Research Article

Analysis of Student Learning Styles in Differentiation Learning

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Abstract.
This research is an attempt to describe students' learning styles in differentiation learning. The study was conducted on all students of class X-3 at SMAN 8 Malang. Learning style is a consistent way that students have in capturing stimulus or information, how to remember, think, and solve problems. Based on the implementation of the independent curriculum, it is also necessary to map learning needs based on the learning profile of students. This mapping can be done by providing a diagnostic assessment to find out. There are various ways of information processing that students display, some are easier to process through visual information, some are auditory (sound), and others are kinesthetic (direct practice). The findings obtained from this study are that mapping different learning styles can not only improve the quality of learning in students but also help them in mastering mathematics.

Keywords: learning style, differentiation learning

1. INTRODUCTION

In learning mathematics in the classroom, students are trained to be able to draw conclusions, be able to solve mathematical problems, and be able to understand certain procedures or rules used in solving mathematical problems. According to Pehkonen, (2013) mathematics learning is not only about calculations, learning objectives must also develop students' understanding and mathematical thinking. In line with the opinion of Rahman & Ahmar, (2016) the learning process not only wants to make learners put forward concepts in their minds, but also how to make them skilled in analyzing and solving problems.

Researchers provide diagnostic assessments in the form of learning style questionnaires for students. Aims to find out the learning style of each student. Seeing such conditions, one way that can be done to improve student learning outcomes is to use an effective learning model and in accordance with the approach to active student learning.

Efforts that can produce maximum learning results are active learning activities. With active learning, learners are trained to discover for themselves the various concepts learned thoroughly.

Another thing that is suspected of affecting the learning outcomes of learners is the characteristics of learners. One of the characteristics of the intended learner is the learning style. This is related to how to understand the subject matter, absorb, process, and store information, and release information. In one class, it consists of several different characteristics of students. There are those who easily understand the subject matter, but it is difficult to save for a long time. Instead, some require returning the information they received. In posing information, there are various ways that students display, some are easy to process through visual, auditory, and kinesthetic information. Learning styles also affect the effectiveness of learning.

According to Arends (2008) the theory of cognitive development says that learners have different learning styles according to the level of cognitive development. The heterogeneity of students in the classroom has become a certainty, they have different abilities in terms of emotional, intelligent, social, academic parents, and various other abilities. Based on thoughts on the heterogeneity of learners, researchers use differentiation learning strategies in implementing problem-based learning models. The use of differentiation learning strategies is considered appropriate to overcome the problem of heterogeneity of learners.

The rationale of differentiation learning strategies is that learners have psychologically different growth and development. According to Amir (2009), teaching with a differentiation strategy has four general characteristics, namely: (1) Teaching focuses on the concepts and principles of the subject matter, (2) Evaluation of the readiness and learning development of learners accommodated into the curriculum, (3) There is a flexible grouping of learners, and (4) learners become active explorers. Amir (2009) stated that, in differentiating teaching, teachers can make modifications to five elements of learning activities, namely subject matter, processes, products, environment, and evaluation.

There are three differentiated learning strategies, namely: content deference, process differentiation, and product differentiation. However, before determining the right differentiated learning strategy, teachers need to pay attention to 3 aspects of mapping student needs, namely: 1) Student learning readiness; 2) Students' interest in learning; 3) Student learning profile. After mapping student needs based on the three aspects above, teachers can then apply differentiated learning strategies, which include: a) Content Differentiation, b) Process Differentiation, c) Product Differentiation.

From the experience of teaching mathematics subjects in class X-3, it turns out that there are still problems, including: (1) Learning Outcomes of mathematics subjects are low. (2) Students are less eager to learn, (3) Students do not pay attention to the teacher when explaining learning materials. To improve the quality of the learning process of mathematics subjects, the learning model that must be pursued by teachers is learning that focuses on activeness and student-oriented, and among the learning models that involve more student participation in the learning process is differentiation learning.

2. METHOD

2.1. Research Approaches and Methods

The type of research used in this study is Class Action Research (PTK) which consists of 4 stages, consisting of planning, implementing actions, observations, and reflections. Class action research can be carried out in more than one cycle if after reflection on the previous cycle there are still shortcomings or have not met the success criteria. This could have happened by marking the learning outcomes of students in the previous cycle which had not improved and also found obstacles that resulted in less than optimal results in the previous cycle. The results of reflection in the previous cycle will be used as consideration to carry out improvements in the next cycle.

