle with the issue of lower academic achievement, as well as poor reading and writing skills demonstrated by HI students (Spencer and Marschark, 2010). It is evident that HI students have shown a gap in their learning ability compared to peers who do not suffer from HI.

In Malaysia, teachers of HI students play the important role of interpreters in class. This unique teaching and learning strategy typically involves chalk and "signs". As 21<sup>st</sup> century learning is currently prevalent, the HI students' teachers are able to integrate the use of ICT in their teaching and learning processes, where slide presentations are widely in use. However, it is a necessity that the teaching and learning of HI students needs to be revised in order to improve their learning motivation, and in turn enhance their learning ability overall (Azham et.al, 2014).

Ismaili and Ibrahim (2016) state that HI students need assistive technology to enhance their classroom learning, as well as their learning at home and in the community. Today's world is recognized as the global technology era, where the technology has remarkably improved the quality of life of mankind (Azham et.al, 2014). In the field of education of HI

students, it is believed that the advantages of technology (e.g. mobile technology) is a new way of learning, which provides a new learning experience that would make sense to HI students' learning (Wu and Xu, 2010). According to Wu and Xu (2010), mobile technology offers a real-time problem-solving based mobile learning environment that addresses HI students' learning difficulties.

In conjunction with this, the researcher has developed a mobile learning application to support the HI students in learning science at school. The design of the mobile application is multimedia-based (with the exception of audio). It uses graphics, text and animations to deliver the learning contents to students. This study aims to exploit the advantages of mobile technology uses in HI students' learning, and to investigate the impact of these uses on HI students' learning ability.

### LITERATURE REVIEW

#### Education of Hearing Impaired Students

In Malaysia, the researchers stated that HI students performed at a low level in academic achievement compared to their peers (M Hanafi et .al, 2013). Researchers have also stated that HI students experienced the problem of self-development, which has affected their intellectual development. The delay in self-development and intellectual development are the factors that result in HI students' low level of academic performance at school. According to theorists such as Kegan (1982) and Stern (1985), cognitive/intellectual development and social/environment experiences are the two major forces that affect self-development. Cognitive/intellectual development refers to the ability

to think, learn, process information, solve problems and make decisions; whereas social/environment experiences refer to the ability to interact with sets of people, groups and communities, and one's own thinking and acting. In conclusion, the inability of hearing is significantly reflected by the learning process of an HI student.

In recent years, numerous researchers have focused their attention on HI students' learning styles. Stroble (2012) indicated that HI students use their own adaptive cognitive strategies to compensate for their hearing limitations in learning. The term of adaptive cognitive strategies means that HI students will process their own way to think, perceive and remember information in order to achieve learning. On the other hand, many researchers also mention that HI students are visual learners (Marschark & Hauser, 2012). Due to hearing difficulties, it is certain that HI students learn through their vision rather than by listening. They prefer for information to be presented by graphics, animations, diagrams and simple text, which is easier for them to understand and generate knowledge. However, in traditional classrooms, most lessons are conducted via chalk and "sign", and note talking, which have reduced the effectiveness of learning.

### **Studies on Mobile Application for HI Students**

Mobile applications are widely available for HI students to make their learning and communication easier, along with numerous of sign language interpreters and aid applications (Jones, Hamilton & Petmecky, 2015). Çuhadar et .al (2009) stated that mobile technology offers an opportunity to the HI community to access knowledge instantly, and obtain meaningful learning experiences. They have promoted "IBEM" – a project for utilizing mobile technologies to facilitate the HI community in daily life tasks, as well as in learning functions. Furthermore, Yaman et al. (2015), in their study, emphasize on the design and development of mobile storybook applications for HI children. Their study was focused on fostering HI children's reading comprehension in order to improve their language and literacy skills.

Many researchers have agreed that the HI community needs technology, especially mobile phones, to facilitate them in communication and learning functions (Cuhadar et .al, 2009; Liu, Han & Li, 2010; Parton, Hancock & Dawson, 2010; Chien-Hsiou L et al., 2010; Wu & Xu, 2012; Michella & Claudia, 2014). Previous research has indicated that the demands of mobile applications for HI students have increased. However, mobile applications should fulfil the learning principles of HI students, so that they truly benefit their learning ability.

### **RESEARCH QUESTIONS**

There are two research questions in this study: (i) Does the implementation of mobile applications enhance HI students' learning ability?; (ii) After becoming experienced in mobile application learning environments, do HI students accept and intend to use the mobile applications in future learning?

### **RESEARCH DESIGN**

In this study, a quantitative research design was applied to collect the data. The researcher applied a quasi-experimental design approach, where The One Group Pretest – Posttest ( $O_1 \times O_2$ ) (Campbell, Shadish & Cook, 2002) was used. As mentioned above, the mobile application was implemented to support HI students in learning science at school. The learning content of the mobile application was related to the topic of "Photosynthesis" in Form Two Science. The objective of the learning was to analyse the process of photosynthesis. The participants involved in the experiment were seven HI students (four males and three females) in a class of Form Two at the school of SMK Taman Sutera, Johor, Malaysia. Based on Mid-Year exam results, the selected seven HI students demonstrated low achievement in science. In other words, these students possessed the same level of cognition, and equal abilities, in learning science.

