EFFECTIVE SIGN LANGUAGE COMMUNICATION AMONG HEARING IMPAIRED MALAYSIAN STUDENTS WITH DIFFERENT COGNITIVE STYLES

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Abstract

This quantitative study investigated the effects of E-SignNet on the learning of Malaysian Sign Language among 147 hearing impaired students with different cognitive styles in Malaysia. A quasi-experimental with control group pre-test and post-test design was used in this research. The independent variables were the presentation modes (SLTI, SLI and SLT) and cognitive styles. The dependent variable was the achievement scores, and the covariate was the pre-test scores. The two-way ANCOVA was performed to analyse the effects of cognitive styles (independent variable) on the achievement scores (dependent variable) among the three presentation modes. The results revealed that by using E-SignNet, there were no significant difference in achievement scores among the three presentation modes and cognitive styles.

Keywords: *E-SignNet, hearing impaired, sign language, cognitive style, Field Dependent (FD), Field Independent (FI).*

Abstrak

Kajian kuantitatif ini melibatkan kesan E-SignNet terhadap pembelajaran Bahasa Isyarat Malaysia dalam kalangan 147 pelajar kurang pendengaran dengan gaya kognitif yang berbeza di Malaysia. Kuasi-eksperimen menggunakan kumpulan kawalan dengan ujian pra dan ujian pasca telah dilaksanakan dalam kajian ini. Pemboleh ubah bebas adalah mod

persembahan (SLTI, SLI dan SLT) dan gaya kognitif. Pemboleh ubah bersandar ialah skor pencapaian dan kovariat adalah markah ujian pra. ANCOVA dua hala yang dilakukan untuk menganalisis kesan gaya kognitif (pemboleh ubah bebas) terhadap skor pencapaian (pemboleh ubah bersandar) antara tiga mod persembahan. Hasil kajian menunjukkan bahawa dengan menggunakan E-SignNet, tidak ada perbezaan yang signifikan dalam skor pencapaian antara tiga mod persembahan dan gaya kognitif.

Kata kunci: *E-SignNet, kurang pendengaran, bahasa isyarat, gaya kognitif, Field Dependent (FD), Field Independent (FI).*

Introduction

There are 58,706 hearing impaired people registered in Malaysia (*Social Statistics Bulletin*, 2014). The hearing impaired (HI) students use the Malaysian Sign Language for communication and they have low ability in the Malay language (Malaysian Federation of the Deaf, 2000). The HI students are taught the Malay language using Manually Coded Malay and Malaysian Sign Language (Malaysian Federation of the Deaf, 2000).

The academic achievement of the HI students based on their literacy rate is very low (Golos, 2010a). Because of the low academic level, it affected the HI students' social and cognitive development (Marschark, Green, Hindmarsh & Walker, 2000).

Purpose of the Study

The aim of this study was to evaluate three presentation modes of the E-SignNet in the learning of sign language among HI students with different cognitive styles. The three presentation modes are:
(i) Sign Language video + Text + Image (SLTI) (see Figure 1),
(ii) Sign Language video + Text (SLT) (see Figure 2),
(iii) Sign Language video + Image (SLI) (see Figure 3).

Figure 1 Sign language video + text + image (SLTI)

Figure 2 Sign language video + text (SLT)

Figure 3 Sign language video + image (SLI)

Research Objective

The research objective was to establish whether there is any significant difference in achievement scores among HI learners with different cognitive styles (Field dependent and Field independent) in using SLTI, SLT and SLI modes.

Research Questions

This study is based on the following research questions;

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

1.1 Will FI HI students attain significantly higher achievement scores (AS) than the FD HI students among the three presentation modes?

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

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

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

Research Hypotheses

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

$H_{01.1}$ There is no significant difference in the mean achievement scores between FI HI students and FD HI students in the three presentation modes.

$$AS_{FI} = AS_{FD}$$

$H_{01.2}$ There is no significant difference in the mean achievement scores between FD HI students using the SLTI mode and FD HI students using the SLT mode.

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

$H_{01.3}$ There is no significant difference in the mean achievement scores between FD HI students using the SLTI mode and FD HI students using the SLI mode.

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

$H_{01.4}$ There is no significant difference in the mean achievement scores between FD HI students using the SLT mode and FD HI students using the SLI mode.

