The effectiveness of mind map treatments on writing accuracy at Islamic Higher Education

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Abstract. The study attempted to investigate the learners' writing accuracy amongst digital mind map, paper mind map, and non-mind map treatments. There were two variables: types of mind map having three variances: digital mind map (x1), paper mind map (x2) and non-mind map (x3) as independent variable and writing accuracy (y) as the outcome variable. The study involved L2 participants at higher education in Kalimantan consisting of three groups based on types of mind map: digital mind map/x1 (n=24), paper mind map/x2 (n=23), non-mind map/x3 (n=23).The total number of the participants was 70 students, consisting two groups: experiment 1, (digital mind map class), experiment 2, (paper mind map class), and a control class (non-mind map class). A one way Anova was used to measure an effect of types of mind map on learners' writing score. The finding confirmed that there was a significant effect of types of mind maps at the p<.05 level for the three different treatments [F (2, 67) = 5.811, p = 0.005]. Post hoc with Tukey HSD test confirmed that the average score for digital mind map (M = 76.79, SD = 9.76) differed significantly than paper mind map (M= 68.78, SD 12.32) at p=0.050 and non-mind map at p=0.005. However, paper mind map did not differ significantly than non-mind map ((M= 65.83, SD 12.12) at p= 0 .657. The further studies with larger sample size were needed to validate the research findings. Abstracts max 200 words.

Key words: effectiveness; mind map treatments; writing performance; islamic higher education.

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INTRODUCTION

This perspective, the implementation of mind map can create a meaningful learning (Akinoglu & Yasar, 2007). Previous investigations believed that visual presentation is vital for learners to master new science. Mind map is believed as a powerful useful tool to help visual presentation (Mona & Khalick, 2008, p. 298). Mind map covers four main ideas. The main topic is located in a central image, the main topic radiates as branches. They consisted of an image to associated lines, and the branches. Learners using mind map enables study efficiently and effectively (Nesbit & Adesope, 2006). Mind map enables learners to create a visual image in order to make easier the learning process (Budd, 2004). In addition, the implementation of mind map enables teachers to use a variety of teaching technique (Nesbit & Adesope, 2006). McGriff (2000) believed that connecting images to concepts can improve creativity. Adam and Mowers (2007) confirmed that students having learning tend to have a 40% higher retention rate. Other investigations found that digital mind map is useful for both teacher and learners in learning process (Chiou, 2008; Erdogan, 2008). By using digital mind maps, learners can easily move the objects by dragging and dropping them (Erdogan, 2008). In addition, they can be saved as files and shared to the others (Riley & Ahlberg, 2004). This is a model of digital mind map using NovaMind software.

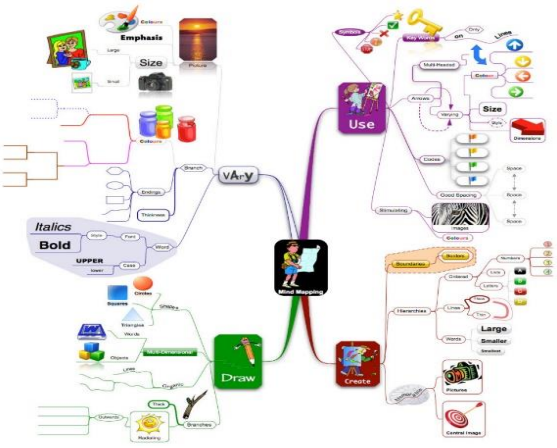


Figure 1. NovaMind model.

The learning theory underlining mind map

There were some learning theories underlining mind map. Cognitivism is a theoretical framework for describing the human mind. They consider that learning is an internal mental schema of knowledge. The focus is on how the brain acquires, structures and processes information. Leonard (2002, p.29) believes that cognitivism focusing on the way the students

process inputs and outputs to understand the way the learners think, and give solution of the problems. The cognitive theory believes that students study via information mental processing. The principle is that learning happened with assimilating new concepts. Here, the students maintain the knowledge structure (Novak & Canas, 2006). Therefore, meaningful learning occurs if the learners associate new knowledge with relevant concepts and prior knowledge. Novak & Canas (2006) believe that this gives strong contribution to meaningful learning. This technique can be applied in the classroom setting through visual aids and mind map tools to aid learners save, process and memorize information. This learning paradigm places teachers not only a source of knowledge but also a motivator for learners in learning process (Zhou, 2004).

