Research Paper

The Impact of Incorporating Concept Mapping in Project-Based Learning on Learning Strategy and Cognitive Styles upon Learning Outcomes of Writing Skills

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ABSTRACT

In a learning process there is a variety of strategies which may be implemented to improve writing skills, one of which is incorporating concept mapping in project-based learning. This strategy is implemented to improve knowledge and creativity skills in a team or group-based problem-solving activity. Furthermore, it is assisted with concept mapping by organizing concepts or ideas. This research applied 2×2 factorial design and was included in a quasi research by involving second semester students of *Sekolah Tinggi Agama Islam Diniyah Pekanbaru*as the subject. The number of students as the research subject is 60 students from two different classes of the academic year 2018/2019. The data from those two classes was obtained by employing cluster random sample. The researchers applied two ways ANOVA technique to test the research hypothesis. The research results show that; (1) there is a significant difference of writing skills between students who were being applied with project-based learning strategy with concept mapping and students who were being applied without concept mapping. It shows that the ideas development in writing which is being applied with concept mapping is more focused and student creativity is more developed, (2) there is a difference in student writing skill on field independence (FI) and field dependence (FD) cognitive styles. The result shows that the students with FI cognitive style have better writing skill than the students with FD cognitive style, and (3) there is no impact of interaction on learning strategy between project-based learning which is incorporated with concept mapping and the one without. Since there is no significant difference on the writing skill grade between the team having project-based learning with concept mapping and the one without either with FI or FD cognitive style.

Key words: Project-Based Learning, Concept Mapping, cognitive style, writing skill

1. INTRODUCTION

Learning requires closeness to the learning materials to be studied long before understanding it. Learning also requires closeness to various matters, not merely repetition or rote learning. The most important matter is how students experience their involvement mentally in the learning process [1]. According to Slavin [2] teachers as professionals must be able to decide, (1) how to recognize problems and issues, (2) how to assess project-based learning with concept mapping situations from various points of view, (3) how to apply relevant professional knowledge to formulate action, (4) how to take the most appropriate action, and (5) how to assess the consequences.

Based on preliminary observations, the researchers found several reasons upon the low interest in learning Bahasa Indonesia at *Sekolah Tinggi Agama Islam (STAI) Diniyah Pekanbaru*, even though the students' grades in the Bahasa Indonesia course were in the moderate or average category. This is indicated by the learning

process which is still limited to theory and has not yet constructed an affection of Indonesian in language skills unconditionally, specifically writing skills. Another reason is that the applied teaching materials have already exist, but not all of them has met the criteria. Lectures still rely on the teacher-centered learning method meaning that the lecturers are the center of learning activities and have not yet provided space for students to be active and innovative in the learning process. Based on those matters, the researchers conducted project-based learning with concept mapping and cognitive styles upon students' learning outcomes of writing skills.

2. LITERATURE REVIEW
A. *Project-Based Learning*

According to Constantinou [3] in his article, this type of learning through project implementation is called Project-Based Learning (PjBL). Project-based learning strategies involve students in authentic assignments and real-world contexts, in order to enhance learning. Students are given a project or problem of which there are many solutions, which aim to simulate the real authentic situation.

Global School Net [4] reports the results of research by the Auto Desk Foundation on the characteristics of Project-Based Learning. The results of this research state that Project-Based Learning is a learning approach which has the following characteristics as follows:
a. Students make decisions about a framework.
b. There are problems or challenges which are proposed to students.
c. Students design processes to determine solutions to proposed problems or challenges.
d. Students are collaboratively responsible for accessing and managing information to solve problems.
e. The evaluation process is implemented continuously.
f. Students periodically reflect on the implemented activities.

g. The final product of the learning activity will be qualitatively evaluated.
h. Learning situations are greatly tolerant of mistakes and changes.

Based on the previous opinions, one may state that the project-based learning approach was developed based on the constructivism philosophy in learning activity. Constructivism develops a learning atmosphere which requires students to construct their own knowledge. Project-based learning is a learning approach which gives students the freedom to plan learning activities, collaboratively conduct projects, and eventually produce work outcomes which can be presented to others.

