The Efficiency of Electrochemistry Manuals through Illustration (I) or Explanation Using Sentences (Eusm) For Form 4 Students Among 3 Schools In Lms Area, Perak

M. A. Yahaya[1*], S. Saleh[2]

[1]*SMK Kamunting, 34600, Kamunting, Perak*
[2]*School of Educational Studies, Universiti Sains Malaysia, 11800, Minden, Pulau Pinang*

Abstract: *This paper will discuss about the performances in Electrochemistry Final Examination (EFE) for some Form 4 students from three schools at LMS, Perak. The students first were sitting for pre-tests- Motivational Level (ML), Puzzle Cards (PC), Logical Thinking (LT), Scientific Reasoning Skills (SRS), and Electrochemistry Final Exam (EFE). Three manuals were used- Illustrations (I), Explanation using Sentences (EuSM), and Ministry of Education Chemistry Textbooks (T). After the treatments using these manuals, students were sitting for post-tests- ML, -PC, - LT, -SRS, and -EFE. The data were then analyzed with One-Way ANOVA Test (Repeated) using IBM SPSS Statistics Software 21.0 to determine whether there will be improvements in the post-tests after using these manuals.*

Keywords: *Electrochemistry Form 4; Logical Thinking (LT); Motivational Level (ML); Scientific Reasoning Skills (SRS); Electrochemistry Manuals (IM, EuSM & T)*

I. Introduction

Electrochemistry Form 4 is in Chapter 6 follows the guidance from Malaysian Ministry of Education syllabus, consisting of the components of Electrochemical Cells (Electrolytic & Galvanic), similarity and differences, types, concepts that happening in the electrolytes, and their advantages or disadvantages. Also, the chemical equations that happened in the electrolytes and electrodes must be discussed [1].

Collaborative learning, where communication is the main aspect shows the way that students can debate their understanding about some facts in Electrochemistry concepts. Other aspects such as social skills, motivational level, and school cultures play crucial roles to achieve learning goals. Many studies reported about collaborative learning [2 – 5]. Self-epistemological beliefs gave positive impacts due to first impression about their study [6]. Govern from that, they will produce positive self-efficacy, self-goal, and increasing behavior towards learning.

In this paper, we will discuss about the achievements in Scientific Reasoning Skills (SRS) and Electrochemistry concepts when using these three manuals - Illustrations (IM), Explanation using Sentences (EuSM), and Ministry of Education Chemistry Textbooks (T).

II. Methods And Procedures

Respondents

91 respondents selected from three schools – SMK Bukit Jana, SMK Kamunting and SMK Klian Pauh, Larut Matang & Selama, Perak. They were 16 years old, in Form 4, Pure Science students.

Research Hypotheses

H_1: Types of manual influence the students' performance in Post-ML, -PC, -LT, -SRS and -EFE.
H_2: There are increasing achievements in Post-Tests compared to Pre-ML, -PC, -LT, -SRS and –EFE.

Tests

5 tests were conducted –ML, -PC, – LT, -SRS and -EFE. Pre-Tests were given initially. Then, students involved into T & L. After finished, the Post-Tests will be given. Motivational Level (ML) Test is also given. The Motivational Level assessed the 5 dimensions of students' motivation in learning Electrochemistry through: (1) self-efficacy, (2) scientific learning value, (3) goal, (4) epistemological beliefs and (5) test anxiety. The 5-point Likert-type scale, from (5) strongly agree to (1) strongly disagree were used to get their opinions in 40 questions.

T&L Sessions

The T&L sessions were done in 4 sessions for 4 to 8 weeks approximately. The activities inside this programme are: (1) lecture session about Electrochemistry, (2) Electrolytic and Galvanic Cells – Components

and How They Works?, (3) Electrochemical Series and Games, and lastly training how to give answer with scientific explanations by using (4) Worksheet about Electrochemistry. Three manuals were used – Illustration (IM), Explanation using Sentences (EuSM) and Chemistry Textbook (T) that followed Ministry of Education syllabus.

Data Analyzing

The data analysing is using IBM SPSS Statistics Software 21.0. The One Way ANOVA, Independent Samples or Repeated Tests were used to analyze the data. The homogeneity of regression slopes was first determined before the One Way ANOVA and ANOVA Repeated Measurements is conducted. While the significant value (p) for the Levene or Brown-Forsythe Tests also must be > 0.05 [7]. So, the homogeneity of variances for the data has been met.

III.   Results And Discussion

Types of Manual

Table 1. The results for Levene and Brown-Forsythe Tests using type of manuals as IV.

