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Experimental Comparison of Promotion Effect for EFL Reading Comprehension between Conventional Summarization and Toulmin Argument Reconstruction

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Abstract: Summarization is a conventional task to promote reading comprehension. However, because it is impossible to diagnose the summary immediately and accurately, it is not easy to realize formative feedback for ongoing reading comprehension. To solve this issue, we have proposed Viat-map reconstruction as a task for promotion of reading comprehension. Viat-map is a three-component (Data, Warrant and Claim) representation of the Toulmin Argument. Reconstruction means that a learner is required to reconstruct a Viat-map prepared by an expert by using provided components. By comparing the reconstructed map with the original map, it is possible to realize immediate and accurate diagnosis and ongoing formative feedback for the reading comprehension. We have conducted a comparative experiment of promotion effect for EFL reading comprehension between conventional summarization and Viat-map reconstruction. Fifty-eight second year students of Information Technology Department from State Polytechnic of Malang, Indonesia were involved in the experiments. All of them are using English as Foreign Language. The experiment was conducted in an English course Subject for three weeks. Experiment and control group were created equally based on the initial test of reading comprehension test. The experiment group was using Viat-map, while control group is using conventional summarization method. The result of the experiment was analyzed by using ANOVA statistical analysis and Holm's Sequentially Rejective Bonferroni Procedure for POST Hoc analysis. The result shows that Viat-map reconstruction overachieved summarization and both groups can maintain the memory one week after the lesson. However, the delay-post test score for experiment group is higher than control group.

Keywords: English Reading Comprehension, Toulmin Argument, Viat-map, EFL

1. Introduction

English has become one of the most popular languages in the world and is recognized as the most widespread language of communication in the fields of education, technology, business, diplomacy, science, and sports, as well as the service-oriented high-tech industries and many other fields (Zhang, 2011). For every student, regardless of their English proficiency, it is important that they can implement their writing, reading, speaking, and listening skills in their academic or scientific environment as well as their social life. (Dehham et al., 2022). In formal education, studying English as English as Foreign Language (EFL) students, took more account on reading abilities, normally because it is the main point of contact with the target language. English knowledge as international language of communication, is becoming more necessary for many adult university learners (Allard & Mizoguchi, 2021).

Reading is one of the important activities to gain knowledge and information. In other words, reading is one of the gateways to gaining an understanding. Because reading is an active and continuous process that involves people with reading material to build meaning or information (Carrell, 1989). Reading is also interpreted as an active task in which the reader

makes choices from specific words derived from the text and relates them to the situational context to build a model of meaning that describes the meaning that is the same as the meaning intended by the writer (Dole et al., 1991).

Sentence structures in reading materials are generally presented to readers in the form of linear sentences without any good directions to assist the reader in recognizing the logical structure of the text (Eftekhari et al., 2016; Eftekhari & Sotoudehnama, 2018). The condition creates a huge confusion, especially for EFL students. Logical structure of text could assist students to promote an autonomous learning and enhance the depth of learning (Andoko et al., 2020). Toulmin Argument could also be applied to practical teaching(Yang, 2022b, 2022a).

The motivation of this study is assisting students to understand the reading material by using Toulmin Arguments strategy and Viat-map application. Research questions of this study are :

1. Do students who use Viat-map application have a better understanding compared to ones who use conventional summarization method?
2. Do students who use Viat-map application maintain their understanding compared to ones who use conventional summarization method?

Several procedures will be conducted to answer the research question, measuring the level of students understanding and memory retention when using the Viat-map application compared to the ones who are using the conventional summarization method. First, we will compare the pre-test score with the post-test score from each group to find any improvement and then comparing the post-test score between groups to find any differences as the representative of students' understanding. Secondly, we will compare the delayed test score with the post-test score from each group to find any changes and then compare the delayed test between groups as the representative of students' memory retention.