B. *Concept Mapping*

Concept Mapping (CM) is an alternative learning strategy which can be chosen to improve the quality of lectures and increase student creativity. This learning strategy was originally developed in the fields of science such as biology, physics, chemistry and nursing.

Erman [5] states the characteristics of concept mapping are as follows: (a) Concept mapping is a way to show the concepts and propositions of a field of study. By implementing a concept map, students are able to comprehend the field of study more clearly and more meaningfully learn the field of study. (b) A concept mapping is a two-dimensional image of a field of study. This characteristic is able to show proportional relationships between concepts. (c) Not all concepts have the same portion. This means that there are concepts which are more inclusive than the others. (d) When two or more concepts are described under a more inclusive concept, a hierarchy is formed in the concept mapping. Based on these characteristics, it is better if concept mapping is arranged hierarchically, meaning that more inclusive concepts are placed at the top of the map, the lower the concepts are sorted into less inclusive concepts.

Arends [6] states steps in constructing concept mapping as follows: (1) identify main idea or principal involving

several concepts, (2) identify second ideas or concepts supporting the main idea, (3) place main ideas in the center or at the top of the map, and (4) group the second ideas surrounding the main idea which visually shows the connection between those ideas and the main idea.

The advantage of concept mapping as learning strategy namely, (1) ease to observe the overview, (2) help the brain to: manage, remember, compare, and build connection, (3) ease to add new information, (4) review may be done more quickly, and (5) every map is unique.

C. Cognitive Styles

Cognitive styles are one of the new ideas in the study of development and educational psychology. The idea is developing on researches of how an individual gain and organize information from their surroundings. Wool folk [7] explains that cognitive styles are how one gain and organize information from their environment, meanwhile cognitive styles are divided into two, field independence (FI) and field dependence.

According to Liu and Ginter [8] an individual's characteristics of field independence in learning are as follows: (1) self-focusing on curriculum in details, (2) self-focusing on facts and principals, (3)

rarely making interaction with the teacher, (4) formal interaction with the teacher only made in order to do assignments, and prefer to get reward individually, (5) prefer to work individually, (6) prefer to gain competence, and (7) able to organize information independently.

D. Writing Skills

Through writing, students are able to comprehend information on a deeper level. Writing may create knowledge more meaningful and is easier to be kept. In short, writing is a valuable literacy tool to improve learning regarding content.

According to Tarigan [9] writing is a form of thinking; however it is all about thinking of specifically reading and timing, the utmost important is to master principals in writing and thinking to reach goal and purpose. Writing skills will not be formed merely by language skills, yet it also needs to be supported by logical skills and knowledge of basic rhetoric.

3. METHODS

This research was designed with quasi experiment design employing pretest-post test non-equivalent control group design [10] factorial version of 2×2. The factorial 2×2 design is presented in Table 3.1 on the following page.

Table 3.1.: Factorial 2×2 Research Design

Cognitive Styles (Y)	Learning Strategy (X)	
	Project-based learning with concept mapping (**X1**)	*Project-based learning without concept mapping*(**X2**)
Field independence (Y1)	X1 Y1	X2 Y1
Field dependence (Y2)	X1 Y2	X2 Y2

The research subjects are students of Islamic Education Study program of second semester which consist of 170 students (five classes) from *Sekolah Tinggi Agama Ilam Diniyah Pekanbaru*. The researchers randomly selected the subjects by raffling on who are going to be the research subjects or commonly known as cluster random sampling. The researchers chose two classes with the first class as the experiment class consisting of 30 students and second class

as the control class consisting of 30 students as well.

Validity test was employed to measure the accuracy of an instrument applied in the research. In other words, the validity was connected to the accuracy of a measurement tool. In the development, the validity test was employed to obtain validity of the measured data [11]. Cognitive styles' measurement tool was adopted from GEFT which was developed by Witkin [12], of which divided two types of cognitive styles,

namely field dependence and field independence.

