The analysis of the implementation of project based learning and its influence to the student deductive reasoning based on cognitive style on solving super edge local antimagic total labeling

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Abstract. In this study, we tried to test students' deductive reasoning based on cognitive style in the application of super edge total local antimagic labels by applying Project Based Learning (PjBL) learning models. This study uses a mixed method, namely qualitative methods and quantitative methods. The research subjects consisted of two classes, namely 28 control class students and 30 experimental class students. The instruments used in this study were pretest, posttest, observation sheet, and interview sheet. Before the research activities, we tested the homogeneity of both classes using the results of the pretest. Homogeneity test results show the sig value is 0.481 > 0.05, so the average difference between the two classes is not significant. This shows that both classes are homogeneous or have the same ability. Next, we also discuss the normality of using posttest data. This shows that the independent sample test on the posttest data from the control class and the experimental class obtained a sig score of 0.657 <0.05, so that it was significant which meant the difference between the control class and the experimental class. While the effect of punishment increases based on students' cognitive style, it shows that 52% are in the very high category, 31% depend on the high category, 13% depend on the average category, and 4% depend on the low category. Project-Based Learning Model (PjBL) and the influence of deductive reasoning based on students' cognitive styles in the super edge study of total local antimagic labeling.

1. Introduction
Currently, education affects the nation's generation. All fields of education are always developing and being improved. Improvements in the field of education contain several variations of components that involve implementation, quality of education, curriculum instruments, and educational facilities as well as improvement of strategies and methods of collection [2].

Education is a conscious effort planned to realize learning and the learning process so that students actively develop the potential to increase the spiritual strength of religion, self-control, society, nation and state.

Mathematics is an exact science, meaning that it cannot be changed anymore. Mathematics can be used to solve problems both in the field of mathematics itself, and in everyday life. Mathematics,
Educators are required to always improve themselves in mathematical knowledge, as well as the teaching and learning process of teaching material resources that will be given to participants students. There are several methods that can be used to improve student achievement in the learning process. One of the efforts made in this research is the application of project-based learning methods (PjBL). With this method learning steps can be developed in several indicators as follows [3]:

**Figure 1. The Procedures of Project-Based Learning Model**

Project Based Learning (PjBL) is a learning model for individuals or groups where the learning model is very systematic, creative and innovative for students because this learning model focuses on students. Then, students will gain a lot of knowledge and skills, and ultimately produce a product.

Project Based Learning is a method and process of learning that has been applied in developed countries like the United States [4]. Project Based Learning is learning that results in a project on student learning outcomes. In this study Project Based Learning is implemented for students in solving the super edge problem of labeling total local antimagic. Activities for teachers and students in this PjBL learning model consist of three steps, namely preparation, learning, and evaluation in which the three steps can be understood into six steps [5]. First, students determine the basic questions about coloring the sides, points, and regions where the neighboring side is colored differently. Second, students approve the project and prepare the tools needed, the plan consists of plans for making projects that are super edge local antimagic total labeling. Third, students complete schedules to complete super edge local antimagic total labeling, and then they complete assignments in groups and complete new coloring patterns. Fourth, the teacher successfully advances students to complete the super edge local antimagic total labeling material. Fifth, answer the results of student assignments to help teachers measure competency standards, treat them to support each student, provide feedback on the level of understanding students have obtained, help teachers develop further learning strategies. Sixth, the teacher completes a project approved by the student and then the student proves the smoothness of the project.

In the learning process, students are required to think, reason and solve a problem. According to one of these sentences, according to dedication according to Sternberg (2006) states that punishment is the process of punishment of one or more related to what is related to getting a reasonable conclusion. There are several indicators of punishment in learning where, according to a high-level assessment can be categorized as follows [30]: (1) Carry out calculations based on certain rules or formulas, (2) Draw logical (criminal) conclusions, (3) Arrange direct proof, proof indirect and proof with mathematical induction, (4) Conceptual support, generally classified as procedural mathematical thinking and doing routine calculations, but counting specifically difficult numbers.