The cognitive theory believes that active learning involves cognitive processes. The class instruction is aimed at using instructional tools to aid learners store and recall information. Pictures and words are processed by pictorial and auditory connection respectively (Mayer & Moreno, 2003). Since mind maps present words, pictures, and associations, the technique is designed as an instructional tool to aid learners in pre-writing activity. Some theories of learning such as connectivism, multiple intelligence, cognitive learning constructivism, and schemata theories are believed to be the theory underlining mind map. Schema is the way of information organized and stored. In the same case, mind map reflects the basic idea of constructivism claiming that individuals actively construct new knowledge from their experiences. Constructivists view learning as an active process using sensory input and constructs meaning. In the perspective of constructivism, mind map provides meaningful learning (Akinoglu & Yasar, 2007). Meaningful learning approach believes that to maintain meaningful learning, the students need to assimilate the new concepts with previous knowledge. Mind maps are useful to identify the learners' misconceptions and restructuring the learners' knowledge (Novak, 2010; Christodoulou, 2010). Based on cognitive learning theory (Sweller, Ayres, & Kalyuga, 2011), the brain performs the complex process. Verbal, logical and analytical thinking are performed by left hemisphere. It relates with naming and categorizing things. It is very linier. In contrast, right hemisphere performs with emotions, and intuitive information. It processes information with a non-linear style. When learners receive and process the information, they use and transfer it actively to the long-term memory (Dye, 2000). The function of brain is illustrated in Figure 3.

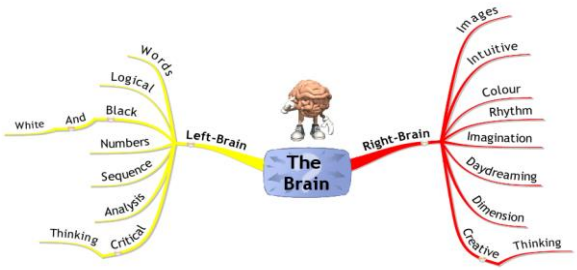


Figure 2. The function of brain
Source: Buzan, 2000, p.42

Investigations on mind map in L2 writing class have been performed by some researchers. For example, Al Naqbi (2011) found that Mind Map provided effective planning and drafting for writing. It guides learners to plan and organize ideas. He confirmed that forming mind maps needs a high level of thinking orders. Learners brainstorm for ideas, for mind maps, followed by visualization and generating ideas. By doing so, learners have chance to memorize, understand, analyze, evaluate the information. It creates a new knowledge in mind map. Moreover, he found that by applying mind map, cognitive skills could be improved. Then, the investigation by Al-Zyoud et al., (2017) revealed that mind map provides useful ideas for learners. It also helps learners to actively motivate in thinking process by activating previous knowledge. Vijayavalsalan (2016) confirmed that the use of mind map facilitated in improving writing skills such as structuring, sequencing, and generating new ideas. He further confirmed that mind map helps learners to plan an essay before starting to write. The learners perceived mind map as a technique that makes essay writing easier. Hallen and Sangeetha (2015) also confirmed that mind map incorporation was helpful for students to write an essay. Davies (2011) also found that mind map was effective tool for familiarizing writing process. Some other researchers claimed that the mind map was more helpful in teaching writing skills because both writing and mind mapping technique required optimum use of one's cognitive capacity. Yunus and Chien (2016) found that students showed positive perceptions toward writing after using the mind mapping technique. Al-Jarf (2009) confirms implementation of mind map motivates learners to perceive positive attitude on writing course, since they can brainstorm and

structuring of paragraphs easily when writing. Then, Rafii (2017) confirmed that the use of mind map could both develop learners' writing skills and arouse learners' motivation. Next, Mercer (2002) confirmed that mind map helps learners in connecting ideas and in linking new information with previous information. In addition, mind map encourages a nonlinear style of thinking. The other investigators (e.g. McGriff, 2007; Novak &Canas, 2006) investigates the effect of mind map in L2 writing. They found that mind map is helpful for L2 learners since mind map is evidenced as to activate students' writing performance. It is believed that mind help provides learners to a meaningful learning. Mind map can also improve learners learning English in writing skills (Ahangari& Behzady, 2011, Lee & Cho, 2010).