DV	Levene Test				Brown-Forsythe Test			
	Levene Statistic	df1	df2	Sig.	Brown-Forsythe Statistic	df1	df2	Sig.
Post-ML	1.696	2	87	0.189	.	.	.	.
Post-PC	3.659	1	58	0.061	.	.	.	.
Post-LT	0.276	2	87	0.759	.	.	.	.
Post-SRS	11.596	2	87	0.000	.	.	.	.
Post-EFE	5.259	2	87	0.007	.	.	.	.

The homogeneity of variances for Post-ML, -PC, and –LT have been met showed from Levene Test (p > 0.05). While from the Brown-Forsythe Test, the significant value did not report as can be seen from Table 1. So, the next step to run One-Way ANOVA (Independent Samples) can be done.

Table 2. Descriptive Statistics for students' scores on Post-ML, -PC, -LT, -SRS, and –EFE using type of manuals as IV.

DV	Textbook			Illustration Manual (IM)			Explanation using Sentences Manual (EuSM)		
	Mean	Std. Deviation	N	Mean	Std. Deviation	N	Mean	Std. Deviation	N
Post-ML	157.17	12.075	30	168.60	14.517	30	154.80	10.968	30
Post-PC	-	-	-	5.40	2.762	30	6.30	2.261	30
Post-LT	12.63	1.650	30	12.60	2.444	30	12.50	1.676	30
Post-SRS	8.47	1.306	30	9.53	3.137	30	8.40	1.653	30
Post-EFE	19.17	4.284	30	18.23	7.968	30	14.37	5.720	30

Table 3. The results for One-Way ANOVA Independent Samples (Tests of Between-Subjects Effects and Univariate Test) using type of manuals as IV.

DV	Tests of Between-Subjects Effects				Univariate Test			
	Statistics	df1	df2	Sig.	Statistics	df1	df2	Sig.
Post-ML	10.279	2	87	0.000	10.279	2	87	0.000
Post-PC	1.907	1	58	0.173	1.907	1	58	0.173
Post-LT	0.038	2	87	0.963	0.038	2	87	0.963
Post-SRS	2.549	2	87	0.084	2.549	2	87	0.084
Post-EFE	5.088	2	87	0.008	5.088	2	87	0.008

Table 4. The results for One-Way ANOVA Independent Samples (Pairwise Comparisons Test) using type of manuals as IV.

DV	I	J	Mean Difference	Sig.
Post-ML	Textbook (T)	IM	-11.433	0.002
		EuSM	2.367	1.000
	Illustration Manual (IM)	T	11.433	0.002
		EuSM	13.800	0.000
	Explanation using Sentences Manual (EuSM)	T	-2.367	1.000
		IM	-13.800	0.000
Post-PC	Illustration Manual (IM)	EuSM	-0.900	0.173

	Explanation using Sentences Manual (EuSM)	IM	0.900	0.173
Post-LT	Textbook (T)	IM	0.033	1.000
		EuSM	0.133	1.000
	Illustration Manual (IM)	T	-0.033	1.000
		EuSM	0.100	1.000
	Explanation using Sentences Manual (EuSM)	T	-0.133	1.000
		IM	-0.100	1.000
Post-SRS	Textbook (T)	IM	-1.067	0.185
		EuSM	0.067	1.000
	Illustration Manual (IM)	T	1.067	0.185
		EuSM	1.133	0.142
	Explanation using Sentences Manual (EuSM)	T	-0.067	1.000
		IM	-1.133	0.142
Post-EFE	Textbook (T)	IM	0.933	1.000
		EuSM	4.800	0.010
	Illustration Manual (IM)	T	-0.933	1.000
		EuSM	3.867	0.052
	Explanation using Sentences Manual (EuSM)	T	-4.800	0.010
		IM	-3.867	0.052

The ML mean scores differences significantly among the three manuals due to $p < 0.05$ when testing using Tests of Between-Subjects Effects and Univariate Test as can be seen from Table 3 and also Pairwise Comparisons Test in Table 4. The ML mean scores is the highest, 168.60 with std. 14.517 while using IM tested to 30 respondents as shown in Table 2 and Figure 1.