In this research, the data were obtained through two stages, namely: (1) experiment preparation stage and (2) experiment implementation stage. The data analysis was tabulated based on the variable of which was presented and counted to answer the research hypothesis [13]. The data analysis was divided into two try-outs namely hypothesis test and requirement analysis test which includes normality test and variable homogeneity test. Those try-outs were conducted to all research variables.

4. RESULTS AND DISCUSSION

All students were given questionnaires on cognitive styles which were questionnaires to differentiate field independence and field dependence cognitive styles. The students' cognitive styles identification results were presented in Table 4.1.below:

Table 4.1. Cognitive Styles Identification Results

Cognitive Styles	Control Class	Experiment Class	Total
field independence(FI)	24	21	45
field dependence (FD)	6	9	15
Total	**30**	**30**	**60**

From the students' cognitive styles identification results as presented in the Table 4.1., it can be seen that 24 students have field independence (FI) and only 6 students have field dependence of 30 students of experiment class (PjBL with CM). Meanwhile, out of 30 students in the control class (PjBL without CM) there are 21 students having field independence (FI) and 9 studentshaving field dependence (FD)

Students' pretest scores of Islamic Education Study Program of *Sekolah Tinggi Agama Islam Diniyah Pekanbaru* between

students who are entitled to project-based learning with concept mapping and those with project-based learning without concept mapping, having field independence and field dependence cognitive styles, were recapitulated to obtain an overvied of research subject preliminary condition[14]. The recapitulation of the students' pretest scores is presented in the following Table 4.2.

Table 4.2.: Students' Writing Skill Pre-Test Score Results

Cognitive styles	Control Group		Experiment Group	
	Average	Std. Deviation	Average	Std. Deviation
FI	61.43	10.86	66.25	8.75
FD	58.33	9.68	58.33	9.83

Based on Table 4.2. it can be concluded that the control class, or the group of students having project-based learning without concept mapping when the pre-test was conducted, has students' writing skill scores with FI cognitive style reaches 61.43 with deviation standard of 10.86. Meanwhile, students with FD cognitive style reach average score of 58.33 with deviation standard of 9.68. Experiment class students or the student group which learn applying project-based learning with concept mapping on the pre-test reaches average writing skills score with FI cognitive style of 66.25, with deviation standard of 8.75.

Initial ability of research subjects coming from the previous pre-test score was later analyzed by SPSS program to obtain an overview of how significant students writing skills ability between experiment and control class. Independent sample t-test analysis results with the support of SPSS program are presented in the following Table 4.3.

Table 4.3.: T-test results for Pre-test Scores

	Group	N	Mean	Std. Deviation	Std. Error Mean
Writing Skills Pre-test	PjBL with CM	30	64.6667	9.37102	1.71091
	PjBL without CM	30	60.5000	10.45104	1.90809

The results of the SPSS output in Group Statistics on the previous page show that there are 30 students in the experiment

class or with project-based learning with concept mapping who have an average pre-test score of 64.67, whereas in the control

class or project-based learning without concept mapping, the pre-test score is 60.50. The Independent Samples Test output which is presented in table 4.4 shows the Sig Levene's Test value. Table 4.4 shows the number 0.266, which has 0.05 more value, and it can be concluded that there is no difference in the diversity (variant) of the writing skills scores between the control group (PjBL without) and the experiment group (PjBL with CM) [15], therefore testing may be conducted with an independent t-test assuming a homogeneous variety of data (equal variance assumed).

Table 4.4.: Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Writing Skills Pre-Test	Equal variances assumed	1.261	.266	1.626	58	.109	4.16667	2.56281	-.96336	9.29669
	Equal variances not assumed			1.626	57.323	.109	4.16667	2.56281	-.96465	9.29798

The post-test score is the students' writing skills score obtained after the students were being provided learning activities applying project-based learning with concept mapping strategy and project-based learning without concept mapping strategy. The post-test scores for writing skills are presented in the following Table 4.5.