2. Literature Review and Related Reseach

2.1 Toulmin Argument

Toulmin Arguments is a form of implementation of a graphical strategy based on the Argumentation model. The argumentation model can give confidence and influence on the reader because it presents logical and strong reasons to prove the truth of an opinion based on data and facts (Hitchcock, 2005; Junaidah Januin, 2021). Toulmin's argument is a complete argumentation pattern and has a good understanding concept, Toulmin's argument has a description of the learning process which consists of claims, qualifiers, ground, warrants, rebuttals, and backing (Magalhães, 2020; Toulmin, 2003). Toulmin's argument is formed by 3 basic elements, namely Claim, Ground and Warrant (Figure 1). Claim is a sentence, information, conclusion to be conveyed. Ground are facts, evidence or data that become a reference for a Claim, while Warrant is a sentence that connects Ground with a Claim. These three must be formed into a logical framework to provide a strong understanding of literacy (Andoko et al., 2022).

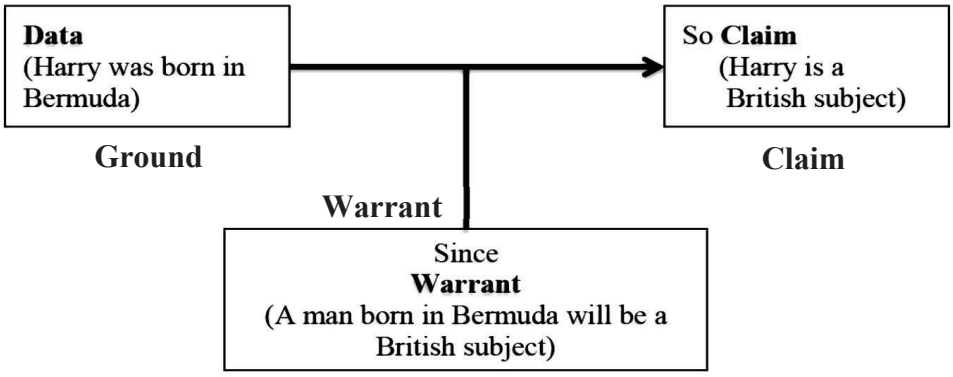
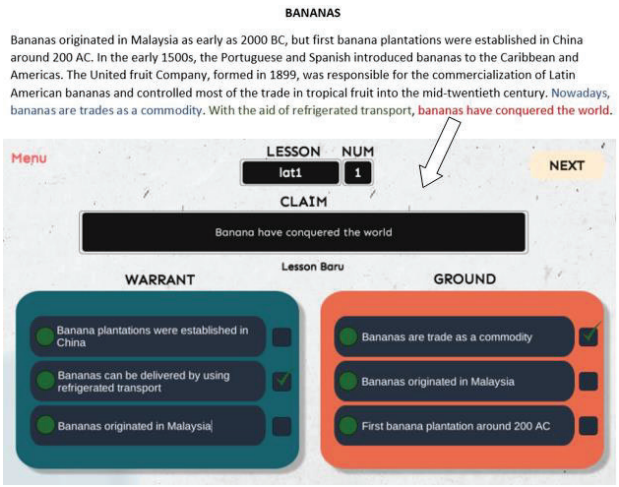


Figure 1. Toulmin Argument concept.

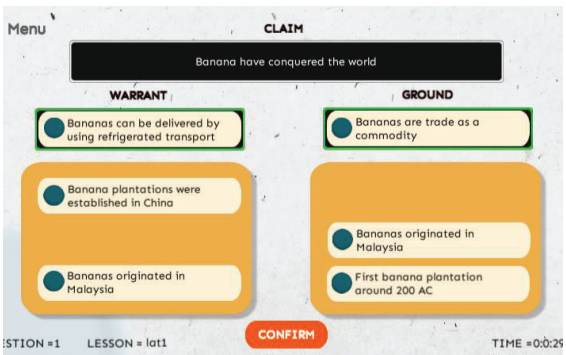
2.2 *Viat-map*

Viat-map is an application developed to provide a deep understanding of literacy. Using it for Reading Comprehension in English for EFL students shows a promising result (Andoko et al., 2022; Rismanto et al., 2021). The main concept is to form a logical framework of text by adopting Toulmin's argument. It intends to emphasize reasoning so students can *construct* a strong understanding of information within the text. There are three main phases of Viat-map (Figure 2) :