While for Post-PC and Post-LT scores, there are no significantly differences ($p > 0.05$). The mean scores for Post-PC using EuSM is higher than IM, 6.30, std. value 2.261 (as can be seen from Figure 2). And the mean scores for Post-LT using T is the highest, 12.63 with std. value 1.650 (as can be seen from Figure 3).
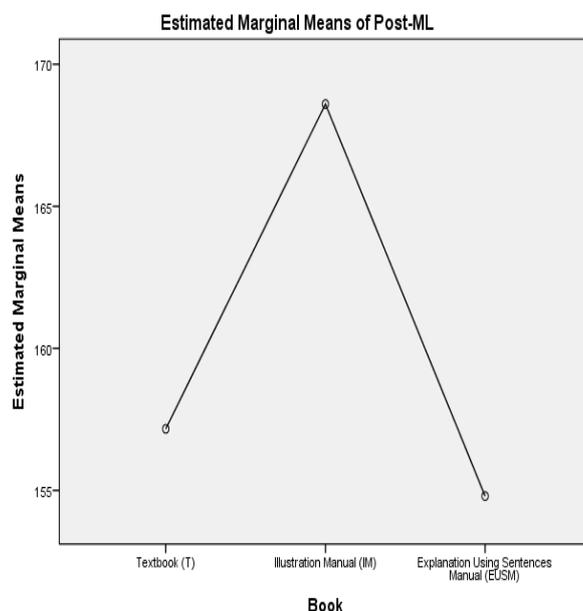

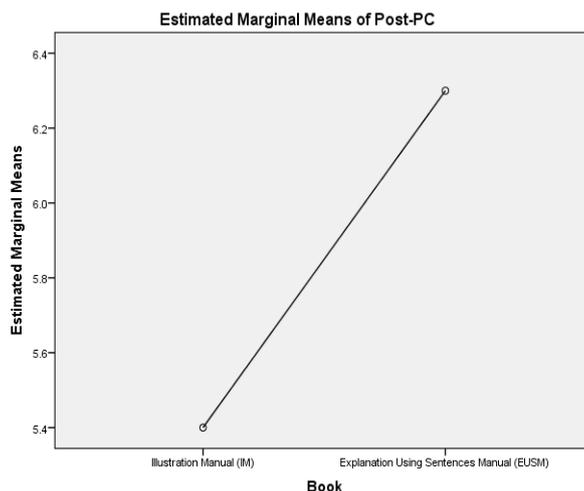**Figure 1.** The EMM for motivational level when using the three manuals.

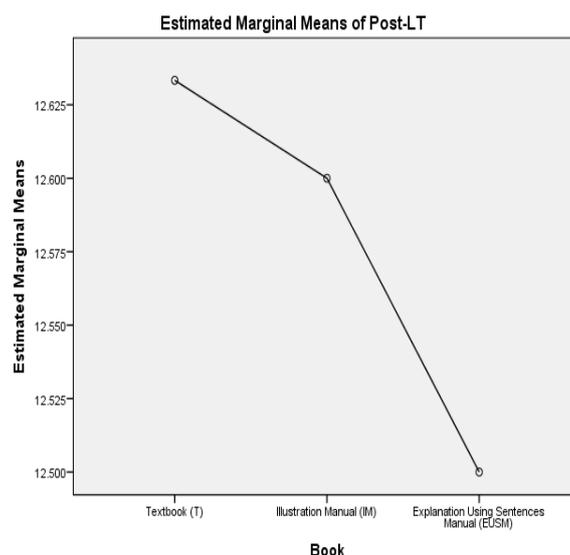**Figure 2.** The EMM for PC scores when using both manuals.

Figure 3. The EMM for LT scores when using the three manuals.

Studying using Chemistry Textbook (T)
 Table 5. The results for Levene and Brown-Forsythe Tests using Pre-Tests as IV when studying with textbook.

DV	Levene Test				Brown-Forsythe Test			
	Levene Statistic	df1	df2	Sig.	Brown-Forsythe Statistic	df1	df2	Sig.
Post-ML	.	.	.	.	.	.	.	.
Post-LT	2.811	3	25	0.060	.	.	.	.
Post-SRS	0.249	4	25	0.908	3.665	4	19.459	0.022
Post-EFE	1.180	7	17	0.364	.	.	.	.

The homogeneity of variances has been met for all the Post-Tests except for ML when studying using textbook (as can be seen from Table 5). Descriptive Statistics for the pre- and post-tests are shown in Table 6. There are increasing in Post-ML and –EFE scores compared to their pre-tests.

Table 6. Descriptive Statistics Pre- and Post-Tests for ML, LT, SRS and EFE using One-Way ANOVA Repeated using textbook as IV.

Test	Mean	Std. Deviation	N
Pre-ML	154.57	11.875	30
Post-ML	157.17	12.075	30
Pre-LT	12.73	1.818	30
Post-LT	12.63	1.650	30
Pre-SRS	8.47	1.306	30

Post-SRS	8.47	1.306	30
Pre-EFE	13.07	4.085	30
Post-EFE	19.17	4.284	30

Table 7. Mauchly's Test of Sphericity for measuring ML, LT, SRS and EFE using textbook as IV.