Each individual has unique characteristics, which are not owned by other individuals. Therefore it can be said that each individual is different from one another. The changing characteristics of each individual in responding to information, is the cognitive style of the individual concerned. Based on the above opinion, it can be said that what is meant by cognitive style (cognitive style) is the way a person processes, stores or uses information to respond to a task or respond to various types of environmental situations.
Regarding the types of cognitive styles, Woolfolk and Margetts (2010) distinguish cognitive styles more specifically in relation to the teaching and learning process, including: (a) independent field-dependent fields, (b) impulsive-reflective, and (c) verbal imagery -nonverbal imagery. Of the many types of cognitive styles mentioned above, the independent dependent field-dependent cognitive style will be the focus of this study.

The type of labeling in this paper is antimagic. Hartsfield and Ringel [7] introduced the concept of antimagic labeling. A labeling of graph can be called antimagic if all weight of labels have different values. The result of antimagic total labelings [4, 5] presented by Dafik et. al. They determined super edge-antimagic total labelings and super edge-antimagicness of graphs.

A total labeling of graph $G(V, E)$ is said to be edge local antimagic total labeling if a bijection $f: V(G)\cup E(G) \rightarrow \{1, 2, 3, ..., |V(G)|+|E(G)|\}$ such that for any two adjacent edges $e_1$ and $e_2$, $w_e(e_1) = w_e(e_2)$, where for $e = uv$, $w_e = f(u) + f(uv) + f(v)$.

The edge local antimagic total labeling induces a proper edge coloring of $G$ if each edge $e$ is assigned the color $w_e(e)$. The edge local antimagic chromatic number of $G$ denoted by $\gamma_{elat}(G)$, is the minimum number of distinct color induced by edge weights over all local antimagic total labeling of $G$.

Local vertex antimagic coloring of graph introduced by Arumugam et al. [3]. A different type of local antimagic has been developed by Agustin et. al. [1], namely local edge antimagic coloring of graph. They identified the lower bound and the upper bound of the local antimagic coloring. Agustin et. al. [1] studied a different type of local antimagic coloring, namely local edge antimagic coloring. They studied the existence of local edge antimagic coloring of some special graphs and the lower bound of local edge antimagic. The chromatic number of some graph by $\gamma_{elat}(G) \geq \Delta(G)$. Agustin et. al. [2] studied super local edge antimagic total coloring of any graph using EAVL technique and they found the lemma by following.

2. Research methods

The type of in this research is a mixed method, namely combination of qualitative and quantitative [11]. The qualitative method uses observation and interview data while the quantitative method uses pre-test and post-test data. Quantitative method is done by involving two classes, namely the experimental and control classes. Then, each class is given a GEFT test to distinguish types of cognitive style and tests for deductive reasoning.

The research design used forms the unequal control group design. Both groups were given different licenses. The control class is applied conventional learning methods and in the experimental class the Project Based Learning (PjBL) learning model is applied.

### Table 1. Project Based Learning (PjBL) learning model

| Class          | Pretest | Treatment | Postest |
|----------------|---------|-----------|---------|
| Eksperiment (N=30) | $R_1$   | PjBL      | $R_2$   |
| Control (N=28)  | $R_3$   | Convensional | $R_4$   |

2.1 Population

The population of this study were all students in semester 3 of Mathematics Education, FKIP Jember University. Samples were taken randomly from two classes, namely 30 students for the experimental class and 28 students for the control class. For the experimental class given the implementation using the Project Based Learning learning method and the control class given the implementation using conventional learning.

2.2 Research instrument

The instruments in this study were tests (pre-test and post-test), observation and interviews. Before applying the project-based learning method carried out by researchers first conduct a GEFT test. This
test is carried out in order to measure the cognitive style of students in independent groups and the field. The work of students is then categorized into four levels of deductive reasoning ability possessed by each student, namely low deductive reasoning ability, good deductive reasoning ability, high deductive reasoning ability and very high deductive reasoning. In this study consisted of three stages in the research design, namely a preliminary study (qualitative research), the influence of deductive reasoning based on students' cognitive styles and the application of the Project Based Learning learning model (quantitative research), the portrait phase (qualitative research)). A description of the research procedure is illustrated in the following chart.

