EFFECTS OF PRESENTATION MODES ON THE LEARNING OF SIGN LANGUAGE AMONG HEARING IMPAIRED STUDENTS WITH DIFFERENT COGNITIVE STYLES

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UNIVERSITI SAINS MALAYSIA

2016

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by

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Thesis submitted in fullfillment of the requirements
for the degree of
Doctor of Philosophy

AUGUST 2016

ACKNOWLEDGEMENT

First and foremost, I would like to say thanks to God for blessing me and giving me the strength to undertake this journey. Next I would like to express my deepest gratitude to my supervisor, Professor Dr Fong Soon Fook and his wife for their encouragement, love and support throughout this journey. Without his guidance and advice, I would not be able to continue and complete this work. My tribute also goes to my co-supervisors Dr Aznan Che Ahmad and Dr Mohd Ali Shamsudin for their constant motivation and assistance. I am enormously grateful to Miss Audrey Liew, Miss Rebecca, Mr Edmond, Mr Raymond, Mr and Mrs Ramal for their assistance and support in completing this work.

Special thanks to the Dean, Professor Dr. Hairul Nizam Ismail, the Deputy Dean, Associate Prof. Dr Shaik Abdul Malik Mohamed Ismail, and the administrative staff of the School of Educational Studies, USM for providing facilities, advice and support. Furthermore I would like to thank the headmasters, teachers and students from the special education schools for the hearing impaired for their collaboration. My profound acknowledgement to the Director of the Educational Planning and Research Division, and the Director of the Special Education Department, Ministry of Education Malaysia for their assistance. On top of that I would like to thank the principal, teachers and students of SMK Darul Ridwan for their facilitation and motivation.

Last but not least, I would like to give my heartiest thanks and love to my beloved wife, Thamil Selvi Sabapathy and my children Prasanadevi, Ishveraj, Bhismer, Gauthamen and Shamala for their unconditional love, prayers, continuous inspiration and support throughout all these years that kept me going to complete this wonderful journey. To all my family members and wonderful friends, I sincerely thank you from the depth of my heart for making this dream come true.

TABLE OF CONTENTS

CHAPTER 3 - METHODOLOGY

CHAPTER 4 - DESIGN AND DEVELOPMENT

LIST OF APPENDICES

LIST OF TABLES

LIST OF FIGURES

KESAN MOD PERSEMBAHAN DALAM PEMBELAJARAN BAHASA ISYARAT DALAM KALANGAN PELAJAR BERMASALAH PENDENGARAN PELBAGAI GAYA KOGNITIF

ABSTRAK

Kajian kuantitatif ini menyiasat kesan mod persembahan ke atas pembelajaran bahasa isyarat dalam kalangan 147 orang pelajar bermasalah pendengaran di sekolah rendah pendidikan khas di Malaysia. Suatu reka bentuk faktorial kuasi-eksperimen 2 x 3 dengan ukuran berulang bagi pemboleh ubah moderator dalam reka bentuk praujian-pascaujian kumpulan kawalan tidak setara telah disesuaikan dalam kajian ini. Pemboleh ubah bebas adalah tiga mod perisian koswer iaitu video Bahasa Isyarat, Teks dan Imej (SLTI), video Bahasa Isyarat dan Teks (SLT) dan video Bahasa Isyarat dan Imej (SLI). Pemboleh ubah moderator adalah pelbagai gaya kognitif (FD dan FI). Pemboleh ubah bersandar adalah pencapaian pelajar seperti yang diukur oleh skor pascaujian. Kajian ini terdiri daripada dua bahagian, iaitu pembangunan dan penilaian. Dalam bahagian pertama, 3 mod persembahan direka dan dibangunkan. Dalam bahagian kedua, kajian ini mengkaji kesan tiga mod persembahan bahasa isyarat multimedia ke atas pelajar bermasalah pendengaran pelbagai gaya kognitif. Analisis statistik ANOVA dan ANCOVA telah dijalankan untuk menguji hipotesis dalam kajian ini. Hasil kajian menunjukkan bahawa pelajar bermasalah pendengaran mencapai perbezaan yang signifikan dalam skor pascaujian dalam tiga mod persembahan. Pelajar bermasalah pendengaran yang menggunakan mod persembahan SLTI mencapai markah pascaujian tertinggi. Kajian ini juga menunjukkan bahawa tidak terdapat perbezaan

yang signifikan antara skor pascaujian yang dicapai oleh pelajar bermasalah pendengaran dengan pelbagai gaya kognitif dalam tiga mod persembahan. Ia juga menunjukkan bahawa tidak terdapat kesan interaksi yang signifikan antara kaedah rawatan dan gaya kognitif. Kesimpulannya, kajian ini menunjukkan bahawa mod SLTI dengan video bahasa isyarat, teks dan imej adalah paling berkesan dalam pembelajaran bahasa isyarat.