Within Subjects Effect	Measure	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon[b]		
						Greenhouse-Geisser	Huynh-Feldt	Lower-bound
PrePost	ML	1.000	0.000	0	.	1.000	1.000	1.000
	LT	1.000	0.000	0	.	1.000	1.000	1.000
	SRS	1.000	0.000	0	.	1.000	1.000	1.000
	EFE	1.000	0.000	0	.	1.000	1.000	1.000
Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.[a]								
a. Design: Intercept Within Subjects Design: PrePost								
b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.								

Table 8. Univariate Tests for measuring ML, LT, SRS and EFE using textbook as IV.

Source	Measure		Type III Sum of Squares	df	Mean Square	F	Sig.
PrePost	ML	Sphericity Assumed	101.400	1	101.400	2.026	0.165
		Greenhouse-Geisser	101.400	1.000	101.400	2.026	0.165
		Huynh-Feldt	101.400	1.000	101.400	2.026	0.165
		Lower-bound	101.400	1.000	101.400	2.026	0.165
	LT	Sphericity Assumed	0.150	1	0.150	0.069	0.795
		Greenhouse-Geisser	0.150	1.000	0.150	0.069	0.795
		Huynh-Feldt	0.150	1.000	0.150	0.069	0.795
		Lower-bound	0.150	1.000	0.150	0.069	0.795
	SRS	Sphericity Assumed	0.000	1	0.000	0.000	1.000
		Greenhouse-Geisser	0.000	1.000	0.000	0.000	1.000
		Huynh-Feldt	0.000	1.000	0.000	0.000	1.000
		Lower-bound	0.000	1.000	0.000	0.000	1.000
	EFE	Sphericity Assumed	558.150	1	558.150	38.877	0.000
		Greenhouse-Geisser	558.150	1.000	558.150	38.877	0.000
		Huynh-Feldt	558.150	1.000	558.150	38.877	0.000
		Lower-bound	558.150	1.000	558.150	38.877	0.000
Error (PrePost)	ML	Sphericity Assumed	1451.600	29	50.055		
		Greenhouse-Geisser	1451.600	29.000	50.055		
		Huynh-Feldt	1451.600	29.000	50.055		
		Lower-bound	1451.600	29.000	50.055		
	LT	Sphericity Assumed	63.350	29	2.184		
		Greenhouse-Geisser	63.350	29.000	2.184		
		Huynh-Feldt	63.350	29.000	2.184		
		Lower-bound	63.350	29.000	2.184		
	SRS	Sphericity Assumed	30.000	29	1.034		
		Greenhouse-Geisser	30.000	29.000	1.034		
		Huynh-Feldt	30.000	29.000	1.034		
		Lower-bound	30.000	29.000	1.034		
	EFE	Sphericity Assumed	416.350	29	14.357		
		Greenhouse-Geisser	416.350	29.000	14.357		
		Huynh-Feldt	416.350	29.000	14.357		
		Lower-bound	416.350	29.000	14.357		

The Univariate Test and Tests of Within-Subjects Contrasts reported that all the p values are > 0.05 except for Post-EFE. This shows impact that there was significant differences between pre- and post-tests for EFE (as can be seen in Table 8 and 9).

Table 9. Tests of Within-Subjects Contrasts for measuring ML, LT, SRS and EFE using textbook as IV.

Source	Measure	PrePost	Type III Sum of Squares	df	Mean Square	F	Sig.
PrePost	ML	Level 1 vs. Level 2	202.800	1	202.800	2.026	0.165
	LT	Level 1 vs. Level 2	0.300	1	0.300	0.069	0.795
	SRS	Level 1 vs. Level 2	0.000	1	0.000	0.000	1.000
	EFE	Level 1 vs. Level 2	1116.300	1	1116.300	38.877	0.000
Error	ML	Level 1 vs. Level 2	2903.200	29	100.110		

(PrePost)	LT	Level 1 vs. Level 2	126.700	29	4.369		
	SRS	Level 1 vs. Level 2	60.000	29	2.069		
	EFE	Level 1 vs. Level 2	832.700	29	28.714		