Table 4.5.: Students' Writing Skill Post-Test Score Results

Cognitive Styles	Control Class		Experiment Class	
	Mean	Std. dev.	Mean	Std. dev.
FI	67.86	6.04	73.75	5.37
FD	65.00	3.54	67.50	5.24

Table 4.5 above shows that in the control class or in the group of students who learn by applying project-based learning without concept mapping strategy at the post-test, the average score of student writing skills with a cognitive style of FI reaches 67.86, with a standard deviation of 6.04. Meanwhile, the average score of writing skills of students who have a cognitive style of FD reaches 65.0 with a standard deviation of 3.54. As for the group of students in the experiment class or in the group of students learning by applying project-based learning with concept mapping strategy at the time of the post-test, the average score of students' writing skills with a cognitive style of FI reaches 73.75, with a standard deviation of 5.37, whereas the average score of writing skills of students who have a cognitive style of FD reaches 67.5 with a standard deviation of 5.24.

The comparison of the abilities of research subjects after being given a learning strategy which was derived from the post-test results was then analyzed employing the SPSS program to obtain an overview of how significant the students' writing skills were between the experiment class and the control class. The results of the independent sample t-test analysis employing the SPSS program are presented in Table 4.6 on the following page.

Table 4.6.: T-test Results of Writing Skills Post-test

	Class	N	Mean	Std. Deviation	Std. Error Mean
Writing Skill Post-Test	PjBL without CM	30	72.5000	5.83539	1.06539
	PjBL with CM	30	67.0000	5.50861	1.00573

Table 4.7.: Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Writing Skills Post-Test	Equal variances assumed	.082	.776	3.754	58	.000	5.50000	1.46511	2.56726	8.43274
	Equal variances not assumed			3.754	57.808	.000	5.50000	1.46511	2.56705	8.43295

The results of the SPSS output in T-test Results of Writing Skills Post-test table above show that there are 30 students in the experiment class or with project-based learning with concept mapping who have an average post-test score of 72.5 while in the control class or project-based learning without concept mapping is 67.0. The Independent Samples Test output table shows that the Sig Levene's Test value shows a number of 0.776 which is 0.05 more valuable, and it can be concluded that there is no difference in the diversity (variance) of the writing skill scores between the control class (PjBL without) and the experiment class (PjBL with), therefore testing can be conducted with an independent t-test assuming a homogeneous variety of data (equal variance assumed).

Next, a comparative test was conducted for the value of writing skills based on the field independence and field dependence cognitive style, with the test results employing the unpaired t-test analysis as follows:

Table 4.8.: T-test Results of Writing Skills Based on Cognitive Styles

	Cognitive Style	N	Mean	Std. Deviation	Std. Error Mean
Writing Skill Post-Test	FI	45	71.0000	6.36039	.94815
	FD	15	66.0000	4.30946	1.11270

Table 4.9.: Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Writing Skills Post-Test	Equal variances assumed	4.060	.049	2.828	58	.006	5.00000	1.76817	1.46062	8.53938
	Equal variances not assumed			3.420	35.720	.002	5.00000	1.46188	2.03437	7.96563

The results of the SPSS output in the T-test Results of Writing Skills Based on Cognitive Styles above shows that there are 16 students with the FI cognitive style having an average post-test score of 71.0, meanwhile 44 students with the FD cognitive style having an average post-test score of 66.0. The Independent Samples Test output table shows that the Sig Levene's Test value shows a number of 0.049 which is 0.05 less valuable, and it can be concluded that there is a difference in the diversity (variant) of the scores of writing skills between groups of students with FI and FD cognitive styles, hence testing can be conducted through an independent t-test assuming an inhomogeneous variety of data (equal variance not assumed).

The comparison of the initial ability (pre-test) and the ability after being given treatment (at post-test) of research subjects deriving from the value of writing skills,

then analyzed employing the SPSS program to obtain an overview of how significant the scores on students' writing skills between the pre-test compared to the post-test. In other words, to comprehend the influence of

the learning strategies which have been given on writing skills. Testing applying analysis with paired t-test (paired sample t-test) with the help of the SPSS program is presented in Table 4.10 on the next page.