EFFECTS OF PRESENTATION MODES ON THE LEARNING OF SIGN LANGUAGE AMONG HEARING IMPAIRED STUDENTS WITH DIFFERENT COGNITIVE STYLES

ABSTRACT

This quantitative study investigated the effects of presentation modes on the learning of sign language among 147 hearing impaired students in special education primary schools for the hearing impaired in Malaysia. This study consists of two parts, namely, development and evaluation. A 2 x 3 quasi-experimental factorial design with repeated measure for the moderator variable in a non-equivalent control group pretest-posttest design was adopted in this study. The independent variables are the three presentation modes of the courseware namely Sign Language Video, Text and Image (SLTI), Sign Language Video and Text (SLT) and Sign Language Video and Image (SLI). The moderator variable is the different cognitive styles (FD and FI). The dependent variable is the students' achievement scores as measured by the posttest scores. In the first part, the presentation modes were designed and developed. In the second part, this study investigated the effects of the three presentation modes on hearing impaired students of different cognitive styles. ANOVA and ANCOVA analyses were conducted to test the null hypotheses in this study. The results revealed the hearing impaired students attained significant difference in the mean achievement scores in the three presentation modes. The hearing impaired students using the SLTI mode attained the highest mean achievement score. The study also revealed that there was no significant difference among the mean achievement scores attained by hearing impaired students with

different cognitive styles among the three presentation modes. It also showed that there were no significant interaction effect among the presentation modes and cognitive styles. In conclusion, this study indicated that the SLTI mode consists of sign language video, text and image is most effective in the learning of sign language.

CHAPTER 1

INTRODUCTION

1.1 Background

There are 58,706 hearing impaired people registered in Malaysia (Social Statistics Bulletin, 2014). According to Schirmer (2001), hearing impaired people are a unique culture group with own customs, norms, habits, thought patterns, language, and common experiences. Hearing impaired people use sign language to communicate and Ethnologue listed 130 sign languages throughout the world (Lewis, 2009).

Sign language use a combination of body language, gestures, facial expression and eye gaze to communicate among hearing impaired people (Cherry, 2012; Ahmad & Ghani, 2011; Liwicki & Everingham, 2009; Trevor & Adam, 2007). For example, a question can be shown by raised eyebrows, widened eyes, and leaning the head forward slightly. According to Valli and Lucas (1998), sign language is a well-structured and independent language.

American Sign Language (ASL), British Sign Language (BSL), Australian Sign Language (Auslan), and New Zealand Sign Language (NZSL) are all used in predominately English speaking countries (Gordon, 2008). Malaysian Sign Language (MSL) and Kod Tangan Bahasa Melayu (KTBM) are used in the hearing impaired schools for the purpose of communication and teaching the Malay language (Savita and Athirah, 2011).

Golos (2010a) stated that the academic achievement of the hearing impaired students based on their literacy rate was very low. According to Holt (1993) and Traxler (2000), hearing impaired students read below a fourth grade level. Marschark, Green, Hindmarsh, and Walker (2000) stated because of the low academic level affected the hearing impaired students' social and cognitive development. Limitations also include minimized ability to organize and produce from memory the associations between concepts (Marschark, 2003). This results in challenges to the child's ability to understand real-world situations socially or emotionally (Cambra, 2005; Rieffe, Terwogt, & Smit, 2003).

A hearing impaired child in the family affects parent-child relationships and communication patterns (Ahmad & Ghani, 2004; Christiansen & Leigh, 2004; Marschark, 1993). According to Mitchell and Karchmer (2004), ninety percent of hearing impaired children has hearing families who need to learn sign language. Normally, the hearing impaired child start learning sign language skills late because of the difficulties in sharing the spoken language in the family (Marschark, 2001).

According to Golos (2010a), hearing impaired students' enter school with limited language experience. Biemiller (1999) stated that late development in spoken language among children affects reading comprehension and academic achievement. Mayberry's (2002) study found a significant correlation between sign language skills and reading skills. Morford and Mayberry (2000) in their study on tests for second language acquisition of both signed and spoken language stated that individuals exposed to languages at earlier ages consistently do better than individuals exposed to language at a later age. Hearing impaired children who have acquired American

Sign Language (ASL) from birth did better than hearing impaired children who acquired ASL at a later age on language skills (Mayberry, 1993). According to Mitchell and Karchmer (2004), ninety percent of hearing impaired children is born to hearing parents who do not know sign language and only twenty percent of parents of hearing impaired children become fluent in ASL. According to Vaccari and Marshark (1997), early language intervention is needed to help hearing impaired children to improve their language skills.

Kochkin, Luxford, Northern, Mason, and Tharpe (2007) found hearing impaired students' poor linguistic skills; affect their social interaction, language and communication. Sign language is crucial for the hearing impaired child, their family and friends so that the hearing impaired child is exposed to as much language as possible. If a child is to attend school then oral and written communication is important too. A hearing impaired student may not have the language skills to allow him to keep up with his hearing peers.