![Flow Chart of the Mixed Method Model](image)

**Figure 2.** Flow Chart of the Mixed Method Model
2.3 Task
Student worksheet super edge local antimagic total labeling. Tests are given to the experimental class and the control class in the form of pre-test and post-test sheets containing several columns to find out the coloring patterns on the path graph. The following is a way to find out the number of colors in the path graph.

2.4 Data collection and analysis
Data for research in the experimental class and the control class using pre-test and post-test data, for data analysis using t-test, and for qualitative data analysis using the results of interviews with several students. And for observations and data analysis researchers use ordinal data. Descriptive and inferential statistics are used to analyze qualitative and quantitative data. The statistical data used are obtained from the average value, standard deviation, and frequency. In addition, normality, homogeneity, and independent tests between the experimental and control classes use inferential data related to Project Based Learning. Linear regression test analysis was used for the experimental class that was given training. Free samples are used to compare two classes with a significance value of 0.05.

3. Research findings
The study was conducted in the experimental class and the control class using qualitative methods to determine the effect of deductive reasoning based on students' cognitive styles. The research was carried out after carrying out the validity and reliability tests of the research instruments. Then the experimental class and the control class are given a pre-test to determine the initial ability of deductive punishment based on students' cognitive styles.

After implementing the pre-test in the control class and the experimental class, learning in the experimental class will be carried out using the project-based learning model (PjBL) and the control class using conventional learning, then data will be obtained using the SPSS application. The following are the results of data analysis using SPSS and Excel applications.

3.1 The validity of the instrument
Before showing the results, it is necessary to discuss the reliability and validity of the research instruments of the two validators who previously showed the results of our study. The following table shows the results of reliability and validity.
Based on Table 2, it can be seen that the $r_{count}$ value of problem 1 is 0.751, problem 2 is 0.622, problem 3 is 0.709, problem 4 is 0.710, problem 5 is 0.558 items which results in $r_{count} > r_{table}$ (0.3172) with $N-2 = 28 - 2 = 26$, so all items are valid.

Table 2. Test Results Validation

| Question | Pearson Correlation | 1  | .529** | .500** | .294 | .247 | .751** |
|----------|---------------------|----|--------|--------|------|------|--------|
| Sig. (2-tailed) |                      | .003 | .005 | .114 | .189 | .000 |
| N       |                     | 30  | 30    | 30    | 30   | 30   |
| Question 2 | Pearson Correlation | .529** | 1 | .301 | .285 | -.009 | .622** |
| Sig. (2-tailed) |                      | .003 | .106 | .126 | .960 | .000 |
| N       |                     | 30  | 30    | 30    | 30   | 30   |
| Question 3 | Pearson Correlation | .500** | .301 | 1 | .370* | .196 | .709** |
| Sig. (2-tailed) |                      | .005 | .106 | .044 | .299 | .000 |
| N       |                     | 30  | 30    | 30    | 30   | 30   |
| Question 4 | Pearson Correlation | .294 | .285 | .370* | 1 | .400* | .710** |
| Sig. (2-tailed) |                      | .114 | .126 | .044 | .028 | .000 |
| N       |                     | 30  | 30    | 30    | 30   | 30   |
| Question 5 | Pearson Correlation | .247 | -.009 | .196 | .400* | 1 | .558** |
| Sig. (2-tailed) |                      | .189 | .960 | .299 | .028 | .001 |
| N       |                     | 30  | 30    | 30    | 30   | 30   |
| Total   | Pearson Correlation | .751** | .622** | .709** | .710** | .558** | 1 |
| Sig. (2-tailed) |                      | .000 | .000 | .000 | .000 | .001 |
| N       |                     | 30  | 30    | 30    | 30   | 30   |

Based on Table 2, it can be seen that the $r_{count}$ value of problem 1 is 0.751, problem 2 is 0.622, problem 3 is 0.709, problem 4 is 0.710, problem 5 is 0.558 items which results in $r_{count} > r_{table}$ (0.3172) with $N-2 = 28 - 2 = 26$, so all items are valid.