Table 4.10.: T-test Results of Writing Skills between Pre-test and Post-test upon Experiment Class

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Writing Skills Pre-test (CM assisted PjBL)	64.6667	30	9.37102	1.71091
	Writing Skills Post-test (CM assisted PjBL)	72.5000	30	5.83539	1.06539

Paired Samples Test

		Paired Differences							
					95% Confidence interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	Writing Skills Pre-test (CM assisted PjBL) - Writing Skills Post-test (CM assisted PjBL)	-7.83333	6.65444	1.21493	-10.31814	-5.34852	-6.448	29	.000

The results of the SPSS output on Paired Samples Statistics above show that out of the 30 students from the experiment class or with project-based learning with concept mapping, an average value of pre-test is 64.67. Meanwhile, the average value at the time of the post test is 72.50. The paired Samples Test output table shows that the difference in the average value is -7.83, meaning that the difference in the average value of the pre-test compared to post-test is 7.83 (more valuable at the post-test than pre-test).

The description of the normality of data for the value of writing skills post-test in student groups with project-based learning without concept mapping strategy (PjBL without CM) and project-based learning with CM strategy (PjBL with CM) is presented in the following figure:
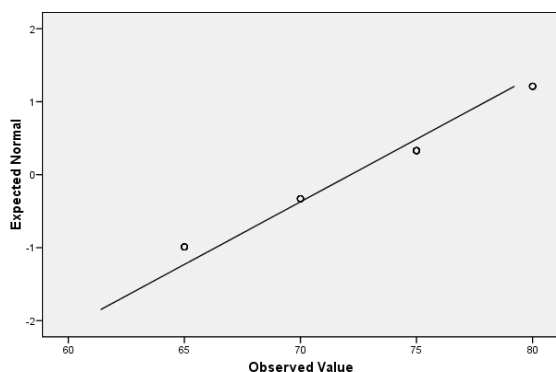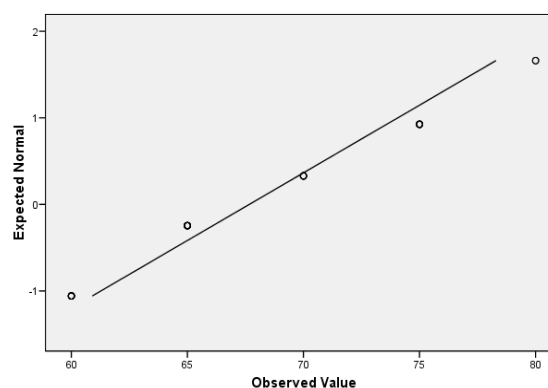

Figure 4.2.: Normal Q-Q Plot of Writing Skills Scores on Non-Concept Mapping assisted Project based Learning Strategy (PjBL without CM)

Figure 4.1 and Figure 4.2 above show that the scores of writing skills in student groups with a project-based learning without concept mapping strategy (PjBL without CM) and a project-based learning with concept mapping strategy (PjBL with CM) shows all data clustered around the test line is pointing to the upper right and no data is located far apart from the data distribution. This shows that the data on the scores of writing skills in groups of students with a project-based learning without concept mapping strategy (PjBL without CM) and a project-based learning with concept mapping strategy (PjBL with CM) has a normal distribution[15].

Figure 4.1.: Normal Q-Q Plot of Writing Skills Scores on Project based Learning with Concept Mapping Strategy (PjBL with CM)

Table 4.11.: Results of Data Normality Test for Writing Skills Scores with FI and FD Cognitive Styles
One-Sample Kolmogorov-Smirnov Test

		Writing Skills Post-test (FI)	Writing Skills Post-Test (FD)
N		45	15
Normal Parameters [a,b]	Mean	71.0000	66.0000
	Std. Deviation	6.36039	4.30946
Most Extreme	Absolute	.202	.258
Differences	Positive	.116	.258
	Negative	-.202	-.208
Kolmogorov-Smirnov Z		1.355	1.001
Asymp. Sig. (2-tailed)		.051	.269