Hearing impaired students are taught using different approaches; auditory-oral, auditory-verbal, cued speech, finger spelling, Total Communication, oral English and bilingual method. In Singapore, Total Communication approach is used to teach English to the hearing impaired (Phua, 2004). In Japan, the bilingual method is used by hearing impaired students to learn Japanese language (reading and writing) using Japanese Sign Language (Honna & Kato, 2003). English, Hindi and other languages in the Indian Continent are taught using Indian Sign Language using the bilingual method (Zeshan, Vasishta, & Sethna, 2005).

According to Baker (2001), Cummins (2000), and Freeman and Freeman, (1998), educators are encouraging the use of bilingual method for hearing impaired students to learn English, French, Spanish, Italian or Germany as a second language in the European countries. Nover and Andrews (1998) have proposed using American Sign Language (ASL) to teach English to hearing impaired children. According to Johnson (1989), sign language as the primary language may form the basis for learning English as a second-language, since ASL provides hearing impaired children a visual means to access language and literacy. Malaysian hearing impaired students depend on the Malaysian Sign Language (MSL) for communication and they have low proficiency in the Malay language (Malaysian Federation of the Deaf, 2000). The hearing impaired students are taught the Malay language using Kod Tangan Bahasa Melayu (KTBM) and MSL (Malaysian Federation of the Deaf, 2000).

The proposed study emerged as a timely respond to the challenges faced by the hearing impaired students in learning the sign language. This study will provide a learning resource for the hearing impaired students, parents with hearing impaired children and the hearing community to learn sign language. This research is to examine the effects of the three presentation modes on hearing impaired students with different cognitive styles (Field dependent and Field independent) in learning sign language.

1.2 Problem Statement

The hearing impaired community seldom received sufficient language intervention to consistently achieve linguistic competencies that allow for effective

communication, socialization, and thinking skills. They continue to suffer from significant delays in social skills as well as from difficulties in cognitive development, including academic areas such as literacy, math, and problem solving, as compared to hearing peers (Marschark, 2003). According to Schirmer and McGough (2005), hearing impaired students perform lower on standardized measures of achievement and graduate with fourth grade level reading skills compared to hearing peers. They also display poor quality written skills and show weakness in comprehension and use of function words in written text (Channon & Sayers, 2007). The hearing impaired students also demonstrate poorer linguistic and academic outcomes than their hearing peers (Rieffe et al., 2003). According to Erting (2001), the majority of hearing impaired students are coming to school without the same language skills and background knowledge as their hearing students. Based on the importance of this communication, there are problems among Malaysian hearing impaired students in studying the same syllabus as the typical hearing student. They need to sit for major examinations such as UPSR, PMR and SPM (Yasin, Bari, & Hassan, 2013). The President of the Malaysian Federation of the Deaf (MFD), Mohamad Sazali Shaari stated that many hearing impaired students fail every year especially in the Malay Language and this is a compulsory subject in any major examination, which makes them to fail the whole examination (Abu Hassan, 2012). The bottom line is that the academic achievement remains an area of concern for the hearing impaired students and they are often left behind, especially in terms of learning because of deafness.

There are a number of studies done in Malaysia associated with multimedia in hearing impaired education. The i-Kod was developed to enable users to learn Kod

Tangan Bahasa Melayu (KTBM) (Muharram, 2007). The i-Kod is a translator of the KTBM to Malay language. Next, the MySlang dictionary was developed to assist the learning and teaching of MSL. The instructions in MySlang dictionary is in English. The content of the dictionary was developed based on the book entitled; Malaysian Sign Language, published by the Malaysian Federation of the Deaf. Two 3D animated human characters (male and female) were used to animate the signing of words. MySlang dictionary has 216 daily used words (Lim, 2008).

The e-Sign Dictionary, an electronic MSL dictionary was developed for the use of the hearing impaired community and the general public. It is a couresware that provided instructions in English, Malay, and Chinese language. The dictionary has 500 words with animation to illustrate the signing of each word, illustration of its meaning with a picture (if available), synonym, antonym, and sample sentences (Ow, 2009). Next, the Malay Sign Language Courseware for hearing impaired children was developed with 3D images with video capability and animated rotational view (Savitha & Nur Athirah, 2011). Then the iMSL; Malay Sign Language for the hearing impaired was developed and the contents in iMSL taught users the basic MSL from finger spelling (alphabets), numbers, and some basic things used in daily life (Nur Tahrina, 2012).