Table 3. Test Results Reliability questions

| Cronbach's Alpha | N of Items |
|------------------|------------|
| .688             | 5          |

After observing table 3, it can be seen that the overall reliability value is 0.688 and $r_\alpha$ (table) as a significant requirement of 5% with $df = N-2 = 28$, $r_\alpha$ (table) = 0.3172 therefore $r_{count} > r_{table}$. This concludes that the instrument items are reliable.

3.2 Results

Preliminary research was conducted on 28 students in the control class to determine the level of deductive reasoning based on the cognitive style of students agreeing with the pre-test (diagram 1), in the control class found 6% fit at a low level, 22% fit at the moment, 34% in the High Level, and 38% are in the High Level.
Diagram 1. Pretest Distribution of Deductive Reasoning Based on Students’ Cognitive Styles in the Control Class

![Diagram 1](image)

The study was conducted on 30 students in the experimental class to determine the level of deductive reasoning based on cognitive style. Thirty subjects were tested with a pretest (diagram 2), in the experimental class it was found that 9% were at a low level, 22% were at a moderate level, 35% were at a high level, and 34% were at a very high level.

Diagram 2. Pretest Distribution of Deductive Reasoning Based on Students’ Cognitive Style in Experimental Classes

![Diagram 2](image)

The next step is to analyze the data obtained from the pre-test and post-test using SPSS. Data analysis that will be carried out is quantitative method. Statistical tests conducted in the second class are normality test, homogeneity test, and independent test. The first step in the analysis using SPSS is a second class homogeneity test to test the truth of the second class or it is not the same. Based on table 4 the homogeneity test get sig.0.481 results is significant if it is greater than 0.05 (based on the average = 0.481> 0.05), so the pre-test variance data from the control class and the experimental class are homogeneous.
After that it will proceed with the normality test analysis. This test is conducted to determine whether the distribution of pretest data in the control class and experimental class is normally distributed or not. Data distribution will be valued significantly if valued greater or equal to 0.05. Based on table 5 shows the significance value of the experimental class is 0.056 ≥0.05 and the control class is 0.200 ≥0.05. So this means that the data from the control class and experiment class are normally distributed.

Based on Table 6 the results of statistical tests that show the average of each class group the control is 61.9643 and the experimental class is 64.6333 where the average control class is lower than the experimental class. Then it was approved by an independent t test in the second class. The sample responds significantly if the Sig. (2-tailed) is greater than 0.05.

Based on Table 7, the Sig. (2-tailed) is 0.078 > 0.05, so Ho is accepted, which means there is no significant difference (real) in the average pretest value of the control class and the experimental class.

| Table 4. Pretest Homogeneity Test Results of Control and Experiment Classes |
|-----------------------------|--------|--------|------|
| Levene Statistic | df1 | df2 | Sig. |
| .504 | 1 | 56 | .481 |

| Table 5. Pretest Normality Test Results of the Control and Experiment Classes |
|-----------------------------|--------|--------|------|
| Group | Kolmogorov-Smirnov² | Shapiro-Wilk |
| |Statistic | Df | Sig. |Statistic | Df | Sig. |
| Pre-Test | Control class | .103 | 28 | .200 * | .950 | 28 | .197 |
| | Eksperimant class | .158 | 30 | .056 | .965 | 30 | .423 |

| Table 6. Pretest Test Results for Control and Experiment Classes |
|-----------------------------|--------|--------|--------|--------|
| Group | N | Mean | Std. Deviation | Std. Error Mean |
| Pre-Test | Control class | 28 | 61.9643 | 5.19603 | .98196 |
| | Eksperimant class | 30 | 64.6333 | 6.04285 | 1.10327 |

| Table 7. Independent Pretest Test Results for the Control and Experiment Class |
|-----------------------------|--------|--------|--------|--------|--------|--------|--------|--------|
| 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 |
| Pre-Test | Equal variances assumed | .504 | .481 | - | 56 | .078 | -2.66905 | 1.48476 | -5.64338 |-5.64338 |
| | Equal variances not assumed | - | 55.641 | .076 | -2.66905 | 1.47697 | -5.62820 | .29010 |
| | 1.807 |
The research was then continued by applying learning using conventional learning models in the control class and Project Based Learning (PjBL) learning models in the experimental class, then proceed with the post test at the end of learning. The study was conducted on 28 students in the control class to determine the level of deductive reasoning based on cognitive style after learning. 28 subjects argued with the posttest (diagram 3), in the control class found 52% were in the very high category, 31% were in the high category, 13% depended on the average category, and 4% depended on the low category of students.

