Prima Magistra: Jurnal Ilmiah Kependidikan
Volume 6 – Nomor 1, Januari 2025, 12-19
https://doi.org/10.37478/jpm.v6i1.5144
Open Access: https://e-journal.uniflor.ac.id/index.php/JPM/article/view/5144

ISSN 2721-8112 (print)
ISSN 2722-4899 (online)

OPTIMIZING LEARNING OUTCOMES THROUGH PROCESS-BASED DIFFERENTIATED LEARNING AT SMA POMOSDA TANJUNGANOM: AN INNOVATIVE APPROACH

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Article History
Received : 07/12/2024
Revised : 27/12/2024
Accepted : 05/01/2025
Keywords:
Learning outcomes, Differentiated learning, Process-based, Innovative approaches.

Abstract. This study aims to analyze the effect of process-based differentiation learning on student learning outcomes at SMA POMOSDA Tanjunganom. With a quantitative approach using a quasi-experimental research design, this study involved two groups: an experimental group that applied differentiated learning and a control group that used conventional methods. The study results showed that applying process-based differentiated learning can significantly improve student learning outcomes. These findings are expected to contribute to developing more effective learning methods and encourage educators to use a more responsive approach to students' needs. Process-based differentiation learning has a significant favorable influence on student learning outcomes. The research results can also provide educators insight into designing more exciting and adaptive learning strategies.

How to Cite: Hasanah, N. U., Suwito, S., Meviana, I., & Setyawan, W. H. (2025). OPTIMIZING LEARNING OUTCOMES THROUGH PROCESS-BASED DIFFERENTIATED LEARNING AT SMA POMOSDA TANJUNGANOM: AN INNOVATIVE APPROACH. *Prima Magistra: Jurnal Ilmiah Kependidikan*, 6(1), 12-19. https://doi.org/10.37478/jpm.v6i1.5144

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Publisher:
Program Studi PGSD Universitas Flores. Jln. Samratulangi, Kelurahan Paupire, Ende, Flores.
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INTRODUCTION

The emerging paradigm in education offers educators the flexibility to design learning plans and evaluations tailored to the characteristics and requirements of students (Shalahuddin et al., 2021). This education guarantees student-centric learning methodologies. Learning constitutes a sequence delineating skill standards and strategizing the learning process. It culminates in the execution of evaluations to enhance learning, enabling students to attain the anticipated capabilities (Kemendikbud, 2020). The abilities in question include 21st-century talents, specifically Communication, Critical Thinking, Collaboration, Problem-Solving, Innovation skills, and Creativity. Students must acquire proficiency in this skill to prepare adequately for the workforce and real-life challenges (Fitriyah & Bisri, 2023).

The education unit has not fully designed a flexible curriculum suited to pupils' demands in the learning process. As is known, many types of pupils in schools or even courses have varying levels of learning readiness, interests, skills, and learning styles. As a result, students need teaching services that are different from each other so that they can understand competencies and learning materials based on their respective traits and uniqueness to develop effectively. Therefore, a learning approach that considers student features and individual variances is needed. Teachers can serve pupils according to their conditions by carrying out the learning process. Schools can use multiple learning approaches to relieve students from being the same in everything, allowing them to express themselves according to their individuality.

Implementing diversified learning will be a flexible and non-rigid learning process that believes in only one technique to attain educational goals in schools (Karyoto et al., 2020; Rukmi & Khosiyono, 2023). Each student brings unique traits to school. Every child is unique, including auditory, visual, and kinesthetic learning methods. Thus are academic abilities (high, medium, and low), learning orientation (mastery, performance approach, and performance avoidance), and lesson comprehension speed (fast, moderate, and slow). Interest (interest in a certain subject, such as math, language, or science), personality (such as introverted or extrovert), motivation (high, medium, or low), self-efficacy (high, medium, or low), and

socioeconomic status/SSE (high, medium, or low SSE). As a result, a strategy and teaching method that can meet the needs of each student is essential. Process-based differentiated learning was the cycle of learning about students and reacting to their learning according to differences (Mulyani et al., 2024; Setyawan, 2024).

Based on the findings of Sari et al. (2024) research, it is possible to conclude that differentiated learning has several benefits, including (1) increased learning variety, (2) increased student learning motivation, (3) increased teacher and student involvement in learning, and (4) training teachers to understand the differences in learning responses among students. In addition to improving student learning outcomes, differentiated learning can boost individuality and diversity and allow students to learn effectively and naturally. The urge to submit opinions, complete assignments, ask questions, and respond to teachers' inquiries demonstrated the learning activities that students engage in during the learning process. Student activeness will cause improved learning motivation, which will ultimately improve student learning outcomes (Sari et al., 2024).