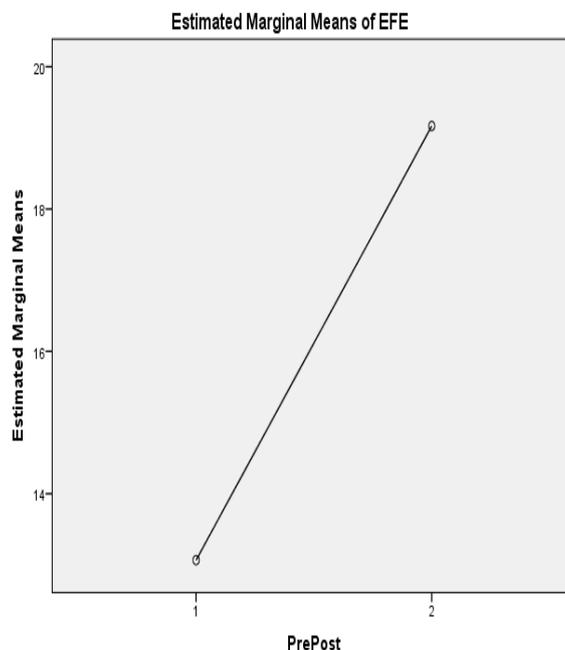The profile plots for EMM of EFE as can be seen in **Figure 4**.

Figure 4. The EMM of EFE scores in pre- and post-tests using textbook.

Studying using Illustrations Manual (IM)
The p value for Post-EFE from Levene Test is > 0.05, so the homogeneity of the variances has been met (in Table 10).

Table 10. The results for Levene and Brown-Forsythe Tests using Pre-Tests as IV.

DV	Levene Test				Brown-Forsythe Test			
	Levene Statistic	df1	df2	Sig.	Brown-Forsythe Statistic	df1	df2	Sig.
Post-ML	.	.	.	.	.	.	.	.
Post-PC	3.878	5	23	0.011	.	.	.	.
Post-LT	4.522	2	25	0.021	.	.	.	.
Post-SRS	3.742	6	21	0.011	.	.	.	.
Post-EFE	1.379	6	14	0.289	.	.	.	.

Table 11. Descriptive Statistics Pre- and Post-Tests for ML, PC, LT, SRS and EFE using One-Way ANOVA Repeated using Illustration Manual as IV.

Test	Mean	Std. Deviation	N
Pre-ML	162.70	11.238	30
Post-ML	168.60	14.517	30
Pre-PC	2.13	2.488	30
Post-PC	5.40	2.762	30
Pre-LT	13.07	0.944	30
Post-LT	12.60	2.444	30
Pre-SRS	9.20	2.074	30
Post-SRS	9.53	3.137	30
Pre-EFE	14.50	5.111	30
Post-EFE	18.23	7.968	30

Table 12. Mauchly's Test of Sphericity for measuring ML, PC, LT, SRS and EFE using Illustration Manual as IV.

Within Subjects Effect	Measure	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon[b]		
						Greenhouse-Geisser	Huynh-Feldt	Lower-bound
PrePost	ML	1.000	0.000	0	.	1.000	1.000	1.000
	PC	1.000	0.000	0	.	1.000	1.000	1.000
	LT	1.000	0.000	0	.	1.000	1.000	1.000
	SRS	1.000	0.000	0	.	1.000	1.000	1.000
	EFE	1.000	0.000	0	.	1.000	1.000	1.000

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. Design: Intercept
 Within Subjects Design: PrePost

b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

Table 13. Univariate Tests for measuring ML, PC, LT, SRS and EFE using Illustration Manual as IV.

Source	Measure		Type III Sum of Squares	df	Mean Square	F	Sig.
PrePost	ML	Sphericity Assumed	522.150	1	522.150	7.713	0.010
		Greenhouse-Geisser	522.150	1.000	522.150	7.713	0.010
		Huynh-Feldt	522.150	1.000	522.150	7.713	0.010
		Lower-bound	522.150	1.000	522.150	7.713	0.010
	PC	Sphericity Assumed	160.067	1	160.067	61.132	0.000
		Greenhouse-Geisser	160.067	1.000	160.067	61.132	0.000
		Huynh-Feldt	160.067	1.000	160.067	61.132	0.000
		Lower-bound	160.067	1.000	160.067	61.132	0.000
	LT	Sphericity Assumed	3.267	1	3.267	1.118	0.299
		Greenhouse-Geisser	3.267	1.000	3.267	1.118	0.299
		Huynh-Feldt	3.267	1.000	3.267	1.118	0.299
		Lower-bound	3.267	1.000	3.267	1.118	0.299
	SRS	Sphericity Assumed	1.667	1	1.667	0.502	0.484
		Greenhouse-Geisser	1.667	1.000	1.667	0.502	0.484
		Huynh-Feldt	1.667	1.000	1.667	0.502	0.484
		Lower-bound	1.667	1.000	1.667	0.502	0.484
	EFE	Sphericity Assumed	209.067	1	209.067	9.859	0.004
		Greenhouse-Geisser	209.067	1.000	209.067	9.859	0.004
		Huynh-Feldt	209.067	1.000	209.067	9.859	0.004
		Lower-bound	209.067	1.000	209.067	9.859	0.004
Error (PrePost)	ML	Sphericity Assumed	1963.350	29	67.702		
		Greenhouse-Geisser	1963.350	29.000	67.702		
		Huynh-Feldt	1963.350	29.000	67.702		
		Lower-bound	1963.350	29.000	67.702		
	PC	Sphericity Assumed	75.933	29	2.618		
		Greenhouse-Geisser	75.933	29.000	2.618		
		Huynh-Feldt	75.933	29.000	2.618		
		Lower-bound	75.933	29.000	2.618		
	LT	Sphericity Assumed	84.733	29	2.922		
		Greenhouse-Geisser	84.733	29.000	2.922		
		Huynh-Feldt	84.733	29.000	2.922		
		Lower-bound	84.733	29.000	2.922		
	SRS	Sphericity Assumed	96.333	29	3.322		
		Greenhouse-Geisser	96.333	29.000	3.322		
		Huynh-Feldt	96.333	29.000	3.322		
		Lower-bound	96.333	29.000	3.322		
	EFE	Sphericity Assumed	614.933	29	21.205		
		Greenhouse-Geisser	614.933	29.000	21.205		
		Huynh-Feldt	614.933	29.000	21.205		
		Lower-bound	614.933	29.000	21.205		

