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The Effects of Elaborative Learning Strategy and Cognitive Style on Students: Evidence from University Students in Lampung, Indonesia

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Abstract

The purpose of this research study was to examine the various effects associated with elaborative learning strategy and the cognitive style among university students taking a course in learning media. The research was conducted in an Islamic university located in Lampung, Indonesia. Data were collected through a random selection of 40 students using the random sampling data collection technique. The study employed the use of a 2x2 treatment design level to test the effect of elaborative learning and cognitive style on students. The results of the study illustrated that: (1) students taught with elaborative learning strategy perform better and, generate higher results than students taught with conventional learning strategy; (2) there is an interconnection between the learning strategy and the cognitive style with each leading to various learning outcomes; (3) students with high cognitive style, tend to make better grades using elaborative learning strategy, compared to those taught with the conventional learning strategy; and (4) students that are taught learning media with low cognitive style generate higher results, compared to students taught with conventional learning strategy. This study concluded that learning outcomes on students can be enhanced by applying the learning strategy that suits the students' cognitive style.

Introduction

Studies on learning strategy and processes associated with learning outcomes, are intertwined inseparable. Various factors influence the learning outcomes internally (interest, internal motivation, students' cognitive style, and way of thinking), and externally (learning materials and learning strategies). This study was limited to the internal and external factors associated with the cognitive learning style and the learning strategy. These factors are believed to contribute effectively to the learning outcome of students.

A learning strategy highly contributes to shaping learning outcomes. There are various learning strategies, such as the conventional and active learning strategies. The conventional learning strategy points to the role of the teacher (teacher-oriented) with respect to a one-way learning process and passive students. While the active learning strategy, is student-centered, as it tends to

centralize more on students. Learning strategy is a plan to help students achieve their learning outcomes (Gagné, Wager, Golas, & Keller, 2005). It can be in form of learning materials or a production unit such as learning media. Seels and Richey (1994) beams that learning strategy is a specification to select and to sort out learning events and activities. From the above mentioned opinions, it can be concluded that learning strategy is a technique used by teachers to assist students select and sort out learning events and activities.

This study used elaborative learning strategy to ameliorate students learning process. The strategy adopted in organizing lesson flows from general to specific (Reigeluth & Rodgers, 1980). Elaborative learning strategy comes from elaborative theory in learning and as a development from *Component Display Theory (CDT)* (Reigeluth & Merrill, 1978; Reigeluth, Merrill, & Bunderson, 1978). It is an alternative theory used to decide an organization's learning standard based on hierarchal 1 task analysis. It aims at supporting the instructional development in choosing and stimulating content, as well as in optimizing learning outcomes.

A study conducted by Hanclosky (1986) compared the contribution of elaboration theory and task analysis to learning concepts and principles. One of the tested hypotheses was to learn better concepts and principles on elaborative theory, with respect to advanced organizer and task analysis. Students tend to learn on their own accord and free will using various learning techniques, such as cognitive style. Furthermore Greeno, Collins, and Resnick (1996) stated that an improved cognitive style is closely related to students' characteristics with respect to their cognitive process. Todd (1982) reported cognitive style is an individual's step in processing information through responsive strategy upon a given task. Cognitive style is influential to learning outcomes.

In addition, Reigeluth and Carr-Chellman (2009) illustrated that learning outcomes are related to the interaction between learning method and learning condition with learners' characteristic as essential elements. Various studies support the existence of learning strategy and cognitive style; one study was conducted by Degeng and Sukarnyana which covered three elements namely elaborative model, cognitive style, and achievement motivation. The results of the study analyzed that (1) students with *FI* cognitive style perform better than students with *FD* style, in terms of learning acquisition and retention; (2) students with higher urge to achieve success have better learning acquisition and retention than students with lower urge to achieve success; (3) learning strategy with elaborative model generates better results than conventional learning strategy, in terms of acquisition and retention; and (4) there is an interaction among the three variables understudy.