In general, process-based differentiated learning has advantages, including a) Teachers ensure a learning process that sees all students' existence and embraces all students. Teachers regard all student assignments as valuable and beneficial. b) adaptable Student classification. Teachers construct a curriculum that permits all students to cooperate with their peers at any given time. Concurrently, students collaborate with classmates who share their readiness and enthusiasm. c) There is continual collaboration and coordination between classroom teachers/subject matter teachers and exceptional educator instructors. d) Students and teachers collaborate to develop a dedication to achieving the desired learning results. e) Flexible use of time in responding to student learning processes and results. f) A variety of learning strategies, including peer tutor learning, sports centres, talent and interest development centres, and so forth. g) Students are tested in many ways according to each student's growth and development (Tomlinson, 2001).

The ability to implement process-based differentiated learning in the educational setting (Atikah et al., 2024) conveys what the teacher must do, including a) Learning enthusiasm, learning attention, and student learning profile are the three pillars upon which learning needs are mapped. This can be accomplished through observations, interviews, questionnaire surveys, and other methods. b) Using the outcomes of mapping to plan process-based differentiated learning (offering a range of options from strategies, materials, and learning methods), c) assessing and considering what has been learned.

The characteristics of the geography subject are aimed at improving the scientific understanding of the area of the Republic of Indonesia by emphasizing character development, preparing, thinking, and acting in a measured manner, understanding the grace of God, who gives many advantages, and various regional differences in this country, according to the Ministry of Education and Culture's Decree Number 008/H/KR/2022 about Learning Outcomes in Early Childhood Education, Elementary Education, and Senior Education Levels in the Independent Curriculum (KEBUDAYAAN, 2022; Sa'diyah et al., 2023).

As a result, the Independent Curriculum includes several phase-level achievements. Students who have completed phase E or class X can comprehend the following topics: Basic Concepts of Geography, Maps/Remote Sensing/GIS, Geography Research, and Geosphere Phenomena. They can also search for and process information about the physical and social diversity of regions and analyze them using the fundamental geography science and the region's physical and social characteristics (location, uniqueness, distribution, similarities and differences, etc.). Students can define the challenges that develop in the geosphere phenomena that occur and propose recommendations for the best strategies to cope with them. Students can share and publish research results via many media.

The learning objectives in the concept comprehension section of the Geographic Information System (GIS) curriculum are designed to help students recognize, comprehend, critically think about, and evaluate the concept of GIS. Meanwhile, in the process skills portion, students are expected to be knowledgeable in reading and writing about Geographic Information

Systems (GIS). In this context, it is difficult to understand the notion of Geographic Information Systems (GIS) in daily life. On the other hand, every pupil has presumptions and the capacity to comprehend the depth of the subject matter, with varying learning styles and speeds. This study employs a learning grouping method based on students' learning styles to accompany students in processing and realizing the desired learning results. Educators can guarantee a learning process that acknowledges each student's existence and regards each student's work as worthwhile and beneficial.

SMA POMOSDA Tanjunganom is an educational unit that has created a differentiated learning strategy to aid the learning process. However, because there is still a significant difference in learning results between high-ability and low-ability pupils, geography class X has not demonstrated improved and balanced learning outcomes.

RESEARCH METHODS

The research design was a strategy covering things that the researcher undertook, starting a hypothesis and then their operational implications until the final analysis of data, which is then decided and proposed. According to a study design, the problem's structure and the investigation plan will be employed to collect empirical data on the linkages inside the issue. This study used a quantitative approach (Muhaini et al., 2023).

This research employs a quantitative methodology. Statement of Sugiono (2016), quantitative research is a method utilized in researching a given population or sample. In addition, quantitative research is a means to answer the problems being researched using data from numbers and statistical programs. Using a two-group design—the experimental and control groups—quasi-experimental research is the methodology employed (Santoso, 2013).

Experimental classrooms are classes that are treated using a process-based differentiated learning methodology. Meanwhile, the control class follows a content-based differentiated learning paradigm. Before learning begins, pupils are given a pretest to determine their initial ability in both classes (Ferlianti et al., 2022). The following is a table of pseudo-experiment designs (Tabel 1).

Table 1. Mock Experiment Design

Group	Pre test	Treatment
Experiment	O1	X
Control	O1	—

(Source: Arikunto in Soeprajitno et al., 2019)

Information: O1: Pre test Before learning, O2: Post test After learning, X: Treatment using a differentiated learning model, —: Treatment using conventional/undifferentiated models

RESULTS AND DISCUSSION

The questionnaires or ones distributed to respondents, the instrumentation test measures variables in research to determine whether the questionnaire accurately captures the subject of the study (Putri et al., 2024). The validity result and reliability components comprise the two sections of the instrumentation test.

1. Validity Test

SPSS Version 26 was used to process the study's validity test. It was applied to a sample of 29 respondents to assess the validity of a questionnaire with a total score of 5% significance. For the validity test, the researcher compared the Pearson correlation of each question item with the table r of the moment product. The results of the variability test data are listed in Table 2. The five-question items currently used all have values greater than the r table. A correlation of the question items in the above table was a valid. Based on this, the five valid question items can be used to test reality and discriminatory power.