The need for the study was triggered by first, the limited number of resources easily available to learn sign language for hearing impaired students. Furthermore, the available resources to learn sign language was not based on the revised curriculum of the special education for the hearing impaired. The revised curriculum for the special education for the hearing impaired was introduced in 2010 (Bahasa

Isyarat Komunikasi, 2010). The learning contents of this study is based on the Bahasa Isyarat Komunikasi (2010). The lack in fulfilment with the revised curriculum for the primary school for the hearing impaired in the available resources, was the need for the study to be conducted. Secondly, this study was carried out to find the best combination of media (SLTI, SLT or SLI) in the presentation modes that will enhance the learning of sign language among the hearing impaired students because hearing impaired people depended on visual to learn (Supalla, 1991; Luckner & Humphries, 1992; Livingston, 1997; Marschark, Lang, & Albertini, 2002; Marschark & Hauser, 2012; Mather & Clark, 2012). Based on this, the researcher believed that hearing impaired students need visual media (combination of sign language video, text and image) to learn (Gentry, Chinn, & Moulton, 2004). Furthermore, the need was supported by the needs analysis conducted among 33 sign language teachers.

The researcher carried out a survey (Appendix A) in April 2013 among sign language teachers. The survey questions were created from literature review and analysis from sign language teachers. Thirty-three sign language teachers responded to the survey. Table 1.1 summarizes the preliminary survey findings and the detailed analysis is attached in Appendix B.

Table 1.1

Preliminary Survey Findings

No.	Statements	Agree	Disagree	Not Sure
1.	I am confident in teaching sign language.	45.5%	42.4%	12.1%
2.	I use sign language to teach the Malay language.	78.8%	18.2%	3.0%
3.	I can understand the sign language found in the sign language book and sign language dictionaries.	75.8%	15.2%	9.1%
4.	Sign language courses were provided during my training in college/ university.	57.6%	30.3%	12.1%
5.	I was given sufficient training in sign language.	27.3%	57.6%	15.2%
6.	Sign language videos will be useful in learning sign language.	78.8%	12.1%	9.1%
7.	I encounter problems to correct each student's sign language in class.	42.4%	48.5%	9.1%
8.	The varied sign language competence of each student in class is making it hard for me to monitor his/ her progress in sign language.	48.5%	42.4%	9.1%
9.	I have difficulties finding resources to teach sign language.	42.4%	45.5%	12.1%

10.	No audio visual aids is provided to support my teaching of sign language.	66.7%	18.2%	15.2%
11.	Hearing impaired students have problems in learning the Malay language correctly.	69.7%	21.2%	9.1%
12.	Hearing impaired students have problems in reading in the Malay language.	81.8%	6.1%	12.1%
13.	Hearing impaired students have problems writing in Malay language	84.8%	6.1%	9.1%
14.	Hearing impaired students do not have sufficient time to practise their sign language in class.	42.4%	39.4%	18.2%
15.	Hearing impaired students feel comfortable to practise their sign language in front of others.	42.4%	36.4%	21.2%

The findings showed that 78.8% of the sign language teachers agreed they use sign language to teach the Malay language and 69.7% of the teachers indicated that hearing impaired students have problems in learning the Malay language. In addition, 81.8% of the teachers highlighted hearing impaired students have problems reading in the Malay language and 84.8% agreed that hearing impaired students face problems writing in the Malay language. Research by Hoffmeister (2000), Strong and Prinz (2000), Padden and Ramsey (2000), and Chamberlain and Mayberry (2000) found that sign language skills is related to reading skills. According to Mayberry (1993), hearing impaired students exposed to ASL from birth, develop

literacy skills that allow them to outperform hearing impaired students with delayed ASL development on vocabulary tasks and language skills. These findings show that the barrier to hearing impaired students' reading development is not simply unable to speak or read in Malay language but rather poor language development, in any form, signed or spoken.

Facilities for the hearing impaired students, specifically the teaching aids, are still lacking. 66.7% of the teachers surveyed stated that there are no visual aids provided to teach sign language. About 78.8% teachers agreed that sign language videos will be helpful since there are very limited sign language learning resources available for the hearing impaired students, their parents, teachers, the hearing impaired community and the normal hearing community to learn sign language. Based on the survey results, we can conclude that sign language teachers face challenges in teaching sign language and Malay literacy to the hearing impaired students are also partly due to limited sign language resources.

Due to the challenges faced in duplication of the best teaching and learning methods for the hearing impaired, the courseware was designed, developed and researched upon. The best suitable presentation mode will be developed to enable the hearing impaired students to learn sign language in an interactive and convenient way and at the same time help to learn the Malay language.

1.3 Purpose of the Study

The aim of this study was to design, develop and evaluate three presentation modes in the learning of sign language among hearing impaired students with different cognitive styles. The three presentation modes to be developed are:

(i) Sign Language video + Text + Image (SLTI) (Figure 1.1),

(ii) Sign Language video + Text (SLT) (Figure 1.2),

(iii) Sign Language video + Image (SLI) (Figure 1.3).

Figure 1.1 Sign language video + text + image (SLTI)

Figure 1.2 Sign language video + text (SLT)

Figure 1.3 Sign language video + image (SLI)

1.4 Research Objectives

The research objectives are:

(i) To design and develop three presentation modes incorporating sign language video, text and image.