Recent studies have also pointed the importance of elaborative process in learning to enhance students' learning outcome (Hall et al., 2007; Goossens, Camp, Verkoeijen, Tabbers, & Zwaan, 2014; Endres, Carpenter, Martin, & Renkl,

2017; Finn, Thomas, & Rawson, 2018). The Indonesian context for applying cognitive style in its educational teaching technique also tells a lot on its potential for university students (Wulandari, Widayati, & Suryobroto, 2016). Based on the benefits associated with learning strategy and cognitive style to the educational sector, this study, aimed to examine the effects of elaborative learning strategy and cognitive style with respect to the learning outcomes among university students undergoing a course in media. This research will also have an insight into previous studies similar to the field. These will be followed by research method and results, and with discussion of research conclusion.

Research Method

This research made use of experimental method of data collection with a 2x2 factorial design technique. Learning outcomes on learning media was the dependent variable used while the learning strategy was the independent variable used. The independent variable was divided into two groups; elaborative learning strategy which was used as the experimental group and the conventional learning strategy which was used as the control group. Cognitive style acted as an intervention variable which was further divided into high cognitive style and low cognitive style. The research design explained is as follows:

Table 1. Treatment design by 2x2 level

Cognitive style (B)	Learning Strategy	
	Elaborative (A1)	Conventional (A2)
High (B1)	A1B1	A2B1
Low (B2)	A1B2	A2B2

The data used for this research work comprises of students from six classes of the same department in an Islamic university in Lampung, Indonesia. Two sample classes were randomly selected. Each class was made up of 20 students with each class either selected as an experimental class or a control class. Experimental classes were labeled Class A which was made up of students who received elaborative learning strategy, while the control class was labeled Class B which was made up of students who received conventional learning strategy.

To determine the level of cognitive style, both classes were given high and low cognitive style's instrument. The results were then sorted in descending order. This was followed by classifying students with 27% cognitive style as top ranking students with high cognitive style and students with 27% cognitive style from the bottom rank as students with low cognitive style. Students with 27% cognitive style from both top and bottom rank were also counted based on Nitko & Brookhart (2011) analysis. According to their analysis, making selection between

25 – 33% can be used in deciding high and low groups. The total number of respondents used in this study were 40 students (10 students from each class).

Therefore, sample of the study consisted of: (1) 10 students with high cognitive style that were taught with elaborative learning strategy; (2) 10 students with high cognitive style that were taught with conventional learning strategy; (3) 10 students with low cognitive style that were taught with elaborative learning strategy; (4) 10 students with low cognitive style that were taught with conventional learning strategy.

Normality and homogeneity tests were also carried out before data was analyzed. Normality test was conducted using Liliefors test (Lilliefors, 1967; Dallal & Wilkinson, 1986) and homogeneity test was conducted using Bartlett test (Bartlett, 1937; Zhang, Jiang, & Chen, 2010). The data was analyzed using two data analysis techniques namely Two way Analysis of Variance technique (*ANOVA*) using a 2x2 factorial design, and the Tukey test which was used to carry out a significant test (Tukey, 1949; Morrison, Sosnoff, Heffernan, Jae, & Fernhall, 2013). This technique aimed at discovering the interactive significance between the elaborative learning strategy and the cognitive style to learning outcomes on learning media. Two-way *ANOVA* is a research design that consists of more than one independent variable. Two independent variables, consisting of elaborative and conventional categories, and cognitive style, were used. These variables were made up of high and low categories. Meanwhile, the dependent variable used was obtained from the learning outcome on learning media.

This study proposed four hypotheses as follows:

H1: learning outcomes on learning media taught to students with elaborative learning strategy generate higher results than learning outcomes on learning media taught to students with conventional learning strategy. This hypothesis can statistically be tested as follows:

$$H_0: \mu_{A1} \leq \mu_{A2}$$

$$H_1: \mu_{A1} > \mu_{A2}$$

H2: there is a relationship between learning strategy and cognitive style to students' learning outcomes. This hypothesis can statistically be tested as follows:

$$H_0: \text{Interaction } A \times B = 0$$

$$H_1: \text{Interaction } A \times B \neq 0$$

H3: learning outcomes on learning media among students with high cognitive style and taught with elaborative learning strategy show higher results compared to those inherent students with high cognitive style and taught with conventional learning strategy. This hypothesis can statistically be tested as follows:

$$H_0: \mu_{A1B1} \leq \mu_{A2B1}$$

$$H_1: \mu_{A_1B_1} > \mu_{A_2B_1}$$

H4: learning outcomes on learning media among students with low cognitive style and taught with elaborative learning strategy show lower results compared to the learning outcome among students with low cognitive style and taught with conventional learning strategy. This hypothesis can statistically be tested as follows.