2.2. Time and Place of Research

This research was carried out in class X – 3 of SMAN 8 Malang, which is where the researcher's task is to carry out PPL. This research was carried out using two cycles, with each cycle being carried out 2-3 meetings. This research was carried out for approximately three months, starting from July to September 2022.

2.3. Research Design

The stages carried out in this class action research use the class action research flow of Kemmis and Mc. Taggart and have been developed by Arikunto (2014) which generally consists of 4 (four) stages, namely (1) planning (plan), (2) implementation of actions (*action*), (3) *observation (observation)*, and (4) reflection (*reflection*). The stages of this study are carried out by the researcher based on a predetermined order. If the 4 (four) stages have not met the research success criteria, the researcher takes action to the

next cycle to achieve success in accordance with the specified criteria. According to Latief (2009) a cycle in PTK is said to have been successful or has not been measured by the achievement of predetermined targets, which are in the form of success criteria. If the achievement of the results is the same as targeted, then the cycle has been successful, if it is not in accordance with the target, then the strategy must be revised to be used in the next cycle. Likewise, in the second cycle, etc., the measure of success is measured by comparing the achievements/impacts that have been achieved with the targeted success criteria, not compared with the results before cycle I or the results in cycle 1.

2.4. Data and Data Sources

The source of this research data comes from researchers, colleagues, civil service teachers, supervisors as observers, and students of class X – 3 of SMAN 8 Malang. The data and data sources used during the study are as follows:

Table 1: Data and Data Sources.

No.	Data	Data Sources
1.	Validation results of Teaching Modules, LKPD, Cycle Tests, Teacher Activity Observation Sheets, Student Activity Observation Sheets	Validation Sheet
2.	Results of Teacher Activity Observations	Teacher Activity Observation Sheet
3.	Observation Results of Student Activities	Student Activity Observation Sheet
4.	Test Cycle Scores	Learner Answer Sheet

2.5. Data Collection Procedures

Based on the data and data sources obtained, the data collection procedure is as follows. (1) A test is a treatment to determine the ability of students about the material that has been studied. In this study, the test given to students was a test in the form of a final test question of the cycle. The results of the end-of-cycle test are used as consideration when reflecting and improving for the next cycle. At the time of the test, the researcher as a teacher and supervises the course of the test. (2) Observation is made during the learning. This observation is carried out to observe teacher activity activities and student activity activities during the learning process. At each meeting, the observer was given two observation sheets, namely the teacher activity observation

sheet and the student activity observation sheet. Each meeting, the researcher acts as a teacher accompanied by 5 observers. The observers who observed were three colleagues of the researcher, one supervisor and one civil service teacher.

2.6. Data Analysis

The data that has been collected from class action research data sources, then analyzed and processed. The source of this class action research data is the results of the answers to the cycle test questions, the results of teacher activity observations, the results of student observations. The collected data is then analyzed by qualitative data analysis and quantitative data analysis. The results of data analysis are used to 1) describe the implementation of differentiation learning in exponent material 2) find out the learning outcomes of students with the diferensiasi learning model that has been carried out.

1. Data on the Results of Validation of Learning Tools and Research Instruments

The learning tools and research instruments that are validated are rpp, LKPD, cycle tests, teacher activity observation sheets, student activity observation sheets. The validation result data is obtained from the total score of the validation results of each validator.

1. Data from Teacher Activity Observation Results

The analysis of the results of observations of teacher activities in the implementation of learning is described, based on the observation sheets that have been given by the observer. Teacher activity in learning using a differentiation learning model is said to be carried out if the results of the observation analysis of teacher activity show good criteria.

1. Data on the Results of Observation of Student Activities

The analysis of the observation results of student activities in learning is described, based on the observation sheets that have been given by the observer. The activity of students in learning using a differentiation learning model is said to be carried out if the results of the observation analysis of student activities show good criteria.

1. Learning Outcomes Test Data

Data on student test results are obtained from the results of cycle tests carried out at each meeting, and end-of-cycle tests to determine the success of actions that show an improvement in student learning outcomes.

As for analyzing the data of student test results, the following formula is used:

$$N_A = \frac{\Sigma\, N_S}{Total\ Students}$$

Information:

N_A is the average test cycle score

N_S is the student's cycle test score

Learning is said to achieve success criteria if student learning outcomes improve, researchers can see from the average cycle test results.

3. RESULTS AND DISCUSSION

3.1. Research Results

This research was conducted at SMAN 8 Malang with class X-3 students as the subject of the study with a total of 36 students.

3.2. Preliminary Activities

In the results of this preliminary data research, several activities will be discussed which include (a) initial actions (b) validation of research instruments and learning tools.