1. Teacher's logical map: in this phase, teacher is responsible to create several exercises by selecting important sentences as claim and provide one correct evidence or fact as ground along with two incorrect evidences. Teacher also provides one correct relation between sentences and evidence (warrant) followed by two incorrect relations.
2. Students' working space: in this phase, students are constructing provided exercise by the teacher by selecting the correct ground and warrant, they cannot move to the next claim until they find the correct ground and warrant.
3. Teacher's overlapping analysis feedback: in this phase, teacher can provide feedback by using the overlapping analysis. Teacher can emphasize more feedback by following the number present in each line of answer. The number consists of two different pieces of information, the first number stands for the number of mistakes made by the students, the second number is for the total number of students who made the mistakes. For further information, the teacher can select the line and it will show the information of the students and the number of mistakes made by each student.



Phase 1



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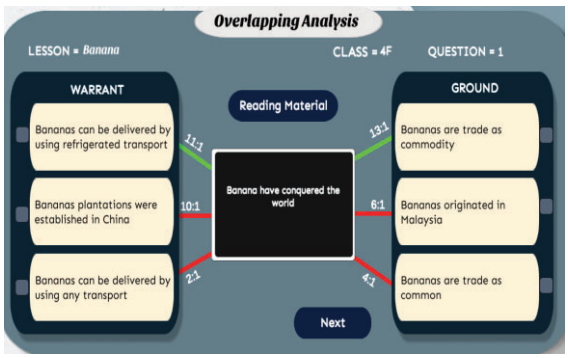

Phase 3

Figure 2. The phases of Viat-map application.

4. Methods

4.1 Experimental Setting

The study took place in October 2022 in an English subject Class of second year Information Engineering Department student of State Polytechnic of Malang. All the students were using English as Foreign Language. There were fifty-eight students involved coming from two different classes. The student never used and familiar with Toulmin argument before. The study was conducted in three weeks where the first week is used to introduce them with Toulmin Argument concept, Viat-map application and to conduct the initial test used to categorize students into a control or experiment group. Each class was divided into two groups to ensure the consistency of the experiment. The next following week was used to conduct the experiment. The third week was used for delayed test. During the experiment, the teacher never give explanation or feedback. Her task was providing the reading material, creating the Toulmin Argument and evaluating the score.

Control groups would use the conventional summarization method where they were creating a summary from the reading material to simplify or to emphasize the most important sentence and words. While control group would be using the Viat-map application to construct their understanding of the reading material. The initial test was using three different reading comprehension material without any treatment to ensure that we get their basic score of reading comprehension test. The experimental design used in the second week was carefully conducted to ensure that we had a controlled environment to avoid unbalanced treatment. The second reading material used of the experiment was using the underlined important sentences so that the control group receive the same hint as the experimental group. The design for the experiment is shown in Figure 3