(ii) To establish the effects of using three presentation modes: Sign Language video + Text + Image (SLTI); Sign Language video + Text (SLT); and Sign Language video + Image (SLI) in the learning of sign language on the achievement scores.

(iii) To establish whether there is any significant difference in achievement scores among hearing impaired students with different cognitive styles (Field dependent and Field independent) in using the three presentation modes.

1.5 Research Questions

This study is ruled by the following research questions;

1. Will the hearing impaired students attain different achievement scores among the three presentation modes?

1.1 Will the hearing impaired students using the Sign Language video + Text + Image (SLTI) mode attain significantly higher achievement scores (AS) than hearing impaired students using the Sign Language video + Text (SLT) mode?

1.2 Will hearing impaired students using the Sign Language video + Text + Image (SLTI) mode attain significantly higher achievement scores (AS) than hearing impaired students using the Sign Language video + Image (SLI) mode?

1.3 Will hearing impaired students using the Sign Language video + Text (SLT) mode attain significantly higher achievement scores (AS) than hearing impaired students using the Sign Language video + Image (SLI) mode?

2. Will the hearing impaired students with different cognitive styles, Field dependent (FD) and Field independent (FI) attain different achievement scores among the three presentation modes?

2.1 Will FD hearing impaired students using the Sign Language video + Text + Image (SLTI) mode attain significantly higher achievement scores (AS) than FD hearing impaired students using the Sign Language video + Text (SLT) mode?

2.2 Will FD hearing impaired students using the Sign Language video + Text + Image (SLTI) mode attain significantly higher achievement scores (AS) than FD hearing impaired students using the Sign Language video + Image (SLI) mode?

2.3 Will FD hearing impaired students using the Sign Language video + Text (SLT) mode attain significantly higher achievement scores (AS) than FD hearing impaired students using the Sign Language video + Image (SLI) mode?

2.4 Are there interaction effects among presentation modes and cognitive styles on the achievement scores?

1.6 Research Hypotheses

Based on the research questions, the researcher's purpose is to test the following null hypotheses formulated from the research questions. The statistical significance of .05 is used to test the null hypotheses.

H_{01} There is no significant difference in the mean achievement scores (AS) among the hearing impaired students using the three presentation modes (SLTI, SLT and SLI).

$AS_{SLTI} = AS_{SLT} = AS_{SLI}$

$H_{01.1}$ There is no significant difference in the mean achievement scores (AS) between the hearing impaired students using the SLTI mode and the SLT mode.

$AS_{SLTI} = AS_{SLT}$

$H_{01.2}$ There is no significant difference in the mean achievement scores (AS) between the hearing impaired students using the SLTI mode and the SLI mode.

$AS_{SLTI} = AS_{SLI}$

$H_{01.3}$ There is no significant difference in the mean achievement scores (AS) between the hearing impaired students using the SLT mode and the SLI mode.

$AS_{SLT} = AS_{SLI}$

H_{02} There is no significant difference in the mean achievement scores (AS) between the hearing impaired students cognitive styles (FD and FI) in the three presentation modes (SLTI, SLT and SLI).

$AS_{FI} = AS_{FD}$

$H_{02.1}$ There is no significant difference in the mean achievement scores (AS) between FD hearing impaired students using the SLTI mode and FD hearing impaired students using the SLT mode.

$AS_{FD\text{-}SLTI} = AS_{FD\text{-}SLT}$

$H_{02.2}$ There is no significant difference in the mean achievement scores (AS) between FD hearing impaired students using the SLTI mode and FD hearing impaired students using the SLI mode.

$AS_{FD\text{-}SLTI} = AS_{FD\text{-}SLI}$

$H_{02.3}$ There is no significant difference in the mean achievement scores (AS) between FD hearing impaired students using the SLT mode and FD hearing impaired students using the SLI mode.

$AS_{FD\text{-}SLT} = AS_{FD\text{-}SLI}$

$H_{02.4}$ There is no interaction effect between the presentation modes and cognitive styles on the mean achievement scores.

1.7 Significance of the Study

This study is significant because it examines the effect of the three presentation modes (SLTI, SLT, SLI) on hearing impaired students in the learning of sign language. According to Brown (2000) who stated that meaningful learning occurs when learning contents involve text, image and screen literacy, supported the significance and relevance of this research. This study hopes to identify the type of presentation mode (SLTI, SLT, SLI) in a sign language learning environment that will foster appropriate sign language learning among hearing impaired students of different cognitive styles. Through the ongoing evaluation done during the design and development process of the presentation modes, a useable learning environment and design principles are produced. This study suggests a practical instructional design and development framework that can guide future multimedia developmental efforts.