Notes:
a. Test distribution is normal
b. Calculated from data

Referring to the table of the results of the calculation of the Kolmogorov-Smirnov Test of Normality probability scores, it can be concluded that the scores of writing skills post-test in the student group with the field independence (FI) cognitive style and the field dependence (FD) cognitive style show a significance score (probability) of 0.051 and 0.269 which 0.05 more valuable. This means that the data on the scores of writing skills in the group of students with the field independence (FI) cognitive style and the field dependence (FD) cognitive style have a normal distribution, therefore further testing can be conducted employing analysis by parametric statistics.

5. CONCLUSION

Referring to the results of data processing and discussion which have been stated, it can be concluded that there is a difference between the writing skills of students who are taught applying project-based learning strategies with concept mapping (PjBL with CM) and students who are taught without concept mapping (PjBL without CM). This shows that the development of ideas in writing presented employing concept mapping is more focused and makes student creativity more developed. In addition, there are differences in writing skills on the different students' field independence and field dependence cognitive style. The findings in this study indicate that students with the field independence (FI) cognitive style are able to have better writing skills than students who have the field independence (FD) cognitive

style, and there is no interaction effect between project based learning strategies with concept mapping and without the incorporation of concept mapping with field independence (FD) and field dependence (FD) cognitive styles on the scores of students' writing skills. Since there is no significant difference in the scores of writing skills in groups with project-based learning strategies with concept mapping and project-based learning without concept mapping with both FI and FD cognitive styles.

6. REFERENCES

1. Melvin L. Silberman. Active Learning. Bandung: Nuansa. 2014. p. 18-19
2. Robert E. Slavin. Psikologi Pendidikan. Jakarta: PT Indeks. 2008. p. 15-19
3. Alexandros C. Mettas & Costas P. Constantinou. The Technology Fair: A Project Based Learning Approach for Enhancing Problem Solving Skills and Interest in Design and Technology Education. International Journal of Technology and Design Education. 2007; 18(1): 79-100.
4. Global SchoolNet. 2000. *Introduction to Networked Project Based Learning*. Diakses tanggal 19 December 2016.
5. Erman Suherman. Contemporary Mathematics Learning Strategies. Bandung: P.T. Remaja Rosdakarya. 2003. p. 32-34.
6. Richard I. Arends. Learning to Teach. Yogyakarta: Pustaka Pelajar. 2008. p. 54-56.
7. Anita Woolfolk. Educational Psychology Active Learning. Boston: Pearson Education, Inc. 2009. p. 105.
8. Yuliang Liu & Dean Ginther. Cognitive Styles and Distance Education. Journal of

Distance Learning Administration. 1999; 2(3): 23-33.

9. Henry G. Tarigan. Writing as a Language Skill.Bandung: Angkasa. 2013. p. 27.

10. Bruce W. Tuckman & Brian E. Harper. Conducting Educational Research. New York: Rowman & Littlefield Publishers.

11. Punaji Setyosari. Educational Research and Development Methods. Jakarta: Prenadamedia Group. 2013. p. 26-27.

12. Herman A. Witkin, Philip K. Oltman, Joan B. Chase, &Florence Freidman. Cognitive patterning in the blind. In J. Hellmuth, Cognitive studies: II. Deficits in cognition. Brunner/Mazel. 1971.

13. Rachmad Hidayat&Akhmad Sabarudin. An Integrated Model ofCustomers' Satisfaction and Loyality: A Business Analysis of BankingService. Mimbar, 32 (1). 2016. P. 139-147

14. Dimitra Kokotsaki, Victoria Menzies, & Andy Wiggins. Project-Based Learning: A Review of the Literature. Improving Schools. 2016; 19(3): 267-277.

15. Oktay Kizkapan & Oktay Bektas. The Effect of Project-Based Learning on Seventh Grade Students' Academic Achievement. International Journal of Instruction. 2017; 10(1): 37-54.

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