Table 14. Tests of Within-Subjects Contrasts for measuring ML, PC, LT, SRS and EFE using Illustration Manual as IV.

Source	Measure	PrePost	Type III Sum of Squares	df	Mean Square	F	Sig.
PrePost	ML	Level 1 vs. Level 2	1044.300	1	1044.300	7.713	0.010
	PC	Level 1 vs. Level 2	320.133	1	320.133	61.132	0.000

LT	Level 1 vs. Level 2	6.533	1	6.533	1.118	0.299
SRS	Level 1 vs. Level 2	3.333	1	3.333	0.502	0.484
EFE	Level 1 vs. Level 2	418.133	1	418.133	9.859	0.004
Error (PrePost)	ML	Level 1 vs. Level 2	3926.700	29	135.403	
	PC	Level 1 vs. Level 2	151.867	29	5.237	
	LT	Level 1 vs. Level 2	169.467	29	5.844	
	SRS	Level 1 vs. Level 2	192.667	29	6.644	
	EFE	Level 1 vs. Level 2	1229.867	29	42.409	

The Univariate Test and Tests of Within-Subjects Contrasts show that the p value < 0.05, thus there are significant difference between pre-and post-tests of EFE while studying using IM (in Table 13 and 14).
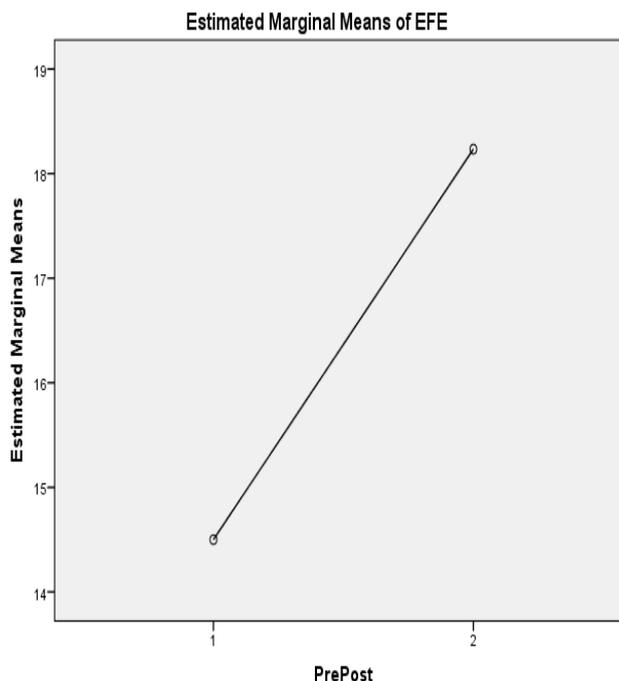The profile plots for EMM of EFE while using IM as in Figure 5.

Figure 5. The EMM of EFE scores in pre- and post-tests using IM.

Studying using Explanation using Sentences Manual (EuSM)
Table 15. The results for Levene and Brown-Forsythe Tests using Pre-Tests as IV.