This study also contributes to the development of teaching strategies and resources for the hearing impaired students. The findings will add to the design of instructional technology for the learning of sign language in the Sign Language Curriculum Specifications. The results of this study will provide ample resource for curriculum designers to develop instructional materials for the hearing impaired students. This study focuses on the relationship between the presentation mode on hearing impaired students with different cognitive styles to increase the achievement scores in the learning of sign language. This study is important as the sign language video with image and text will make a deep impact in the teaching and learning of sign language.

The courseware designed is navigable, user-friendly, and self-paced. The hearing impaired students can select the content to learn. The courseware encourages self paced learning and self evaluation. It guides the hearing impaired students systematically and at the same time they learn at their own pace, whereby they can begin and pause the lessons as well as replay the lessons again at a pace effective to them. The hearing impaired students can decide when, where, what and how fast to learn sign language. According to Scheiter and Gerjets (2007), learner control supports active learning and motivates the learners. The hearing impaired students will learn to be more self-reliant in forming their learning strategy. This will definitely help low ability learners from being disappointed and the high ability learners from getting uninterested (Rashid, Aini, Majid, & Chow, 2002). Moreover, the courseware is meant for hearing impaired students to keep on drilling and practising learning the sign language at their own pace. Finally, the researcher hopes that this study can help hearing impaired students, parents with hearing impaired children, and normal hearing people who are interested to learn sign language benefit from this study.

1.8 Theoretical Framework

The following theories form the theoretical framework of this study;

1.8.1 Paivio's Dual Coding Theory (Paivio, 1986)

1.8.2 Sweller's Cognitive Load Theory (Sweller, 1999)

1.8.3 Mayer's Cognitive Theory of Multimedia Learning (Mayer, 2001)

1.8.4 Cummins' Linguistic Interdependence Theory (Cummin's 1979)

A short explanation of the theories is given below and additional explanations as how it is related to the hearing impaired students are given in Chapter 2. Figure 1.4 is the theoretical framework of this study.

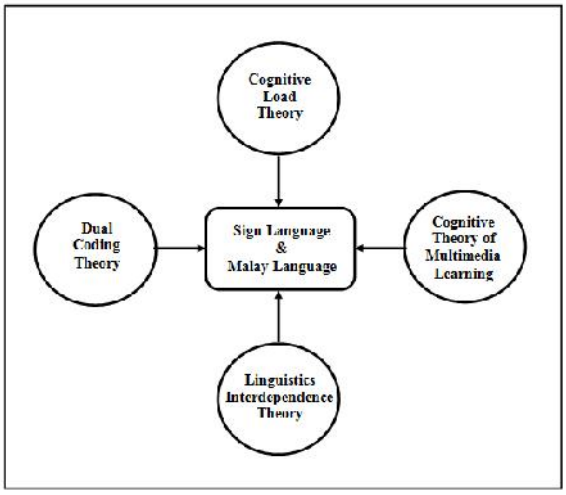


Figure 1.4 Theoretical Framework

1.8.1 Paivio's Dual Coding Theory

The Dual Coding Theory suggested by Paivio (1986) gave equal emphasis to verbal and non-verbal processing. Dual Coding Theory involves two subsystems, as shown in Figure 1.5, a verbal system, logogens, or words (either spoken or written), and the nonverbal system, imagens, or images (Paivio, 2007; 2014). Paivio's Dual Coding Theory (1986) stated that the verbal and non-verbal processing systems were important in language learning. Textbooks and educational literature use written words (logogens) and images/ illustrations (imagens) to relay information to the reader. Paivio proposed that this method, which combines the logogens and imagens coding systems, enhances the reader's learning abilities and retention to a greater degree than using only one coding system, such as text only or image only, or audio only (Paivio, 2007).

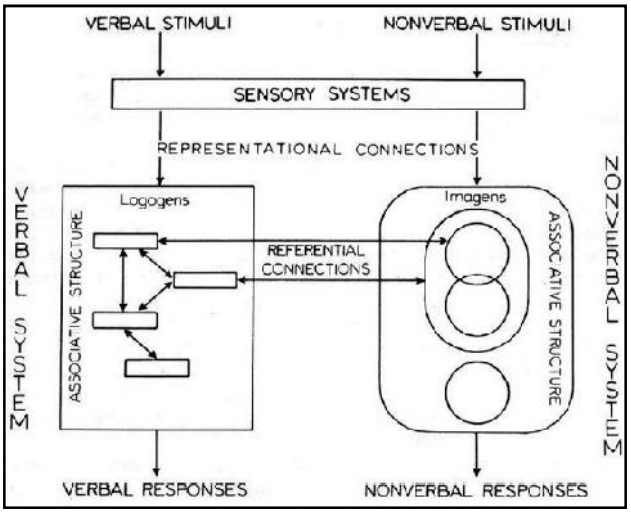


Figure 1.5 Dual Coding Theory (Paivio, 1986)

Paivio's Dual Coding Theory (1986) suggested that the logogen and the imagen, work together to form associations in the mind. When a reader decodes the words, he forms referential connections between the words and the mental images (Clark & Paivio, 1991). For example, when you read a word you think about the meaning and also make a connection to the image of that word or picture an image in your mind's eye (Picker, 2013). The specific visual representation will vary among readers, but exists (Wood & Endres, 2004; Gambrell & Jawitz, 1993; Gambrell & Bales 1986).