1. Initial Actions

Researchers provide basic ability tests to students, containing 10 *essay* questions consisting of 50% of the prerequisite material that has been studied in junior high school, and 50% of the material that will be studied at the next meeting. Researchers also provide learning style questionnaires, aiming to find out the learning styles of each student.

From the results of the learning style questionnaire given in classes X – 3, 18 students with visual learning style types were obtained, 7 students with audiotorial learning style types, and 11 students with kinesthetic learning style types. Based on the results of these observations and analyses, researchers design appropriate learning for research.

1. Validation of Learning Tools and Research Instruments

The learning tools and research instruments validated by validators include (1) Teaching modules, (2) Student Activity Sheets, (3) Teacher Observation Sheets, (4) Student Obervation Sheets, and (5) Cycle Tests.

3.3. Cycle 1

In the first cycle research data, there is data exposure consisting of (a) planning, (b) implementation of actions, (c) observation and evaluation, (e) reflection of cycle I.

1. Planning

At this stage what the researcher will do is:

1. The researcher explained to the observer what would be observed and explained about the learning that the researcher did using a differentiated learning model with students in grades X – 3 at SMA Negeri 8 Malang.

2. Compile or prepare learning steps that will be implemented using a differentiated learning model.

3. Preparing Student Activity Sheets (LKPD).

4. Compiling the First Cycle Test in the form of *an essay* to find out the learning outcomes of students.

5. Compile a teacher activity observation sheet that serves to find out the steps during learning whether the teacher has carried out in accordance with the learning steps that have been prepared.

6. Compile a student activity observation sheet that serves to find out the steps during learning whether students have carried out in accordance with the learning steps that have been prepared.

7. Compile LKPD validation sheets, cycle tests, teacher activity observation sheets, and student activity observation sheets.

8. Submit all learning instruments and tools to validators for validation, namely Supervisors and Pamong Teachers.

9. Implementation of Actions

In the stage of implementing actions, learning activities are carried out in accordance with the learning steps that have been made. To be able to adjust the learning steps in the delivery of material, including learning using a difered learning model , it is carried out in 2 meetings, where 1 meeting for the delivery of material and 1 meeting for evaluation.

1. Observation and Evaluation

2. Observation Results

The observation results were obtained from the results of observations made by observers made by colleagues, supervisors, and civil service teachers by filling out observation sheets for teacher activities and student activities to record the learning process. From the results of observations and observations made, it was found that the learning process was not as expected because there were still shortcomings both from the teacher himself and from the students, including:

1. Teachers have not provided motivation and apperception to learners.

2. Teachers do not have writing activities on the board, so they have not facilitated students with a visual learning style type.

3. There are still students who are not active in discussing and lack focus in learning.

4. The activity level of these learners is relatively low.

Therefore, the activities of teachers and students in the next cycle still need to be improved.

1. Evaluation of Learning Outcomes

Complete data on student learning outcomes in cycle I can be seen in the appendix. Based on the results of the evaluation in the first cycle after analysis, data were obtained that the completeness of learning achieved by students was still low. These results have not yet reached the completion of the learners' learning so that the learning continues to the next cycle.

1. Reflection of Cycle I

Based on the analysis of the evaluation results in Cycle I, there are still many students whose scores are below the grade average. Those results have not yet achieved the expected results, for which the researchers proceed to the next cycle. In this cycle I there are deficiencies that need to be considered and corrected in cycle II activities including:

1. The provision of motivation and apperception that is still lacking makes students a little confused in receiving new subject matter by applying differentiated learning so that in cycle II the provision of motivation and apperception is paid more attention to.

2. Teachers provide facilities for learners with visual, auditorial, and kinesthetic learning style types

3. Ask students to be more active in discussions, not just silently watching their friends work and just chatting with their friends.

4. Ask students to be more active and ask questions if they have difficulties or if there are materials and discussion questions that have not been understood.

5. Unclear conclusions make students a little confused or unclear with the limitations of the material presented by the teacher so that in cycle II the conclusion is given more attention.

6. Heterogeneous group division based on learners' learning styles.

3.4. Cycle 2

1. Planning

At this stage, the activities that need to be carried out by the researcher are:

1. Compile or prepare learning steps that will be carried out using a differentiated learning model.

2. Prepare student activity sheets (LKPD).

3. Compile a final test of the cycle in the form of *an essay* to find out the learning outcomes of students.

4. Compile teacher activity observation sheets and student activity observation sheets.

5. Create a list of groups to determine the members of each group with heterogeneous learning styles.

6. Implementation of Actions

In the implementation stage of the action, learning activities are carried out in accordance with the learning implementation plan that has been made. To be able to adjust the learning implementation plan in the delivery of material, including learning using a differentiation learning model. For the exponent function material, 2 meetings are held for the delivery of the material and 1 meeting for evaluation.