To conclude, the above investigation evidenced the effectiveness of mind maps in EFL writing class. To fill the above mentioned gaps the researchers encourage to perform an investigation on the learners' writing accuracy amongst digital mind map, paper mind map, and non-mind map treatments at higher education. Specifically, the study attempts to measure whether there is a significant difference or not on the learners' writing accuracy amongst digital mind map, paper mind map, and non-mind map treatments. This study has some differences from those studies. The current study focuses to measure the effectiveness of three types of mind map writing accuracy amongst Islamic University students. In the present study, the researchers divided types of mind map as independent variable into three categories: digital mind map (x1), paper mind map (x2), non-mind map (x3). The novelty is that the research involves non-mind map class into control group. The design applied a posttest quasi-experiment using a one way analysis of variance with participant's types of mind map. It was expected to give scientific contribution of using mind map in increasing learners' writing accuracy. If the implementation of digital/paper mind maps evidenced to give effect in L2 writing accuracy its, L2 lecturers in Kalimantan context will have a new insight in teaching methodology. Moreover, this will help both teachers and learners for effective teaching methodology for increasing studying with understanding.

METHODS

A pretest-posttest quasi-experiment design was applied to measure the effect of types of mind map (independent categorical variable) on writing outcome. The independent variable was types of mind map having three variances: digital mind map (x1), paper mind map (x2) and non-mind map (x3) and the outcome variable (writing accuracy/ y). A one-way ANOVA was basically constructed to test the difference between three or more variables. The study involved L2 participants consisting of three groups based on types of mind map: digital mind map/x1 (n=24), paper mind map/x2 (n=23), non-mind map/x3 (n=23).The total number of the participants was 70 students, consisting two groups: experiment 1, (digital mind map class), experiment 2, (paper mind map class), and a control class (non-mind map class). All classes were given pre-posttests. on essay writing. The independent variables of the study were types of mind map: digital mind map/x1, paper mind map/x2, and non-mind map/x3. Meanwhile the dependent variable was the learners' writing score (y). Therefore, the theoretical thinking of the research was described in Figure 4.

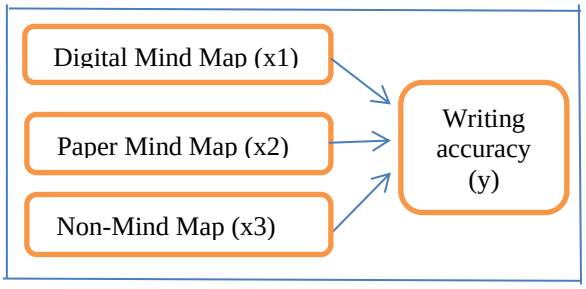


Figure 4. Theoretical framework

This type of Anova was used to measure an effect of types of mind map (digital mind map, paper mind map, non-mind map) on learners' writing score. Here, It determined if there was an effect amongst types of mind on writing accuracy. This study was performed at higher education in Kalimantan. The number of the subjects was 70 L2 learners, as explained in Table 1.

Table 1. The Participants of the study

Types of treatment (A)	Total
Digital Mind Map (A1)	24
Paper Mind Map (A2)	23
No Mind Map (A3)	23
Total	70

Data Collection Procedure

There were 70 EFL learners participated in the investigation. The participants were classified into two groups: two experiment groups (digital mind map/ x1 and paper mind map/x2 classes and one control group (non-mind map class/x3). At the beginning, all three classes were given pretest

in order to know the early ability and to ensure that all participants had equal ability in writing. The result of p value was 0.07> 0.05 meaning that the groups had similar writing ability. During the learning process in the whole semester, each class were taught the same materials such as introduction to expository essay writing, the structure of an essay, and the development of an essay. During the writing class, they implemented three steps in writing process. However, they obtained different treatment. The experiment group 1 was treated using digital mind map. Then, the experiment group 2 was treated using paper mind map. Meanwhile, the control class was not given any treatment (non-mind map). Step 1 was planning. In planning step, they were given the materials of expository essay. Individually, they selected the interesting topic. Step 2 was drafting. In drafting, they wrote the first draft. Here, before writing the first draft, each class was given different treatment as mentioned above. Step 3 was editing and publishing. In this step, they revised the composition on sentence structure, punctuation, diction, grammar rules, organization, and so on. Afterward, they wrote the final product and submitted to the teacher. At the end of semester, all class were given posttest. They were assigned to write an expository essay about 450-500 words. Each learner was assigned about four to five paragraphs of an expository essay in 90 minutes. The score was based on content, organization, sentence structure, and mechanics. The learners' writing product was scored using the scoring method as proposed by Weigle (2002, p. 116). The scores of each class were compared to see the effect of three different treatments in writing class. Finally, the data were gathered and tabulated using SPSS program.