### **Experiment Procedure**

In this study, only one group of seven HI students were gathered as the treatment group. Prior to conducting the experiment, the mobile application was installed on their mobile devices. After the installation of mobile application, the group of students was given an orientation to introduce the mobile application learning environment and the learning tasks. Next, all of these seven HI students went through a pre-test composed of 20 multiple choice questions. The 20-minute pre-test was developed based on their previous science lesson. Later on, the treatment group of seven HI students was instructed to begin their mobile application learning journey for about 30 minutes in class. The treatment group was encouraged to access to their mobile applications after class, anytime, anywhere.

In next section of the science lesson, the treatment group was given a post-test to evaluate their learning outcomes using the mobile application. The post-test paper was also composed of 20 multiple choice questions based on what they had learned in the experiment. The HI students were then given a questionnaire consisting of Likert-type scale items to measure their acceptance and intention of using this mobile application for learning science. The experiment procedure is illustrated in **Figure 1**.

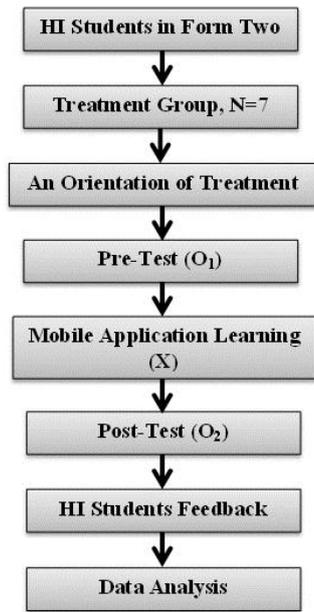


Figure 1: Experiment Procedure

Table 1a: Results of Pretest and Posttest

Students ID	Pretest scores	Posttest scores	Diff
A	4	7	3
B	5	10	5
C	4	5	1
D	3	4	1
E	7	10	3
F	6	8	2
G	8	14	6

Table 1b: Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
Post	8.29	7	3.402	1.286
Pre	5.29	7	1.799	.680

## RESULTS AND ANALYSIS

### Results of Pre-Test and Post-Test

Overall, the results of the pre-test and post-test demonstrate that there is significant difference between the scores obtained with the post-test (M (mean) = 8.29, SD (standard deviation) = 3.402) and the pre-test (M (mean) = 5.29, SD (standard deviation) = 1.799). The results of the pre-test and post-test are shown in **Table 1**. In **Table 1**, both student C and D show increasing of 1 score, whereas student F shows increasing of 2 scores and following, both student A and E show increasing of 3 scores. Meanwhile student B and G show the greatest increasing of scores with 5 scores and 6 scores. The changes in scores indicated overall the HI students' cognition and knowledge has been increased. The results exists strong evidence that the implementd mobile application improved the hearing impaired post-test scores, compared to the pre-test scores.

Meanwhile, HI students' feedback from the questionnaire results also demonstrates that they favoured using the mobile application to learn science. Overall, the mean for the six questions fell between the range of 4.00 and 5.00; indicating that the HI students agreed that the implemented mobile application had facilitated them in learning science. As a summary, the mean values and associated question are listed as follows: Q1: M(mean)=4.00; Q2: M(mean)=4.29; Q3: M(mean)=4.43; Q4: M(mean)=4.29; Q5: M(mean)=4.14 and Q6: M(mean)=4.57. **Table 2** below displays the questionnaire results.

Table 2: Students Feedback/Questionnaire Results

No.	Question/Statement	M (Mean)
1.	I am able to understand my teacher teaching, when I use mobile application.	4.00
2.	I can understand the learning content and I gain the new knowledge.	4.29
3.	I like the presentation in graphics, short texts and animation in mobile application.	4.43
4.	Using mobile application, I found the learning is interesting and learning science is easier.	4.29
5.	I like the mobile application and I repeat my learning after school using mobile application.	4.14
6.	I hope my future learning in whatever subject, I can continue to use mobile application to help my study.	4.57

Note: The Likert-type scale:

Strongly Disagree = 1; Disagree =2; Neither Agree or Disagree = 3; Agree =4; and Strongly Agree = 5.

## CONCLUSION

This study aimed to investigate the advantages of mobile technology as an assistive technology tool in facilitating HI students' learning ability. A quasi-experiment in one group of pre-test and post-test approach was used in this study to investigate the effectiveness of implementing a mobile application to enhance HI students' learning. The experiment had displayed the expected results, and demonstrates that the mobile application indeed offered great help in HI students' learning, particularly in terms of their cognitive processes. The post-test scores demonstrated by the HI students indicated that there is a significant of "change" in their cognitive process through the mobile application. The "change" had enabled them to acquire new knowledge and to obtain better scores in the post-test, compared with the scores of the pre-test. Hence, we can conclude that the mobile application successfully enhanced their learning ability. On the other hand, the feedback by the HI students after the experiment also implicate that the mobile application was acceptable in their learning, and that they would readily apply such an application in their future learning. In conclusion, this study demonstrated a significant impact on teachers to develop more innovative mobile applications to enhance HI students' learning ability.

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