$$H_0: \mu_{A_2B_2} \geq \mu_{A_2B_1}$$

$$H_1: \mu_{A_2B_2} < \mu_{A_2B_1}$$

Results and Discussion

The summary of the research data used in this study is shown in Table 2 below. The table presents descriptive statistics of number of samples for each group, its total number, mean, and standard deviation. The table also summarized the total data of all the samples used in the research.

Table 2. Summary of the research data

Cognitive style (B)	Learning Strategy (A)		Total
	Elaborative (A1)	Conventional (A2)	
High (B1)	n = 10	n = 10	n = 20
	$\sum X = 857$ $\bar{X} = 85.7$	$\sum X = 575$ $\bar{X} = 57.5$	$\sum X = 1432$ $\bar{X} = 71,6$
	S = 5.85	S = 4.10	S = 15.03
Low (B2)	n = 10	n = 10	n = 20
	$\sum X = 598$ $\bar{X} = 59.8$	$\sum X = 400$ $\bar{X} = 40$	$\sum X = 998$ $\bar{X} = 49.9$
	S = 5.35	S = 4.23	S = 11.23
Total	n = 20	n = 20	n = 40
	$\sum X = 1455$ $\bar{X} = 72.75$	$\sum X = 975$ $\bar{X} = 30.86$	$\sum X = 2430$ $\bar{X} = 60.7$
	S = 14,10	S = 9,90	S = 17,11

Source: Primary data, authors' estimation. Notes: N : Number of sample; $\sum X$: Total number; \bar{X} : Mean; s: Standard deviation.

To test the hypotheses, the research conducts a two-way analysis of variance with interaction (*ANOVA* 2x2) with the aim of understanding the difference on the given treatment namely learning strategy and cognitive style, as well as its interaction to learning outcomes on learning media as the dependent variable. The summary is shown in the following table.

Table 3. Summary of two-way ANOVA test to groups and sub-groups

Variance sources	Df	Ss	MS = Ss/Df	F _c =MS/MSW
Learning strategy (A)	1	4730.62	4730.62	8.219*
Cognitive style (B)	1	5783.02	5783.02	10.045*
Interaction factors (AxB)	1	5317.07	5317.07	9.240*
Within-group (D)	36	20719.70	575.553	-
Total (T)	39	31405.00	-	-

Source: Primary data, authors' estimation. Notes: Df: Degree of freedom on variance source; Ss: Sum squares on variance source; MS: Mean of sum squares on variance source; MSW: Mean of sum squares within-group; F_c: F_{calculate} value; and *: Significant at $\alpha = 5\%$ & 1% .

Analysis on the abovementioned table is as follows: There is a significant effect on learning strategy to learning outcomes on learning media among groups of students who become the subjects of this study which produces a significant effect on (A) column since $F_c = 8.219271 > F_t = 2.092$ with significance $\alpha = 0.05$. There is also a significant effect of cognitive style to learning outcomes on learning media among groups of students who became the subject of this study, which also produces a significant effect on (B) row since $F_c = 10.045 > F_t = 2.092$ with significance $\alpha = 0.05$. The result also indicates that there is a significant difference on students' cognitive style in the subject learning media on column data variance, both in significance $\alpha = 0.05$ and significance $\alpha = 0.01$. Furthermore, there is a significant effect and interaction factor between learning strategy and cognitive style to learning outcomes on learning media among groups of students used as a case study in carrying out this research work. since F_c value = $9.239942 > F_t = 7.562$ with significance $\alpha = 0.01$. It indicates that there is an effect on interaction between learning strategy and cognitive style, both in significance $\alpha = 0.05$ and significance $\alpha = 0.01$.

From the hypothesis test obtained, the study verifies that there is an interconnection between the learning strategy and the cognitive style to learning outcomes on learning media. the data analysis is then followed by Tukey test to find out the significance difference in each group. The result of Turkey test in significance $\alpha = 0.01$ is shown in the following table.