Significance Test

The null and alternative hypotheses are:

$$H_0: \mu_1 = \mu_2 = \mu_3 = \cdots = \mu_k$$

Where:

μ : group mean

k : number of groups (digital mind map, paper mind map, non-mind map)

This analysis used a 5% level of significance or α = 0.05 to test the hypothesis, and the F test was used for statistical significance. In the present study, the null hypotheses was: "there is no significant difference on the learners' writing accuracy amongst digital mind map, paper mind map, and non-mind map treatments.

Validity and Reliability

To meet the validity of the test, face validity and content validity were used. Then, reliability was done using correlation product moment calculation by applying it to a pilot study of (L2) students (outside from the sample). The result of r value was (0.82), which was in accordance with this study.

Data Analysis

The data were collected through pre-post writing test. The three different classes were scored and compared in order to see the difference on the learners' writing accuracy amongst digital mind map, paper mind map, and non-mind map. All of the data were calculated using SPSS program. In analyzing data, the first step was to perform the assumption tests such as normality (using Kolmogorov-Smirnov test) and homogeneity tests (using levene's test). The next step was to test the null hypothesis by using a one way ANOVA, descriptive statistics, and post hoc test. Lastly, the interpretation was made to accept or reject the null hypothesis. Then, the discussion was made to clarify the research findings.

RESULTS AND DISCUSSION

The assumption test for a one way Anova was done before testing the hypothesis.

Assumption test

Before testing the hypothesis, the test assumption was conducted. They were normality test and homogeneity test, as shown in Table 2.

Table 2. Normality Test

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Treatments	Statis	df	Sig.	Statis	df	Sig.
Learners' Writing Accuracy	Digital Mind Map	.161	24	.106	.943	24	.187
	Paper Mind Map	.148	23	.200*	.973	23	.768
	Non-mind Map	.092	23	.200*	.980	23	.900

The output confirmed that the sig value of Kolmogorov-Smirnov for Digital Mind Map (0.106); Paper Mind Map (0.200); and Non-mind Map (0.200). It was said that the data was in normal distribution. Then, Table 3 showed the homogeneity test, as follows

Table 3. Homogeneity test

Levene Statistic	df1	df2	Sig.
.685	2	67	.508

The output Levene's Test confirmed that the sig. value of writing accuracy was 0.508> 0.05. It was said that the data were not violated the homogeneity.

Testing hypothesis

There was a single research question: Is there any significant difference on the learners' writing accuracy amongst digital mind map, paper mind map, and non-mind map treatments? To test the hypothesis, there were some procedures to be performed. First, the mean score for each variable was illustrated in Table 4.

Table 4. Descriptive Statistics

Types of Mind Map	N	Mean	Std. Dev	Std. Error	95% Confidence Interval for Mean		Min	Max
					Lower	Upper		
Digital Mind Map	24	76.79	9.762	1.992	72.66	80.91	50.00	93.00
Paper Mind Map	23	68.78	12.32	2.569	63.45	74.11	42.00	90.00
Non-mind Map	23	65.82	12.115	2.526	60.58	71.06	45.00	91.00
Total	70	70.55	12.207	1.459	67.64	73.46	42.00	93.00

This table provided the average score, standard deviation (SD), and standard error (SE) for each group. The descriptive table showed the mean score for digital mind map was 76.79 (SD=9.76, SE= 1.99) n=24; for paper mind map was 68.78 (SD=12.32 SE=2.57) n=23; for non-mind map was 65.83 (SD=12.12, SE=2.53) n=23. The total mean was 70.56 (SD=12.21, SE=1.4) n=70. The output confirmed that the participants using digital and paper mind maps had better achievement than those who did not use mind map. The mean score of all groups was illustrated in Figure 5.

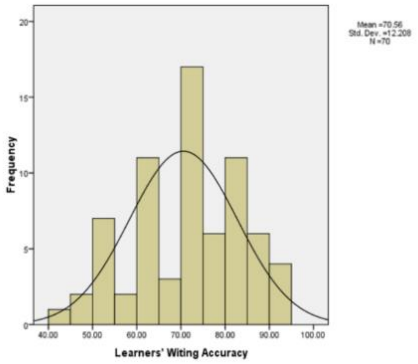


Figure 5. The mean score of the whole.