**Diagram 3.** Postest Distribution of Deductive Reasoning Based on Students' Cognitive Styles in the Control Class

![Diagram 3](image1.png)

**Diagram 4.** Postest Distribution of Deductive Reasoning Based on Students' Cognitive Style in Experimental Classes

![Diagram 4](image2.png)

After the learning process in the control class and the experimental class, the data obtained from the posttest results were analyzed using the normality test, homogeneity test, and independent test. The first step in the analysis using SPSS is a second class homogeneity test to test the truth of the second class or it is not the same. Based on table 8, homogeneity tests get sig results. \(0.657\). This is significant if it is greater than 0.05 (based on mean = 0.657 > 0.05), so the pretest data variants from the control and experimental classes are homogeneous.
that it will proceed with the normality test analysis. This test is conducted to determine whether the data distribution in the control class and experimental class is normally distributed or not. Data distribution will be valued significantly if valued greater or equal to 0.05. Based on table 9 shows the significance value of the experimental class is 0.200 ≥0.05 and the control class is 0.200 ≤0.05. So this means that the data from the control class and experiment class are normally distributed.

The next step is data analysis using quantitative statistics to find differences in learning outcomes with the Project Based Learning (PjBL) learning model. Data analysis using SPSS applications with posttest learning outcome data.

The posttest average test results in table 10 show that the average of each control class group is 74.50 and the experimental class is 81.50 where the average control class is lower than the experimental class. Then it was approved by an independent t test in the second class. The sample received is significant if the Sig. (2-tailed) is greater than 0.05.
The results of the posttest independent test in the control class and the experimental class in table 11 show the Sig. (2-tailed) is 0.000 <0.05, then Ho is rejected, which means there is a significant (real) difference in the average posttest scores of the control class and the experimental class.

The next analysis is the analysis of the distribution of observations from the Project Based Learning (PjBL) learning model carried out in the experimental class with 30 students. Based on diagram 5, it was found that 62% students were very active in PjBL learning, 18% students were active in PjBL learning, 13% students were quite active in PjBL learning, 6% students were not active in PjBL learning, and 1% students were very inactive in learning PjBL. So the Problem Based Learning (PjBL) learning model can provide work that is solved by the super edge problem of labeling the total local antimagic.

**Diagram 5. Distribution of student activities in the implementation of PjBL.**

![Distribution of Student Activities in the Implementation of PjBL](image)

| Indicators                  | Very active | Active | Hesitate | Inactive | Very inactive |
|-----------------------------|-------------|--------|----------|----------|---------------|
| Fundamental statement      | 25          | 2      | 2        | 1        | 0             |
| Design Project Planning    | 22          | 3      | 4        | 1        | 0             |
| Arrange Schedule           | 22          | 6      | 2        | 0        | 0             |
| Monitor students and project success | 17 | 5 | 5 | 2 | 1 |
| Test Results               | 11          | 8      | 6        | 4        | 1             |

### 3.3 Phase Potrait

The phase portrait was taken to draw a deductive penalty process based on the student's cognitive style. 4 subjects were selected from the experimental class and the control class according to the posttest results. Interviews were conducted on subjects that have been determined to determine the results of deductive reasoning based on students' cognitive styles in completing the super edge of total local antimagic labeling.
The following is an interview conducted on one of the students who worked on super edge local antimagic total labeling in the category of low deductive penalties.