Table 4. Summary of Tukey test comparing a1 b1 - a2 b1 groups

Result of learning	A ₁ B ₁	A ₂ B ₁	Q _{cal}	Q _{tab} ($\alpha = 0.05$)
Mean	85.7	57.5		
MSW		575.532	3.71	3.15
Df		20		

Source: Primary data, authors' estimation.

Based on the analysis displayed on the above table, it can be analyzed that $Q_{cal} = 2.62$ is lower than $Q_{tab} = 3.15$ with a significance (α) value of 0.05; therefore, H_0 is rejected and H_1 is accepted with $\alpha = 0.05$. Therefore, it can be concluded that, the group of students with low cognitive style, there are fewer students with elaborative learning strategy than those with conventional learning strategy.

Previous data obtained can be used to interpret and test for hypothesis. The first hypothesis states that learning outcomes on learning media taught to students using elaborative learning strategy, generates higher results compared to learning outcomes on learning media taught to students with conventional learning strategy. The hypothesis test has proven that there is a significant difference in learning outcomes on learning media using elaborative and conventional learning strategy. Based on the analysis obtained from using Two-way *ANOVA* table 2 to compare learning outcomes on learning media using elaborative and conventional learning strategy, the results show that F_c (value = 8.219271) is larger than F_{tab} value with $\alpha = 0.05 = 2.092$ and $\alpha = 0.01 = 7.562$. It, therefore, means that H_0 is rejected and H_1 is accepted.

In conclusion, it can be deduced from the first hypothesis that learning outcomes from elaborative learning strategy generates higher results compared to learning outcomes from conventional learning strategy which is acceptable. This supports previous works related to the advancement of this learning strategy. Hall, Hladkyj, Perry, & Ruthig (2004) opines that that elaborative and attributional learning processes can invariably improve learning among college students. One of the benefits of adopting the use of this strategy the fact that it is equipped with synthesis and completed with summary of the presented learning materials. According to Ausubel (1963,), this technique it is closely related to acquisition and retention of the newly learnt materials. If students can build their cognitive structure on the materials that they are going to learn, it will definitely affect their learning outcomes. In addition, a well-built cognitive structure will aid in organizational characteristics of learning suitable with students' characteristics.

The second hypothesis outlines a relationship between learning strategy and cognitive style to students' learning outcomes. The results obtained using a Two way *ANOVA* test illustrates that learning outcomes on learning media is influenced by the interaction of, learning strategy and cognitive style. This is as shown in F_c with a value of 9.239942 which is larger than F_{tab} value with $\alpha = 0.05 = 2.092$ and $\alpha = 0.01 = 7.562$. The results prove that H_0 is rejected while H_1 is accepted. In summary, the second hypothesis proves that there is a relationship between learning strategy and cognitive style to learning outcomes on learning media which is acceptable.

Many points were taken into consideration during the learning process, for instance, the best learning strategy was considered along with the characteristics of students' cognitive style. These two points put into consideration, will greatly result to an effective learning outcome (or, achieving the learning target). In this

study, students are capable of obtaining good scores using both elaborative learning strategy, and conventional learning strategy. However, with regards to learning outcomes, students taught with elaborative learning strategy stand the chance of generating higher results compared to students taught with conventional learning strategy. Elaborative learning strategy demands students to be actively involved in the various class activities, because they are required to synthesize and to explore their analytical skills during each learning process (student-oriented). These activities are the factors that distinguish elaborative learning strategy from conventional learning strategy. The later emphasis more on teacher's role (teacher-oriented).

Students who are accustomed to one-way learning strategy as well as those who depend greatly on their teacher tend to grow more receptive and passive with the implementation of elaborative learning strategy. This is because these students are already used to the conventional learning strategy. The learning outcomes of students with high cognitive style and taught with elaborative learning strategy appear to be higher than those taught with conventional learning strategy. This therefore means that learning outcomes can be well-achieved when they meet the right students' cognitive style. Therefore, it can be said that the learning outcomes on learning media will reach its peak when the learning strategy applied meets students' self-efficacy. The third hypothesis states that learning outcomes on learning media among students with high cognitive style and taught with elaborative learning strategy show higher results than the learning outcomes among students with high cognitive style and taught with conventional learning strategy. The hypothesis test shows that there is a significant difference in the Mean scores between students with high cognitive style and taught with elaborative learning strategy and students with high cognitive style and taught with conventional learning strategy.