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

Cognitive Styles

Cognitive psychology described cognitive style as how an individual chooses to organize and process information in problem solving (Sadler-Smith & Riding, 2004). Witkin (1978) described cognitive styles as how individuals prefer to organize stimuli and construct meanings for themselves out of their experiences. To determine a person's cognitive style, the Group Embedded Figures Test (GEFT) involved finding simple images embedded within complex images (Witkin, Moore, Oltman, Goodenough, Friedman, Owen & Raskin, 1977).

Witkin et al. (1977) described individuals who relied on external cues and were less able to identify an embedded figure in an organized field as being FD and those who relied on internal cues and were more able to identify an embedded figure in an organized field as being FI. FD's perceive objects as a whole but FI's focus on individual parts. FD's rely on external references,

whilst FI's rely on internal references (Witkin et al., 1977). Aldalalah, O. and Fong, S. F. (2010) & Messick (1984) stated that cognitive style may interact with instructional treatments to moderate learning and retention.

Group Embedded Figures Test

The Group Embedded Figures Test was used to evaluate HI students' cognitive styles; FD and FI. According to Witkin, Oltman, Raskin & Karp (1971), GEFT is a variation of the Embedded Figures Test that measures a person's ability to find simple image embedded within a complex image. The HI students need to trace a simple image from the complex image.

Research Design

The factors in this study are the three presentation modes (SLTI, SLT and SLI) and the cognitive styles (FD and FI) are the moderator variable. Analyses for the effects of the moderator in the factorial design are illustrated in Figure 4.

Figure 4 Presentation modes X cognitive styles - a3 X 2 quasi-experiment design

SLTI - Sign Language video + Text + Image
SLT   - Sign Language video + Text
SLI   - Sign Language video + Image
FD   - Field dependent   **FD**
FI   - Field independent

Testing the Hypotheses

$H_{01.1}$ There is no significant difference in the mean achievement scores between FI HI students and FD HI students in the three presentation modes.

$$AS_{FI} = AS_{FD}$$

The results in Table 1 showed the adjusted mean scores for FI (41.464) was slightly higher than the adjusted means scores for FD (39.669). But, the mean difference between FI and FD was 1.795 at p= 0.053, which was more than the p-value of 0.05 as displayed in Table 2, showed no significant difference in achievement scores between the FD and FI HI students among the three presentation modes. Hence, the statistical result failed to reject the null hypothesis $H_{01.1}$.

Table 1 Estimated marginal means of cognitive styles

Dependent Variable: Achievement

GEFT	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
FD	39.669[a]	.616	38.451	40.888
FI	41.464[a]	.683	40.114	42.814

a. Covariates appearing in the model are evaluated at the following values: Pretest = 18.4014.

Table 2 Pairwise comparisons for cognitive styles

Dependent Variable: Achievement

(I) GEFT	(J) GEFT	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
					Lower Bound	Upper Bound
FD	FI	-1.795	.920	.053	-3.614	.025
FI	FD	1.795	.920	.053	-.025	3.614

Based on estimated marginal means
a. Adjustment for multiple comparisons: Bonferroni.

$H_{01.2}$ There is no significant difference in the mean achievement scores between FD HI students using the SLTI mode and FD HI students using the SLT mode.

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

The results in Table 3 showed the adjusted mean scores for FD HI students using SLTI mode (55.891) was higher than the adjusted mean scores for FD HI students using SLT mode (33.416), but the p= 0.563, which was more than p-value of 0.05 as shown in Table 4. This indicated there was no significant difference in achievement scores between FD HI students using the SLTI mode and SLT mode. Hence, the statistical result failed to reject the null hypothesis $H_{02.2}$.

Table 3 Estimated marginal means by presentation modes and cognitive styles

Dependent Variable: Achievement

Mode	GEFT	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
SLTI	FD	55.891[a]	1.090	53.736	58.045
	FI	57.581[a]	1.213	55.183	59.980
SLT	FD	33.416[a]	1.052	31.335	35.496
	FI	34.066[a]	1.188	31.718	36.415
SLI	FD	29.701[a]	1.067	27.592	31.810
	FI	32.744[a]	1.156	30.458	35.030

a. Covariates appearing in the model are evaluated at the following values: Pretest = 18.4014.