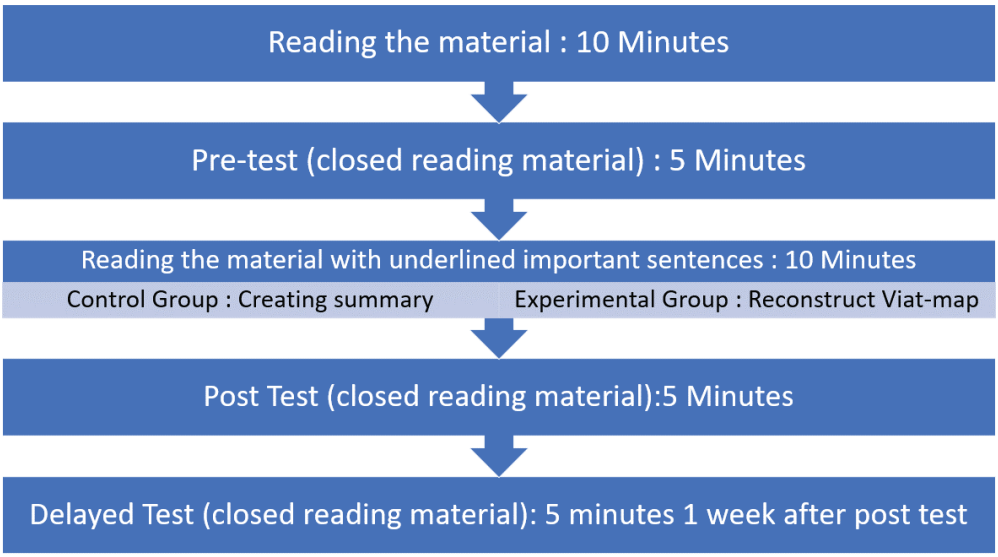

Figure 3. Experimental design.

4.2 Measurement and Analysis

The scoring measurement used in this experiment was using a normal calculation score, each correct answer will receive 1 point. The test material for each group for pre, post and delay-test are using the same material. Students never know their mistakes since the test result is never exposed to them until the experiment is over. The test material consists of 10 multiple choices. Each correct answer will be given 1 point and 0 point for incorrect. Total score is the summary of correct answer. The Analysis was using ANOVA (Analysis of Variance). Considering the students are having the same background, age, and the percentage of gender

is almost the same where Male is 54% while female is 46%. Post hoc analysis using Holm's Sequentially Rejective Bonferroni Procedure was also conducted to explain the ANOVA result in detail.

5. Result

This section will analyze the reading comprehension score from each group.The first step of analysis is the mean analysis for each group for every test (Table 1). The result shows that the standard deviation is smaller than mean. It indicates that each data is clustered around each mean. The second step is checking the Sphericity Test and Epsilons before conducting the ANOVA calculation (Table 2). Based on the result, the sphericity is violated (p-value = 0.0001; $p < .001$), it is occurred because the number of data sample is small. Greenhouse-Geisser (GG), Huynh-Feldt-Lecoutre (HF) and Chi-Muller (CM) correction are used to correct the violation of the assumption of sphericity, it shows that the variance of differences between groups are equal (GG = 0.7816; HF = 0.8179; CM = 0.8148) and the ANOVA calculation can be conducted.

Table 1. *Mean Analysis for each group and test*

GROUP	test	n	Mean	S.D.
Control	El.InitTest	29	5.6897	1.6280
Control	El.PreTest	29	6.1034	1.8774
Control	El.PostTest	29	5.8621	1.7672
Control	El.DelayedTest	29	5.7931	2.4550
Experiment	El.InitTest	29	5.5517	1.8242
Experiment	El.PreTest	29	5.9655	1.4264
Experiment	El.PostTest	29	6.9655	1.5920
Experiment	El.DelayedTest	29	6.8966	1.7596

Table 2. *Mendoza's Multisample Sphericity Test and Epsilons*

Effect	Lambda	Approx. Chi	df	p-value	LB	GG	HF	CM
test	0.0000	37.2606	11	0.0001 ***	0.3333	0.7816	0.8179	0.8148

LB = lower.bound, GG = Greenhouse-Geisser HF = Huynh-Feldt-Lecoutre, CM = Chi-Muller

After checking the sphericity, ANOVA calculation was conducted, and the result can be seen in Table 3. The result indicates that there is no significant difference found between groups for all combined test scores (p-value = 0.2271). However, there are significant different found for test within the groups (p-value = 0.0012; $p < .01$) and each test between groups (p-value = 0.0013; $p < .01$). Based on the ANOVA calculation results, there are significant differences found for the test and each group test. However, the detailed information cannot be determined and needs to conduct a post hoc analysis.