DV	Levene Test				Brown-Forsythe Test			
	Levene Statistic	df1	df2	Sig.	Brown-Forsythe Statistic	df1	df2	Sig.
Post-ML	.	5	.	.	.	.	.	.
Post-PC	4.483	4	23	0.008	.	.	.	.
Post-LT	5.687	3	24	0.004	.	.	.	.
Post-SRS	1.254	6	23	0.317	7.241	6	18.183	0.000
Post-EFE	2.146	8	18	0.085	.	.	.	.

The homogeneity of variances of Post-SRS and –EFE has been met due to p > 0.05 (as can be seen in Table 15). Descriptive Statistics showed the scores for Pre- and Post-Tests for ML, PC, LT, SRS and EFE when using EuSM then analyzed by One-Way ANOVA (Repeated) (as can be seen in Table 16).

Table 16. Descriptive Statistics Pre- and Post-Tests for ML, PC, LT, SRS and EFE using One-Way ANOVA Repeated using Explanation using Sentences Manual as IV.

Test	Mean	Std. Deviation	N
Pre-ML	153.07	12.624	30
Post-ML	154.80	10.968	30
Pre-PC	2.33	2.187	30
Post-PC	6.30	2.261	30
Pre-LT	12.70	1.784	30
Post-LT	12.50	1.676	30

Pre-SRS	7.50	2.162	30
Post-SRS	8.40	1.653	30
Pre-EFE	8.63	3.917	30
Post-EFE	14.37	5.720	30

Table 17. Mauchly's Test of Sphericity for measuring ML, PC, LT, SRS and EFE using Explanation using Sentences Manual as IV.

Within Subjects Effect	Measure	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon[b]		
						Greenhouse-Geisser	Huynh-Feldt	Lower-bound
PrePost	ML	1.000	0.000	0	.	1.000	1.000	1.000
	PC	1.000	0.000	0	.	1.000	1.000	1.000
	LT	1.000	0.000	0	.	1.000	1.000	1.000
	SRS	1.000	0.000	0	.	1.000	1.000	1.000
	EFE	1.000	0.000	0	.	1.000	1.000	1.000

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.[a]

a. Design: Intercept
 Within Subjects Design: PrePost

b. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

Table 18. Univariate Tests for measuring ML, PC, LT, SRS and EFE using Explanation using Sentences Manual as IV.

Source	Measure		Type III Sum of Squares	df	Mean Square	F	Sig.
PrePost	ML	Sphericity Assumed	45.067	1	45.067	0.947	0.339
		Greenhouse-Geisser	45.067	1	45.067	0.947	0.339
		Huynh-Feldt	45.067	1	45.067	0.947	0.339
		Lower-bound	45.067	1	45.067	0.947	0.339
	PC	Sphericity Assumed	236.017	1	236.017	97.108	0.000
		Greenhouse-Geisser	236.017	1.000	236.017	97.108	0.000
		Huynh-Feldt	236.017	1.000	236.017	97.108	0.000
		Lower-bound	236.017	1.000	236.017	97.108	0.000
	LT	Sphericity Assumed	0.600	1	0.600	0.659	0.423
		Greenhouse-Geisser	0.600	1.000	0.600	0.659	0.423
		Huynh-Feldt	0.600	1.000	0.600	0.659	0.423
		Lower-bound	0.600	1.000	0.600	0.659	0.423
	SRS	Sphericity Assumed	12.150	1	12.150	9.967	0.004
		Greenhouse-Geisser	12.150	1.000	12.150	9.967	0.004
		Huynh-Feldt	12.150	1.000	12.150	9.967	0.004
		Lower-bound	12.150	1.000	12.150	9.967	0.004
	EFE	Sphericity Assumed	493.067	1	493.067	33.729	0.000
		Greenhouse-Geisser	493.067	1.000	493.067	33.729	0.000
		Huynh-Feldt	493.067	1.000	493.067	33.729	0.000
		Lower-bound	493.067	1.000	493.067	33.729	0.000
Error (PrePost)	ML	Sphericity Assumed	1379.933	29	47.584		
		Greenhouse-Geisser	1379.933	29.000	47.584		
		Huynh-Feldt	1379.933	29.000	47.584		
		Lower-bound	1379.933	29.000	47.584		
	PC	Sphericity Assumed	70.483	29	2.430		
		Greenhouse-Geisser	70.483	29.000	2.430		
		Huynh-Feldt	70.483	29.000	2.430		
		Lower-bound	70.483	29.000	2.430		
	LT	Sphericity Assumed	26.400	29	0.910		
		Greenhouse-Geisser	26.400	29.000	0.910		
		Huynh-Feldt	26.400	29.000	0.910		
		Lower-bound	26.400	29.000	0.910		
	SRS	Sphericity Assumed	35.350	29	1.219		
		Greenhouse-Geisser	35.350	29.000	1.219		
		Huynh-Feldt	35.350	29.000	1.219		
		Lower-bound	35.350	29.000	1.219		
	EFE	Sphericity Assumed	423.933	29	14.618		
		Greenhouse-Geisser	423.933	29	14.618		
		Huynh-Feldt	423.933	29	14.618		
		Lower-bound	423.933	29	14.618		

Table 19. Tests of Within-Subjects Contrasts for measuring ML, PC, LT, SRS and EFE using Explanation using Sentences Manual as IV.