Table 4 Two-way ANCOVA for achievement scores by presentation modes and cognitive styles with pretest scores as covariate

Dependent Variable: Achievement

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Observed Power[b]
Corrected Model	24414.632[a]	6	4069.105	132.462	.000	.850	1.000
Intercept	7016.269	1	7016.269	228.401	.000	.620	1.000
Pretest	5128.727	1	5128.727	166.956	.000	.544	1.000
Mode	18760.459	2	9380.229	305.355	.000	.814	1.000
GEFT	116.826	1	116.826	3.803	.053	.026	.491
Mode * GEFT	**35.488**	**2**	**17.744**	**.578**	**.563**	**.008**	**.144**
Error	4300.675	140	30.719				
Total	265718.750	147					
Corrected Total	28715.306	146					

a. R Squared = .850 (Adjusted R Squared = .844)
b. Computed using alpha = .05

$H_{02.3}$ There is no significant difference in the mean achievement scores between FD HI students using the SLTI mode and FD HI students using the SLI mode.

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

The results in Table 3 showed the adjusted mean scores for FD HI students using SLTI mode (55.891) was higher than the adjusted mean scores for FD HI students using SLI mode (29.701), but the p= 0.563, which was more than p-value of 0.05 as shown in Table 4. This indicated there was no significant difference in achievement scores between FD HI students using the SLTI mode and SLI mode. Hence, the statistical result failed to reject the null hypothesis $H_{02.3}$.

$H_{02.4}$ There is no significant difference in the mean achievement scores between FD HI students using the SLT mode and FD HI students using the SLI mode.

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

The results in Table 4 showed the adjusted mean scores for FD HI students using SLT mode (33.416) was higher than the adjusted mean scores for FD HI students using SLI mode (29.701), but the p= 0.563, which was more than p-value of 0.05 as shown in Table 3. This indicated there was no significant difference in achievement scores between FD HI students using the SLT mode and SLI mode. Hence, the statistical result failed to reject the null hypothesis $H_{02.4}$.

Cognitive Styles and Presentation Modes Related to Achievement Scores

Referring to null hypothesis $H_{01.1}$, this study indicated that there was no significant difference in the achievement scores of the FI and FD HI students among the three presentation modes. According to a study by Ramirez (1973), FI students' achievement in learning is better than FD students because FI students are task oriented and prefer learning situations that emphasize details of concepts. Moreover, FI students have been noted to do better at abstract material (Messick & Damarin, 1964). According to Berger and Goldberger

(1979), Kent-Davis and Cochran (1989), FD students are unable to focus on related aspects of the learning content, lack in encoding and long-term memory processing. According to Fong and Ng (2000), Joseph (1987), Reardon, Jolly, McKinney, and Forducey (1982), the FI students are active learners compared to the FD students who are passive learners. FI students who are task oriented and active learners were the basis to expect a significant difference in achievement scores by the FI HI students over FD HI students in this study. But, the results showed no significant difference in achievement scores among the FI and FD HI students in this study.

This contradicting result that no significant difference in achievement scores by FI and FD HI students can be explained using Paivio's Dual Coding Theory and Sweller's Cognitive Load Theory. According to Paivio's (1986; 2007) Dual Coding Theory has two main cognitive processing systems; sensory motor systems refer to the way in which logogens and imagens are perceived, while the symbolic system refers to the way logogens and imagens are mentally processed and stored. Information gained through the same type of sensory motor system may be processed either in the logogens or imagens symbolic system. This study is concerned with sign language video, printed text and image. Sign language video, text and image are acquired through the visual sensory motor system, and the text is processed in the logogens symbolic system and the sign language video and images are processed in the imagens symbolic system (Paivio, 1986). But for the FI and FD HI students who depend solely on the visual channel (Luckner & Humphries, 1992; Livingston, 1997; Marschark, Lang, & Albertini, 2002), the sign language video, text and image are initially processed in the visual channel will create cognitive load on the visual sensory motor system. The FI and FD HI students in all three treatment modes will have cognitive load in processing the learning contents that might have hampered the learning process. This probably could be the reason there were no differences in achievement scores between the FI and FD HI students.