Tabel 3. *ANOVA calculation result for each group ant tests.*

Source	SS	df	MS	F-ratio	p-value
GROUP	13.5172	1	13.5172	1.4916	0.2271 ns
S X GROUP	507.5000	56	9.0625		
test	22.7586	3	7.5862	5.5558	0.0012 **
GROUP X test	22.3448	3	7.4483	5.4548	0.0013 **
S X GROUP X test	229.3966	168	1.3655		

Total	795.5172	231	3.4438	

+p < .10, *p < .05, **p < .01, ***p < .001

Holm's Sequentially Rejective Bonferroni Procedure analysis for “tests” and “GROUP X test” need to be conducted to show a better result. The alpha level used is 0.05. Firstly, mean analysis needs to be conducted to make sure that the data is clustered around the mean (Table 4). The result shows that all the standard deviations are below the mean of each test. Multiple Comparison for "test" then conducted (Table 5). It shows that the combination of post-test score is higher than the combination of initial test while other remain equal.

Table 4. *Mean Analysis for test in groups.*

test	N	Mean	S.D.
El.InitTest	58	5.6207	1.7150
El.PreTest	58	6.0345	1.6540
El.PostTest	58	6.4138	1.7575
El.DelayedTest	58	6.3448	2.1889

Table 5. *MULTIPLE COMPARISON for "test"*

Pair	Diff	t-value	Df	p	Adj.p	
E1.InitTest-E1.PostTest	-0.7931	3.5603	56	0.0008	0.0046	E1.InitTest < E1.PostTest *
E1.InitTest-E1.DelayedTest	-0.7241	2.6037	56	0.0118	0.0589	E1.InitTest = E1.DelayedTest
E1.PreTest-E1.PostTest	-0.3793	2.3405	56	0.0228	0.0914	E1.PreTest = E1.PostTest
E1.InitTest-E1.PreTest	-0.4138	2.0217	56	0.0480	0.1440	E1.InitTest = E1.PreTest
E1.PreTest-E1.DelayedTest	-0.3103	1.3406	56	0.1855	0.3709	E1.PreTest = E1.DelayedTest
E1.PostTest-E1.DelayedTest	0.0690	0.3752	56	0.7089	0.7089	E1.PostTest = E1.DelayedTest

Simple Effects for "GROUP x test" interaction is conducted to explain the interaction between group and test comparisons. Mendoza's Multisample Sphericity Test and Epsilons for GROUP X test was examined to check for any *Sphericity* violation (Table 6). The result showed that there is a violation found due to the small number of samples for test at Control (p-value = 0.0025) and test at Experiment (p-value = 0.0069), however, correction have been made by using GG, HF and CM. After the correction, simple effects for "GROUP x test" interaction was conducted (Table 7). The result showed that: (1) No significant difference found for the initial test between control and experiment group (p-value = 0.7624). (2) No significant difference found for the pre-test between control and experiment group (p-value = 0.7539). (3) Significance difference found for the post-test between control and experiment group (p-value = 0.0154; p < .05). (4) Significance difference found for the delayed test between control and experiment group (p-value = 0.0541; p < .10). (5) No significant difference found for all test in control group (p-value = 0.6465). (6) Significance difference found for all test in experiment group (p-value = 0.0000; p < .001).

Table 6. *Mendoza's Multisample Sphericity Test and Epsilons for GROUP X test*

Effect	Lambda	Approx. Chi	df	p-value	LB	GG	HF	CM
test at Control	0.0001	18.3672	5	0.0025 **	0.3333	0.7321	0.7970	0.7852
test at Experiment	0.0002	15.9899	5	0.0069 **	0.3333	0.7278	0.7917	0.7800

LB = lower.bound, GG = Greenhouse-Geisser HF = Huynh-Feldt-Lecoutre, CM = Chi-Muller