Researcher : what do you get after reading the worksheet?
Student : I discovered many things that I did not understand.
Researcher : whether you can consider the super edge local antimagic total labeling material
Student : I do not understand about the material.
Researcher : well, for example for the installation process or the concept of super edge total local antimagic labeling is it already possible?
Student : To complete the process and concept I can.
Researcher : Are you able to provide labeling patterned on a circle graph?
Student : I have not been able to label circle graphs yet
Researcher : can you continue labeling the super edge local antimagic total labeling?
Student : I can continue the labeling
Researcher : Are you able to give circle notation?
Student : I have not been able to give notation to the circle graph.
Researcher : are you able to create a total local antimagic super edge pattern
Student : I have not been able to make a pattern on a circle graph

The results phase portrait student of low deductive reasoning
Researcher : whether you can consider the super edge local antimagic total labeling material
Student : I can already understand about this material
Researcher : well, for example for the installation process or the concept of super edge total local antimagic labeling is it already possible?
Student : To complete the process and concept I can.
Researcher : Are you able to provide labeling patterned on a circle graph?
Student : I have been able to label circle graphs
Researcher : can you continue labeling the super edge local antimagic total labeling?
Student : I can continue the labeling
Researcher : Are you able to give circle notation?
Student : I have been able to give notation to the circle graph
Researcher : are you able to create a total local antimagic super edge pattern
Student : I have not been able to make a pattern on a circle graph
Researcher : are you able to prove the formula on the findings.
Student : I have not been able to prove it

The results phase portrait student of average level deductive reasoning

The following is an interview conducted on one of the students working on super edge local antimagic total labeling in the category of high deductive reasoning.
Researcher : what do you get after reading the worksheet?
Student : I discovered many things that I did not understand.
Researcher : whether you can consider the super edge local antimagic total labeling material
Student : I can already understand about this material
Researcher : well, for example for the installation process or the concept of super edge total local antimagic labeling is it already possible?
antimagic labeling is it already possible?

Student : To complete the process and concept I can.
Researcher : Are you able to provide labeling patterned on a circle graph?
Student : I have been able to label circles.
Researcher : can you continue labeling the super edge local antimagic total labeling?
Student : I can continue the labeling
Researcher : Are you able to give circle notation?
Student : I have been able to give notation to the circle graph.
Researcher : are you able to create a total local antimagic super edge pattern
Student : I have been able to make a pattern on a circle graph
Researcher : are you able to prove the formula on the findings.
Student : I have been able to prove it

The results phase portrait student of high-level deductive reasoning

The following is an interview conducted on one of the students working on a super-edge problem labeling the total local antimagic which is in the category of very high level of deductive reasoning.

Researcher : what do you get after reading the worksheet?
Student : I discovered many things that I did not understand.
Researcher : whether you can consider the super edge local antimagic total labeling material
Student : I can already understand about this material
Researcher : well, for example for the installation process or the concept of super edge total local antimagic labeling is it already possible?
Student : To complete the process and concept I can.
Researcher : Are you able to provide labeling patterned on a circle graph?
Student : I have been able to label circle graphs
Researcher : can you continue labeling the super edge local antimagic total labeling?
Student : I can continue the labeling
Researcher : Are you able to give circle notation?
Student : I have been able to give notation to the circle graph
Researcher : are you able to create a total local antimagic super edge pattern
Student : I have been able to make a pattern on a circle graph
Researcher : are you able to prove the formula on the findings.
Student : I have been able to prove it

4. Discussion

The aim of this research is to find out the effect of deductive reasoning ability based on students’ cognitive style in the implementation of project based learning methods. Deductive reasoning is filled with a number of indicators, namely (1) Carrying out calculations based on certain rules or formulas, (2) Drawing logical conclusions (logical reasoning), (3) Arranging direct proof, indirect proof and proof by mathematical induction, (4) Ability in terms of conceptual, generally classified as procedural mathematical thinking and carrying out routine calculations, however certain calculations involve difficult numbers. The subjects used were 28 students from the control class and 30 students in the experimental class. Implementation of project based learning methods is done in the experimental class. It is known that, from the results of data analysis in the experimental class there is a good effect in conducting learning methods based on project learning and there is an influence of deductive reasoning based on cognitive style and the effect is significant because students are more effective in the learning process.