Source	Measure	PrePost	Type III Sum of Squares	df	Mean Square	F	Sig.
PrePost	ML	Level 1 vs. Level 2	90.133	1	90.133	0.947	0.339
	PC	Level 1 vs. Level 2	472.033	1	472.033	97.108	0.000
	LT	Level 1 vs. Level 2	1.200	1	1.200	0.659	0.423
	SRS	Level 1 vs. Level 2	24.300	1	24.300	9.967	0.004
	EFE	Level 1 vs. Level 2	986.133	1	986.133	33.729	0.000
Error (PrePost)	ML	Level 1 vs. Level 2	2759.867	29	95.168		
	PC	Level 1 vs. Level 2	140.967	29	4.861		
	LT	Level 1 vs. Level 2	52.800	29	1.821		
	SRS	Level 1 vs. Level 2	70.700	29	2.438		
	EFE	Level 1 vs. Level 2	847.867	29	29.237		

The Univariate Test and Tests of Within-Subjects Contrasts showed that the p value < 0.05, thus there are significant differences between pre-and post-tests of SRS and EFE while studying using EuSM (in Table 18 and 19).

The profile plots for EMM of SRS and EFE while using EuSM are presented as in Figure 6 and 7 respectively.
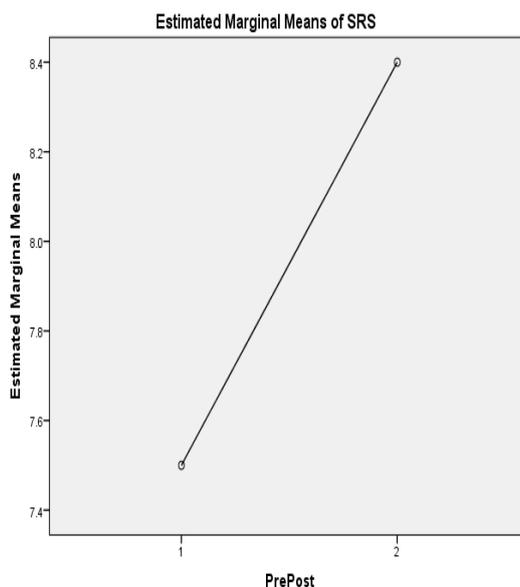

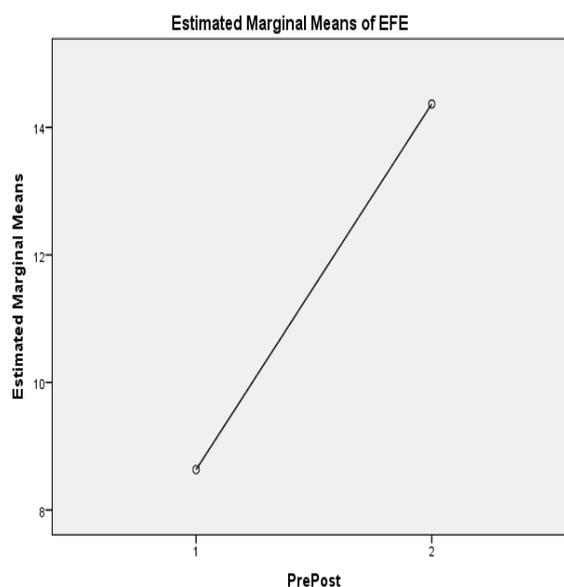**Figure 6.** The EMM of SRS scores in pre- and post-tests using EuSM.

Figure 7. The EMM of EFE scores in pre- and post-tests using EuSM.

IV. Conclusion

Overall, while using types of manuals as IV, there are significant differences of motivational level among students that used these manuals with the highest scores for IM. While there are no significant differences on Post-PC Test for both IM and EuSM. For Post-LT Test, there are also no significant differences among those three manuals used. While Pre-Tests as IV, when using T, there are no significant differences for LT and SRS, except EFE. IM showed mean scores differences for EFE with increasing in Post-Test. There are additions in Post-Tests compared to Pre-Tests while using EuSM for SRS and EFE significantly.

Acknowledgements

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