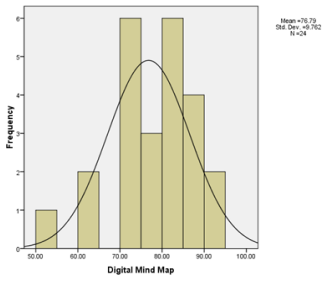
The next step was to see the result of F test, as described in Table 5.

Table 5. Analysis of Variance

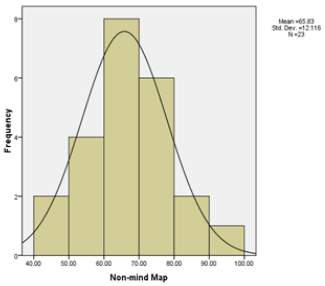
Source variation	Sum of squares	df	Mean square	F	Sig.
Between Groups	1520.096	2	760.048	5.811	.005
Within Groups	8763.176	67	130.794		
Total	10283.271	69			

The output confirmed that the F value was 5.811, and the sig value was 0.005. Based on the output, it was said that there was significant different effect of types of mind maps on learners writing accuracy at the p< 0.050 significance level for the three different treatments (F 2.67)=5.811, p=0.005). The mean score of each was illustrated in Figure 6.

Digital Mind Map (X1)



Non-Mind Map (X3)



Paper Mind Map (X2)

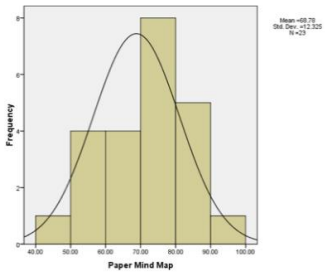


Figure 6. The mean score of each group

The figure showed a difference means of different types of mind map on the learners' writing performance at the mean square between groups 760.048. The mean square within groups 130.794, F(2.69)=5.811, (p=0.005). In addition, the post hoc analysis was shown in Table 6.

Table 6. Post Hoc Test

	(I) Treatments	(J) Treatments	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower	Upper
Tukey	Digital Mind Map	Paper Mind Map	8.009*	3.33	.050	.010	16.00
		Non-mind Map	10.965*	3.33	.005	2.96	18.96
	Paper Mind Map	Digital Mind Map	-8.009*	3.33	.050	-16.00	-.0104
		Non-mind Map	2.956	3.37	.657	-5.12	11.03
	Non-mind Map	Digital Mind Map	-10.965*	3.33	.005	-18.96	-2.96
		Paper Mind Map	-2.956	3.37	.657	-11.03	5.12

The output indicated that Post hoc comparisons using the Tukey HSD test showed the mean differences between (1) digital mind map and paper mind map; (2) digital mind map and non-mind map; (3) paper mind map and non-mind map. From the output, it was seen a significant difference between all three different types of mind map (p<0.005). The output showed that the mean difference between digital mind map and paper mind map was 8.009, SE=3.337, p=0.050. This indicated the mean difference was significant. It meant that digital mind map was better than paper mind map. Meanwhile, the mean difference between digital mind map and non-mind map was 10.965, SE=3.337, p= 0.005; It meant that digital mind map was better than paper mind map. In contrast, the mean difference between paper mind map and non-mind map was 2.956, SE=3.372, p= 0.657. As the p value was higher than 0.05, it indicated the mean difference was not significant. It meant that paper mind map did not differ significantly from non-mind map. It was said that digital mind map was better than paper mind map and non-mind map, as illustrated in Figure 7.

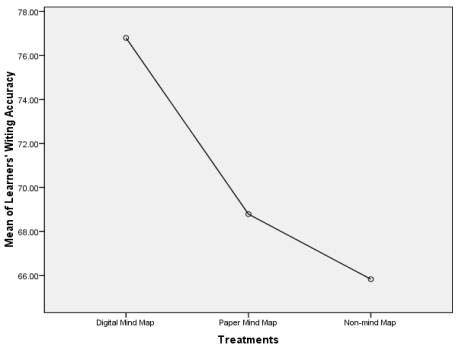


Figure 7. The three different treatment

The figure showed the mean score of writing was significantly different in three condition: digital mind map, paper mind map and non-mind map, as illustrated in Table 7.

Table 7. The different mean

			Subset for alpha = 0.05	
	Treatments	N	1	2
Tukey HSD[a]	Non-mind Map	23	65.8261	
	Paper Mind Map	23	68.7826	68.7826
	Digital Mind Map	24		76.7917
	Sig.		.653	.051

The output confirmed that there was a significant difference between digital mind map and paper mind map and digital mind map and non-mind map. However, there was no significant difference between paper mind map and non-mind map.