1.8.2 Sweller's Cognitive Load Theory

Cognitive Load Theory according to Sweller, Van Merrienboer and Pass (1998) was made up of a limited working memory with separate processing information inputs for visual and auditory that interacted with an unlimited long-term memory. According to Sweller et al. (1998), intrinsic cognitive load, extraneous cognitive load, and germane cognitive load are three types of cognitive load. Intrinsic cognitive load happens in an interaction between individual differences like students'

past knowledge or experiences with the nature of the instructional materials. For example, intrinsic cognitive load will rise if a student is facing a complex instructional content. But, if a student encounters a situation that they have experienced before, they will produce smaller levels of intrinsic load (Paas, Tuovinen, Tabbers, & Van Gerven, 2003; Sweller et al., 1998).

Germane cognitive load happens when schemas and mental models are constructed and stored in long-term memory. Schemas classify information in long-term memory that helps to understand new situations help to reduce working memory load (Sweller et al., 1998). Schemas and mental models help learning by automating the new information to be learned, thus contribute to germane load (Paas, et al. 2003; Sweller et al., 1998).

Extraneous cognitive load happens when the presentation mode and learning activities interferes with schema formation and automation (Sweller et al., 1998). The extraneous load is triggered by the format of the instruction rather than learning content (Sweller et al., 1998). According to Sweller et al. (1998), the effects of high extraneous load may not be obvious when intrinsic and germane load are low.

1.8.3 Mayer's Cognitive Theory of Multimedia Learning

The multimedia principle proposed that "*people learn more deeply from words and pictures than from words alone*" (Mayer, 2001). This model is based upon three primary assumptions:

i. Visual and auditory information are processed through separate and distinct information processing channels.

ii. Each channel is limited in its ability to process information.

iii. Processing information in channels is an active cognitive process designed to construct coherent mental representations (Mayer, 2001).

According to Mayer (2001, p. 54), the learner must engage in five cognitive processes (Figure 1.6), that is;

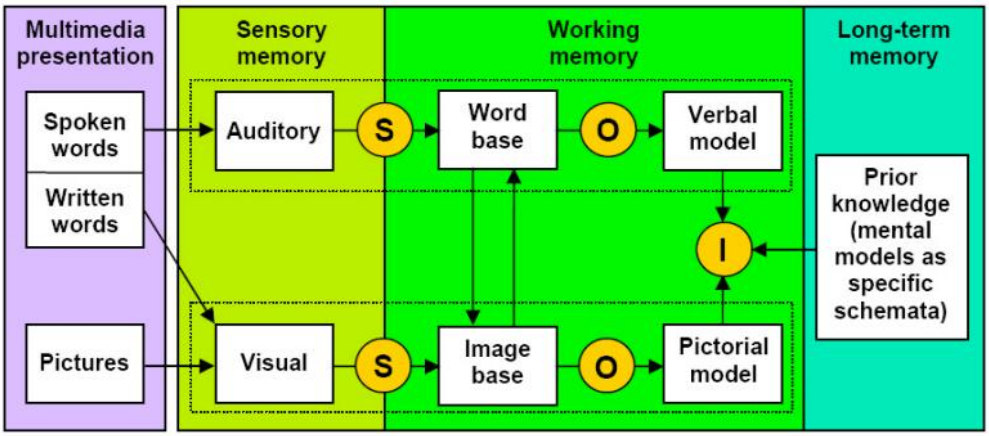
i. selecting relevant words for processing in verbal working memory,

ii. selecting relevant images for processing in visual working memory,

iii. organizing selected words into a verbal mental model,

iv. organizing selected images into a visual mental model, and

v. integrating verbal and visual representations as well as prior knowledge.



S = selecting, O = organising, I = integrating

Figure 1.6 Cognitive Theory of Multimedia Learning (Mayer, 2001)

According to Mayer (2001), only a limited amount of information can be processed in a channel at a time, and the information can only be interpreted by creating mental representations. The multimedia presentation of text, images and auditory information are selected and organized to produce logical mental constructs (Mayer, 2001). Mayer (2001) examined the roles of sensory memory, working

memory, and long-term memory. Mayer (2001; 2009) carried out a series of studies identifying multimedia principles that aids recall and transfer of information with the assumption that the learner has capacity to store pictorial and verbal information and finally integrate them during the learning process.