Based on the Turkey analysis test, the Mean score of students with high cognitive style and taught with elaborative learning strategy is 85.7. In addition to this, the Mean score of students with high cognitive style and taught with conventional learning strategy is 57.5. Elaborative learning strategy is essentially influenced by constructivism learning strategy. Constructivism approach emphasizes on student active learning process. This approach makes extensive use of the brain in creating new ideas, synthesizing them, as well as summarizing the whole process. As a result of this, students' cognitive is greatly encouraged. However, this strategy best suits students with high cognitive style.

The last hypothesis states that learning outcomes on learning media among students with low cognitive style and taught with elaborative learning strategy tend to show lower results compared to the learning outcomes among students with low cognitive style and taught with conventional learning strategy. Based on the Turkey analysis test, the Mean score of students with low cognitive style and taught with elaborative learning strategy is 59.8. Additionally, the Mean score of

students with low cognitive style and taught with conventional learning strategy is 40.0.

Data analysis indicates that Q_{cal} value= 2.62 and Q_{tab} value= 3.15 with $\alpha = 0.05$; hence, H_0 is rejected and H_1 is accepted. The above result approves the fourth hypothesis which states that learning outcomes among students with low cognitive style and taught with elaborative learning strategy show lower results compared to the learning outcomes among students with low cognitive style and taught with conventional learning strategy. The hypothesis testing has illustrated mean score among students with low cognitive style and the difference in learning outcomes among students taught with elaborative and conventional learning strategies.

The mean score of the learning outcomes among students taught with elaborative learning strategy is lower than the mean score of the learning outcomes among students taught with traditional learning strategy. When students learn with elaborative learning strategy, they are exposed to certain concepts which they tend to memorize. By the end of the lesson, students would forget all that they have learnt rather, they are expected to accurately comprehend what had been taught to them and also repeat the materials explained. This conventional learning strategy is definitely comfortable for this type of students. Therefore, the learning outcomes from this strategy is higher than the learning outcomes of students taught with elaborative learning strategy.

When teachers learn to effortlessly recognize students' characteristic on cognitive style, either high or low cognitive style, it will be easier for them to choose and apply the most suitable strategy for each student. It is noteworthy that teachers' style learning technique is a very important factor used to enhance students' engagement in classroom (Shaari, Yusoff, Ghazali, Osman, & Dzahir, 2014). Students with low cognitive style will be opportune to acquire more knowledge in using the learning strategy suitable and relevant to their interest and learning capacity. Additionally, students with high cognitive style will get lower results if the learning strategy used does not meet their characteristics. Therefore, each strategy possesses its own characteristics; it has strengths and weaknesses.

Conclusion

The outcome of the data analysis used explains that there is a significant difference in learning outcomes between students taught with elaborative and conventional learning strategies. In summary learning outcomes among students taught with elaborative learning strategy show higher results compared to the learning outcomes of students taught with expository learning strategy. The results, therefore, indicates that in order to improve learning outcomes on learning media, teachers need to apply the elaborative learning strategy.

Similarly, there tends to be a tremendous effect between the learning strategy and cognitive style to learning outcomes. Result of the study indicates that students with high cognitive style can be taught with elaborative learning strategy

to enhance their learning outcomes. On the other hand, students with low cognitive style can be taught with conventional learning strategy. In the case of students with high cognitive style, they tend to generate better grades when taught with elaborative learning strategy, than students taught with the conventional learning strategy. In conclusion, to improve learning outcomes, students with high cognitive style can learn with elaborative learning strategy while students with low cognitive style can learn with conventional learning strategy.

This study demonstrates some insights on how teachers can improve students learning outcome by picking the right teaching technique for the right students and how learning strategy and cognitive style interconnect with each other. Such findings can enrich current state of the art technique used in teaching university students in Indonesia. However, there were some limitations associated with this research work which would be pointed out for further research work on this field area to address it. Among this study's limitations are its limited scope of students used in analyzing data. It will be more helpful to further focus on students with less knowledge on teaching or learning styles to ensure that more audience is covered.

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