To sum up, the statistical analysis of one way ANOVA was used to measure the effect of types of mind maps on learners writing accuracy. The table of one way analysis variance concluded there was significant different between groups (types of mind maps) on learners writing accuracy at the $p<0.050$ significance level for the three different treatments ($F=2.67)=5.811$, $p=0.005$), as demonstrated in Table 8.

Table 8. ANOVA

Source of variation	SS	df	MS	F	Sig.
Between	1520.096	2	760.048	5.811	.005
Within	8763.176	67	130.794		
Total	10283.271	69			

The output confirmed that p-value (0.005) was lower than alpha (0.05). It was obvious, the null hypothesis claiming there was no difference on the learners' writing accuracy amongst digital mind map, paper mind map, and non-mind map treatments was rejected. There was no enough to support the claim that the means of three different treatment were equal. There was a significant effect of types of mind maps at the $p<0.05$ level for the three different treatments ($F=2,67)=5.811$, $p= 0.005$). Post hoc comparisons with Tukey HSD test confirmed that the average score for digital mind map (M=76.79, SD=9.76) differed significantly than paper mind map (M= 68.78, SD=12.32) at p=0.050 and non-mind map at p=0.005. However, paper mind map did not differ significantly than non-mind map (M= 65.83, SD=12.12) at p= 0 .657.

The finding confirmed that there was a significant effect of types of mind maps at the $p<0.05$ level for the three different treatments ($F(2,67)=5.811$, $p=0.005$). Post hoc with Tukey HSD test confirmed that the average score for digital mind map (M=76.79, SD=9.76) differed significantly than paper mind map (M=68.78, SD=12.32) at p=0.050 and non-mind map at p=0.005. However, paper mind map did not differ significantly than non-mind map ((M= 65.83, SD=12.12) at p= 0 0.657. This findings were significant with Al Naqbi (2011) found that Mind Map provided effective planning and drafting for writing. Al-Zyoud et al., (2017) found that mind map gave chance to learners to come up with original and useful ideas. Nurlaila (2013) stated that the use of mind mapping technique enriches vocabulary, creativity and encourages writing skills. Vijayavalsalan (2016) confirmed that the use of mind map facilitated in improving writing skills such as structuring, sequencing, and generating new ideas. Hallen and Sangeetha (2015) also confirmed that mind map incorporation was helpful for students to write an essay. Davies (2011) also found that mind map was effective tool for familiarizing writing process. Yunus and Chien (2016) found that students showed positive perceptions toward writing after using the mind mapping technique. Al-Jarf (2009) confirms implementation of mind map motivates learners to perceive positive attitude on writing course. Then, Rafii (2017) confirmed that the use of mind map could both develop learners' writing skills and arouse learners' motivation. In this regard, Mercer (2002) confirmed that mind map helps learners in connecting ideas and in linking new information with previous information. The finding was also in accordance with Al-Jarf (2009) found that the mind map technique aids learners to compose a better essay writing helps. Then, Darayesh (2003), Sabarun (2020), Elhawwa (2019) evidenced that mind map helped to develop writing proficiency. Also, Saed and Al-Omari (2014) confirmed that mind map enhance learners' writing performance in Jordan. The benefits of mind map in prewriting strategy were as follows. First, the majority of learners can enjoy mid map class and it contributed to develop writing ability. Second, it was noticed that mind map improved learners' ability to organize ideas and produced a better writing product. In this case, Bharambe (2012) confirmed that learners become skillful in organizing ideas and promoted learners' writing creativity. Then, Keles (2012) claimed that mind map was an effective way and promoted critical thinking.

All in all, the finding provides new insight in teaching strategy especially in L2 writing

instructions. The finding also demonstrated that mind maps both digital and paper mind map performed better than non-mind map. It enabled learners to generate ideas for writing expository essay. It was evidenced that learners using mind map performed a better quality in essay writing. It helped learners easily understand to do the writing assignment given. It was recommended that writing teachers applied mind map in prewriting technique to help learners organize ideas and broaden their knowledge on writing skills. Consequently, it motivated learners and activated their previous knowledge which contributed to generate ideas. Since this study only involved limited participants, it was recommended for other researchers to perform similar studies on the effect of mind map with a wider scope and sample size to validate this finding.

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