During the implementation, the researcher acts as a teacher, three colleagues, a civil service teacher, and a supervisor acts as an observer who observes the activities of the teacher and the activities of students. The teaching module contains learning steps, LKPD, and supporting teaching materials. The learning steps consist of: initial activities, core activities, and closing.

The activities in the learning of each meeting in general are as follows: (1) students are grouped with 4-5 students heterogeneously, (2) each student in the group works on LKPD according to the instructions, (3) each group has the opportunity to present the results of their work in front of the class, in this activity there are steps for students to compare and discuss answers, (4) students with the direction of the teacher make conclusions about The material that has been studied, (5) at the end of the cycle students do the cycle test questions.

1. Observation and Evaluation

2. Observation Results

The results of observations from three observers conducted in this second cycle study are carried out in an implementable manner showing that learning has taken place well and in accordance with the learning steps that have been designed by the researcher. Based on observations made by observers, during learning, students respond actively to questions and instructions from the teacher. When discussing with their group, students are also actively involved and cooperate with the group. When the teacher asks, the learners are actively involved by raising their hands to answer the questions given by the teacher.

Students present product differentiation in the form of summary results as stated in the form of *power points* (PPT) or summaries on a piece of paper. For learners of audio and visual learning style types, some make *power points* (PPT), and for learners type kinesthetic learning styles some make summaries on a piece of paper.

Students then present their work. When presenting in front of the class, learners are not shy and are able to communicate their answers to their peers in class. In cycle II, learning is more active and learners are more engaged in learning.

1. Evaluation of Learning Outcomes

Complete data on student learning outcomes in cycle II can be seen in the appendix. Based on the results of the evaluation in cycle II after analysis, data were obtained that the completeness of learning achieved by students has increased. The results of this average score have increased compared to the activities of cycle I. For this reason,

there is no need for learning in the next cycle, thus learning by applying a differentiation learning model is said to be able to improve mathematics learning outcomes.

1. Reflection of Cycle II

From the results of the observation of student activities in cycle II, learning activities have been able to run well, where the results of observations of student activities can be classified as high as seen from each learning activity as well as teacher activities have been classified as high. From the results of the analysis of the results of the evaluation, there was an increase in the average class. Therefore this research is stopped until cycle II according to planning.

4. Discussion

This class action research is carried out as an effort to improve mathematics learning outcomes in class X-3 students by implementing learning by applying / using differentiation learning models at SMAN 8 Malang for the 2022/2023 Learning Year.

Based on the results of data analysis in each cycle, it can be seen that the results of the average value of cycle I to cycle II have increased. In the implementation of learning and the results of data analysis cycle I, for student activities obtained an average score of 56.5 and student activities in cycle II obtained a grade point average of 82.3. From cycle I to cycle II, student learning outcomes increased by 25.8%.

This class action research is carried out as an effort to improve mathematics learning activities and outcomes through the implementation of differentiation learning models. Where this study was conducted in two cycles.

5. CONCLUSION

Based on the results of the research and discussion above, it can be concluded that the learning model is differentiated to improve the learning outcomes of class X-3 students of SMAN 8 Malang. The increase can be seen from the average value of classes in each cycle has increased in both cycle I and cycle II. And based on visual, audio, and kinesthetic learning styles also have a positive effect on the learning implementation process. In a heterogeneous group, it also affects the process of implementing learning in absorbing and processing information so that student activities also increase. From the research that has been carried out, differentiation learning also has a positive effect

in the implementation of learning activities, where students can pour what has been learned in various forms of creativity according to the learning style of each student.

From the results of the research and discussion above, we can conclude that a differentiated learning model can improve the learning outcomes of class X-3 students of SMAN 8 Malang for the 2022/2023 Academic Year.

References

[1] Emir. Differentiated learning: Alternative approaches for gifted children. Edukas. 2009;1:57-67.

[2] Arends R. Learning to teach. Penerjemah: Helly Prajitno & Sri Mulyani. New York: McGraw Hill Company; 2008.

[3] Arikunto S. Research procedures an approach to practice. Jakarta: Rineka Cipta; 2014.

[4] Pehkonen E, dkk. On teaching problem solving in school mathematics. CEPS J. 2013;3(4).

[5] Rahman A, Ahmar AS. Exploration of mathematics problem solving process based on the thinking level of students in junior high school. Int J Environ Sci Educ. 2016;11:14.