Table 7. *Simple Effects for "GROUP x test" interaction*

Source	SS	df	MS	F-ratio	p-value
GROUP at E1.InitTest	0.2759	1	0.2759	0.0923	0.7624 ns
Er at E1.InitTest	167.3793	56	2.9889		
GROUP at E1.PreTest	0.2759	1	0.2759	0.0992	0.7539 ns
Er at E1.PreTest	155.6552	56	2.7796		
GROUP at E1.PostTest	17.6552	1	17.6552	6.2412	0.0154 *
Er at E1.PostTest	158.4138	56	2.8288		
GROUP at E1.DelayedTest	17.6552	1	17.6552	3.8704	0.0541 +
Er at E1.DelayedTest	255.4483	56	4.5616		
test at Control	2.6897	3	0.8966	0.5545	0.6465 ns
s x test at Control	135.8103	84	1.6168		
test at Experiment	42.4138	3	14.1379	12.6898	0.0000 ***
s x test at Experiment	93.5862	84	1.1141		

+p < .10, *p < .05, **p < .01, ***p < .001

Multiple Comparison for "test at Experiment" using Holm's Sequentially Rejective Bonferroni Procedure was conducted to break down the result found in the simple effect for "GROUP x test" (Table 8). The factor is analyzed as dependent means and the alpha level used is 0.05. The result showed that: (1) initial test score is less than post-test score. (2) initial test score is less than delayed test score. (3) pre-test score is less than post-test score. (4) pre-test score is less than delayed test score. (5) initial test score is equal to pre-test score. (6) post-test score is equal to delayed test score.

Table 8. *MULTIPLE COMPARISON for "test at Experiment" using Holm's Sequentially Rejective Bonferroni Procedure*

Pair	Diff	t-value	Df	p	Adj.p	
E1.InitTest-E1.PostTest	-1.4138	4.5901	28	0.0001	0.0046	E1.InitTest < E1.PostTest *
E1.InitTest-E1.DelayedTest	-1.3448	4.0271	28	0.0004	0.0589	E1.InitTest < E1.DelayedTest *
E1.PreTest-E1.PostTest	-1.0000	3.8079	28	0.0007	0.0914	E1.PreTest < E1.PostTest *
E1.InitTest-E1.PreTest	-0.9310	3.0870	28	0.0045	0.1440	E1.PreTest < E1.DelayedTest *
E1.PreTest-E1.DelayedTest	-0.4138	1.6506	28	0.1100	0.3709	E1.InitTest = E1.PreTest
E1.PostTest-E1.DelayedTest	0.0690	0.3864	28	0.7089	0.7021	E1.PostTest = E1.DelayedTest

6. Discussion and Conclusion

Viat-map application allows students to build a kind of logical structure following the Toulmin Arguments concept. This kind of action will also form a kind of cognitive structure in their perception. By representing students with the visible logical structure in the application, they will also be able to view their own cognitive structure. Viat-map application also directs the students by following the teacher's understanding of the text. Closed-ended approached is beneficial for directing the student to have the same level of understanding as the teacher and will be easier for the teacher to compare the mistakes made by the students. The map reconstruction approach has been implemented for the concept map(Hirashima, 2019) and several investigations have reported that it is useful to realize immediate and accurate diagnosis and feedback (Andoko et al., 2020; Pailai et al., 2017)

Based on the result above, the main objective of this study is to find out the comparison of students' understanding and memory retention between students who use Viat-map and summarization conventional method. Firstly, to measure student understanding, the test score

was used as the representation of students understanding. Secondly, to measure memory retention, the delay-test score was used to measure the students' memorization.

The first aim is to measure students' understanding by using pre-test and post-test scores. Based on the calculation in, the experiment group having an improvement from pre-test to post-test (Table 8), while the control group remain the same (Table7) where test at control found no significant difference (p-value = 0.6465). The comparison of post-test between experiment and control group also shown that experiment group overachieved the control group (Table 7; P-value = 0.0154; $p < .05$). The improvement from pre-test to post-test in experiment group also indicates that there is an improvement of score before using the application (pre-test) compared to the score after using the application (post-test). The experimental result indicated that the use of application helped the students to get a better test score than one that didn't use. Assisting students in learning process by providing the require components to be used by the students could improve their understanding (Hirashima, 2019; Hirashima et al., 2015).