Another possible explanation for no significant difference in achievement scores between the FD and FI HI students among the three treatment modes can be explained using the modality principle in Mayer's Cognitive Theory of Multimedia Learning. The modality principle asserts that

people learn more deeply from images and spoken words than from images and visual text when instructional materials include both text and images (Mayer, 2009). The modality principle is based upon working memory model which have two subsystems; one for visual information and another for verbal information (Baddeley, 1992). Paas, Renkl and Sweller (2003), Sweller (2005) and Mayer (2005a; 2009) claimed that when the text is presented visually, the visual subsystem of working memory will become overloaded. Students have to split their visual attention between text and images (Mousavi, Low & Sweller, 1995). HI students are dependent on the visual modality (Luckner & Humphries, 1992; Livingston, 1997; Marschark et al., 2002) and have to split their visual system between sign language video, text and image. These would create cognitive load on visual subsystem of working memory of the HI students in all the three modes as proposed by the modality principle. The FI and FD HI students will have cognitive load in processing the learning contents that could hinder learning. This probably could be the reason there were no significant difference in achievement scores between the FI and FD HI students. It implies that the cognitive styles had similar effects in achievement scores on HI students irrespective of presentation modes.

Effects of the FD Cognitive Style in SLTI Mode Compared to FD Cognitive Style in SLT Mode and SLI Mode on Achievement Scores

With reference to null hypotheses $H_{01.2}$, $H_{01.3}$ and $H_{01.4}$, the results showed no statistically significant difference in achievement scores of the FD HI students among the three presentation modes. The three presentation modes have a similar effect among the FD cogitive style HI students on learning sign language.

MacGregor, Shapiro and Niemiec (1988) found that FD students benefited from computer aided learning as it provided more structure and consistency for FD students. Fitzgerald and Semrau's (1997) study revealed multimedia improved learning for FD students. According to Chen and Ford (1998), Jonassen and Grabowski (1993) and Lourdusamy (1994) stated that FD learners prefer a linear approach and structured learning content. The findings by MacGregor et al. (1988) and Fitzgerald and Semrau (1997) did not support the findings in this study that there is no significant difference in

achievement scores by FD HI students learning from multimedia. A possible explanation why there was no significant difference in achievement scores by FD HI students can be explained by Witkin's cognitive style theory which stated that FD learners can perform better when learning contents are structured (Thompson, 1988, Witkin et al., 1977). The learning contents in the three presentation modes are structured and probably fulfilled the learning conditions for FD HI students as proposed by Thompson (1988) and Witkin et al. (1977) irrespective of the presentation modes. FD HI students improved in learning sign language irrespective of the presentation modes and this findings are similar to the studies by Chen and Ford (1998), Jonassen and Grabowski (1993) and Lourdusamy (1994). The structured learning content probably fulfilled the learning conditions and characteristics of the FD HI students in learning sign language irrespective of the presentation modes.

Another possible explanation why there was no significant difference in the achievement scores in the FD HI students among the three presentation modes is the control over the pacing of instruction. According to Parkinson and Redmond (2002), Shih and Gamon (2001), Brenner (1997) and Cameron and Treagust (1997), FD learners perform better in a computer learning environment and web based learning. A study by Yoon (1994), found that FD learners are passive learners and performed better with program controlled learning instruction. Fong (2001) and Daniels (1996) found no significant difference between FD learners and learner control of presentation modes in a multimedia setting. Yoon (1994) and Daniels (1996) findings supported this study that there is no significant difference in achievement scores by FD HI students irrespective of the three presentation modes. Based on these findings, probably learner control and pacing could have an effect on the learning of FD HI students.

Conclusion

This research has highlighted that the HI students' cognitive styles did not affect the achievement scores irrespective of the presentation modes. Among the FD and FI normal hearing students, FI students normally perform better than FD students in various types of learning environment. But in this

study, the FD and FI HI students showed similar results among the three presentation modes. HI students are at the mercy of having only one channel to receive information. This creates cognitive load on the visual channel and will impede processing and learning for the HI students. It calls for more research on innovative instructional strategies to help FD and FI HI students in processing information.

Further research should be done on HI students cognitive styles. The FD and FI HI students are at the mercy of processing information via the visual channel and that will cause cognitive load and can delay learning. This calls for more innovative research strategies to establish a learning theory for the FD and FI HI students. Future studies would benefit from research designs that investigated the interactions between cognitive styles and learner control verses system control, presentation designs, outcomes and learning environments that are facilitated by computer-based technologies.

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