Independent sample t-test results on the pre-test questions in the control class and experimental class obtained by Sig. (2-tailed) is 0.78 and 0.76 > 0.05 under conditions if Sig (2-tailed) > 0.05, then there is no significant difference between the learning control results and the experimental class. Whereas in the post-test results, independent tests were obtained in the control class and the experimental class with Sig. (2-tailed) is 1.00 < 0.05 so it gets a significant value and can prove the two classes have differences in terms of student achievement tests after improving the implementation of project-based learning.

This study uses a project-based learning model (PjBL) to see the effect of deductive reasoning based on student cognitive style so that students can effectively carry out the learning process, so that based on the learning model Project Based Learning in this study affects the student's learning process. For this research, it is expected that the results of the implementation of project based learning can improve students' deductive, disciplined and effective reasoning in conducting learning [10].

5. Conclusion

The application of project based learning that has been implemented by researchers has a significant influence on deductive reasoning based on students' cognitive styles in the experimental class. Students in the experimental class showed deductive reasoning based on their cognitive style compared to deductive reasoning in the control class which tends to be very lacking. The results showed that an increase in student learning outcomes in deductive reasoning based on cognitive style can be seen from the post-test done by students. The value of experimental class is better because it is supported by the implementation of project based learning (PjBL) learning models. Based on data obtained by researchers through the results of interviews, each student can give a positive response through their comments regarding the implementation of project-based learning. Before using the learning model, project-based learning, students have difficulty finding ideas, difficulties in reasoning, and difficulties in solving problems. After getting the implementation of project-based learning, students get penalties based on cognitive style, find ideas easily, and can find super edge labeling patterns of total local antimagic labeling.

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References

[1] Santrock, J W 2004 Psikologi Pendidikan (Jakarta: Kencana)
[2] Efstratia D 2014 Experiential education through project based learning Procedia-social and behavioral sciences 152 1256-1260
[3] Chu S K W, Zhang Y, Chen K, Chan C K, Lee C W Y, Zou E and Lau W 2017 The effectiveness of wikis for project-based learning in different disciplines in higher education The internet and higher education 33 49-60
[4] Gómez-Pablos V B, del Pozo M M and Muñoz-Repiso A G V 2017 Project-based learning (PBL) through the incorporation of digital technologies: An evaluation based on the experience of serving teachers Computers in Human Behavior 68 501-512
[5] Kizkapan O and Bektas O 2017 The Effect of Project Based Learning on Seventh Grade Students' Academic Achievement International Journal of Instruction 10(1) 37-54
[6] Hendriana H and Soemarmo U 2014 Penilaian pembelajaran matematika (Bandung: Refika Aditama)
[7] Inuwa U, Abdullah Z and Hassan H 2018 A Mixed-Method Study of the Effect of the Demonstration Method on Students’ Achievement in Financial Accounting International Journal of Instruction 11(4) 577-592
[8] Tohir M, Abidin Z and Dafik 2018 Students creative thinking skills in solving two dimensional arithmetic series through research-based learning Journal of Physics: Conference Series 10089(1) p 012072
[9] Suntusia, Dafik and Hobri 2019 The Effectiveness of Research Based Learning in Improving Students' Achievement in Solving Two-Dimensional Arithmetic Sequence Problems International Journal of Instruction 12(1) 17-32
[10] Kizkapan O and Bektas O 2017 The Effect of Project Based Learning on Seventh Grade Students’ Academic Achievement International Journal of Instruction 10(1) 37-54
[11] Anggara S A 2017 Penerapan Model Project Based Learning untuk Meningkatkan Kemampuan Menulis Siswa Arabi: Journal of Arabic Studies 2(2) 186-196
[12] Sternberg R J 2006 Psikologi Kognitif (Yogyakarta: Pustaka Pelajar)
[13] Dafik, Miller M, Ryan J, and Baca M 2011 Super edge-antimagic total labelings of mKn;n Ars Combinatoria 101 97-107