The second aim for memory retention was using the post-test and delay-test score. Based on the result, both groups can get the same score between post-test and delay-test score. However, considering that the delay-test score between control and experiment groups are different, where experiment group overachieved the control group (Table 7; p-value = 0.0541 +; $p < .10$) we can assume that the experiment group is better than the control group for memory retention. To show a better view of the overall test, a line chart of mean for each test in both groups is created (Figure 4). The differences of mean between groups for all tests are clearly showed. Other perspective of the score distribution for each test in both groups, box plot chart was also conducted (Figure 5). The initial test from both group shows that the score distribution is a little unbalance where the control group is denser than the experiment group. However, the score distribution was changed for pre-test where they are almost having the same distribution and means. A huge change occurred for post-test where means value for experiment group is higher than control group, however the score distribution is similar. Other changed is also occurred for delay-test where the distribution score for control group become wider compared to their post-test even the means remain the same.

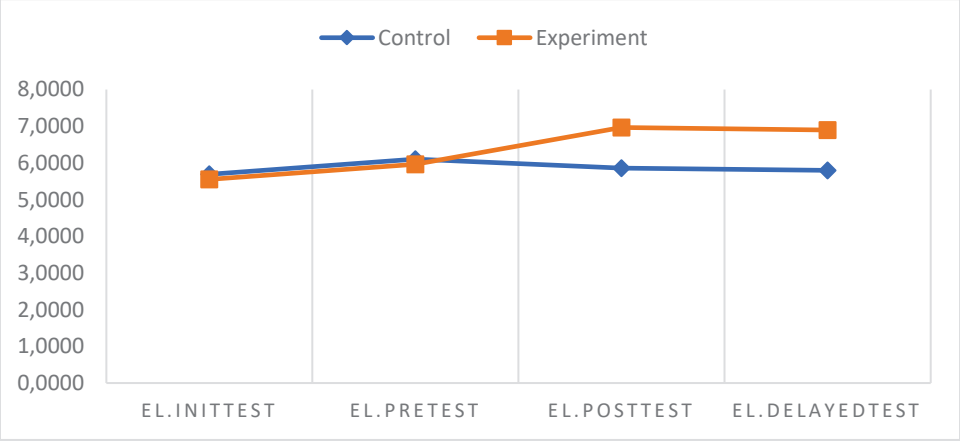

Figure 4. Line chart for control and experiment group.

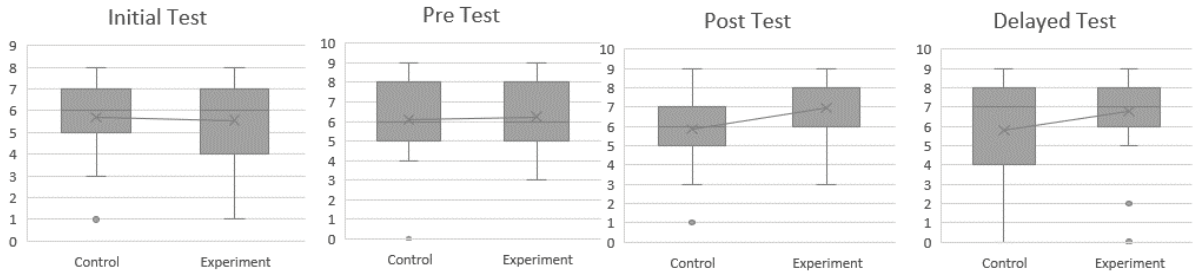

Figure 5. Box plot chart for control and experiment group.

In summary, constructing Toulmin arguments as logical structure offering students to understand the reading material in a different way. Using applications for study could also assist them to enrich their learning process. This study found that students who used Viat-map application have a better understanding compared to one who is not using the application. They also could retain their understanding 1 week after the lesson. However, there are several limitations for this study. First, this study only involves students from one University and one department that cannot represent the university students. Second, the number of sample size is only fifty-eight students which is very small. This study requires more evidence and many students to represent an ideal used of application in a classroom situation. For future research, it is important to conduct a comprehensive log analysis to give a better explanation and new points of view to improve the result of this study.

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