1.8.4 Cummins' Linguistic Interdependence Theory

Linguistic Interdependence Theory proposes that the relationship of the first language supports the learning of another language (Cummins, 2000; 2001; 2006). This theory puts forward that every language contains surface features and underlying those surface appearance of language are proficiencies that are common across languages (Cummins, 2001). Cummins (2001) proposed a Common Underlying Proficiency (CUP) model where the first language and the second language were seen as interdependent in a bilingual approach.

Cummins' (1980; 2001) CUP model is represented with the "*dual iceberg metaphor*", where the two peaks of the iceberg are equal for totally bilingual individuals. The cognitive language proficiency that is much more significant is not obvious in daily communication is below the surface. According to Cummins (1980; 2001), the higher order thinking skills are located in the depths of this model (Cummins, 1980; 2001). The model "*Dual Iceberg*" is shown in Figure 1.7.

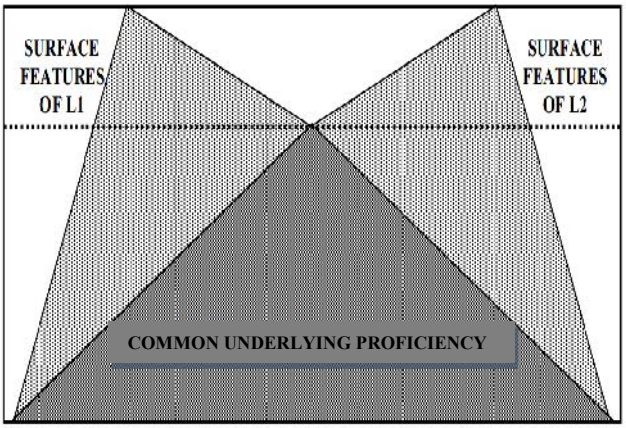


Figure 1.7. "*Dual Iceberg*" Representation of bilingual proficiency (Cummins, 2001)

According to Branford and Donovan (2005) prior knowledge is needed for the interpretation of text. Cummins (2000) stated that a student who had strong conceptual knowledge in the first language, has more cognitive ability to read the text in the second language. The studies by Baker (2001), Cummins (2000), Freeman and Freeman (1998) found significant relationship between ASL skill and English literacy supported the Linguistic Interdependence Theory (Cummins, 2006).

According to Cummins (2003) and Hakuta (1986), linguistic knowledge in the first language transfers to the acquisition process of learning the second language. Nover and Andrews (1998), Stone (1995), Johnson et al. (1989) have suggested that the primary language for hearing impaired children is sign language because it can be easily learned by them. Furthermore, sign language can provide linguistic access to language skills.

Hearing impaired students' below-average reading skills is likely from lacking of sign language instruction, rather than the lacking of hearing impaired students' ability (DeLana, Gentry, & Andrews, 2007). Research has shown that

failing to develop the first language results in challenges in academic and vocational success (Niemann, Greenstein, & David, 2004; Strong & Prinz, 1997). According to Chamberlain and Mayberry (2000), ASL development is related to reading development in hearing impaired students whose primary language is sign language.

1.9 Research Framework

The research framework in Figure 1.8 displays the connections between the variables. The independent variables are the three presentation modes namely Sign Language video, Text and Image (SLTI); Sign Language video and Text (SLT); and Sign Language video and Image (SLI). The dependent variable is the hearing impaired students' achievement scores. The moderator variable is the cognitive styles.

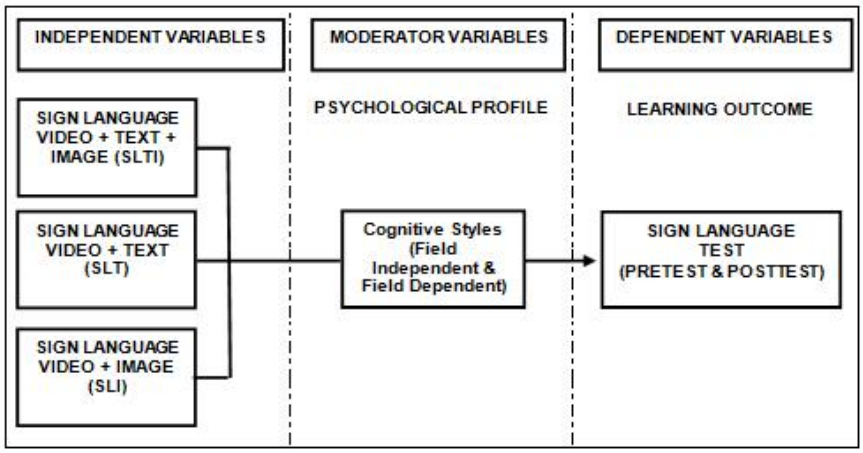


Figure 1.8 Research framework

1.10 Limitations of the Study

It is accepted that there are limitations which may affect the overview of the research in this study. First, this study's samples are restricted to only hearing impaired students recruited from hearing impaired schools in Peninsular Malaysia.