Table 2. Validity Test Results

Question	r_{hitung}	r_{tabel}	Results
1	0.767	0.3673	Valid
2	0.781	0.3673	Valid
3	0.848	0.3673	Valid
4	0.732	0.3673	Valid
5	0.924		Valid

2. Reliability Test

The Alpha-Cronbach formula is used in reliability calculation to determine the consistency of survey data. This formula is adjusted to reflect the scoring technique used on each item in the instrument. For an indicator to be deemed reliable, its item-total correlation value must be at least 0.70. The results are the findings of the feasibility test of each variable. Table 3 lists the outcomes of the reliability test.

Table 3. Result Reliability Test

Reliability Statistics

Cronbach's Alpha	N of Items
0.870	5

Source: Output SPSS

Considering the outcomes of the reality test in the preceding table, information was obtained that Cronbach's Alpha value was 0.870, the value > 0.7. Based on this, it can be concluded that the data is reliable.

3. Discriminatory Power

Discriminatory power is a measurement made to determine the degree to which an item can differentiate between people or groups who possess and lack the attributes being measured (Puspitasari et al., 2022). The discriminatory power itself is carried out by the correlation coefficient with the distribution of the item's score and the distribution of the scale score itself, the minimum score in discriminatory power is 0.40. The following are the criteria for discriminatory power. This is shown in Table 4, which is based on the discriminatory power data results.

Table 4. The criteria for discriminatory power

Criteria	Interpretation
0.00-0.20	Bad
0.21-0.40	Enough
0.41-0.7	Good
0.71-1.00	Very good

The discriminatory power presented in the Table 5 below.

Table 5. The discriminatory power

Criterion	Descrimination Power	Interpretation
1	0.633	Good
2	0.654	Good
3	0.732	Very good
4	0.615	Good
5	0866	Very good

Based on Table 4 and Table 5, information was obtained that of the 5 existing items, 2 had very good criteria, and 3 question items had good criteria.

4. Difficulty Level

Table 6 shows the difficulty index, which indicates whether a question is difficult or easy. The higher the item difficulty index, the easier the problem. Problem difficulty analysis

examines the questions in terms of their difficulty so they can be classified as easy, medium, or complex. The following are the criteria for decision-making at a problematic level.

Table 6. Difficulty Level

Criterion	Interpretation
0.00-0.299	Difficult
0.30-0.699	Medium
0.70-1.00	Easy

The results of problem difficulty analysis are presented in the Table 7 below.

Table 7. Result of problem difficulty analysis

Question	Discriminatory Power	Information
1	0.9052	Easy
2	0.7241	Easy
3	0.7241	Easy
4	0.6983	Medium
5	0.7759	Easy

Information about the five current items was gathered based on the Table 7, 4 items have easy question criteria, and 1 item has medium question criteria.

5. Analysis Bivariate

Bivariate analysis is an analysis carried out to test hypotheses with two variables to obtain answers as to whether the two variables are related, correlated, there are differences, there is an influence, and so on. One of the bivariate analyses is the independent t-test, which is used to compare two unpaired data groups. This test is included in parametric statistics, which must meet the assumptions or requirements of the hypothesis testing pretest. The test is transferred to the Mann-Whitney test if these requirements are unmet. The outcomes of the bivariate analysis are as follows:

a. Normality Test

The normality test by statistical analysis used the Shapiro-Wilk test because the data is < 50 people. Decisions can be made in the Shapiro-Wilk normality test by comparison of the Sig. value, with the significance, used α=0.05. If the value of Sig. > 0.05, the normality assumption is met, and the test is used as a paired test. When the value of Sig. < 0.05, then the normality is not met, and the test uses the Wilcoxon test. The statistical analysis of the normalcy test is displayed in Table 8 below.

Table 8. Normality Test Results

Variable	Group	Sig.	Conclusion
Pretest	Control	0.000	Abnormal
	Experiment	0.159	Normal
Posttest	Control	0851	Normal
	Eksperimen	0.034	Abnormal

Table 8 explains that in the pretest, the result Sig. of the Control group was 0.000, then that the Experimental group was 0.159. There was a group with a value less than 0.05, so it could be decided that the conclusion was not normally distributed in the pretest; then, it used the Mann-Whitney test. Meanwhile, in the posttest, the Sig. value of the Control group was 0.851, and the Experimental group was 0.034. There was a group with a value smaller than 0.05 so that it could be decided that the post-test data was not normally distributed, and the analysis used the Mann-Whitney test

b. Homogeneity Test

Based on decision-making, the homogeneity test employs Levene's variance test, which states that the two groups have distinct variances if the Sig. < value is 0.05. In contrast, the two groups have the same variance if the Sig. > value is 0.05. Table 9 below shows the homogeneity test listed.

Table 9. Homogeneity Test

Variable	Sig.	Results
Pretest	0.000	Non-Homogeneous
Posttest	0.040	Non-Homogeneous

The findings of the Homogeneity result in the table above show that the probability value of p or Sig is 0.000 in the pretest and 0.040 in the posttest, both values < 0.05. Thus, it can be determined that the data has not been homogeneous.

c. Test of Mann Whitney

The Mann-Whitney test determines whether the average of two unpaired samples differs. this test is a test of non-parametric statistics where the test does not require a prerequisite test. The following are the hypotheses and the basis for making decisions from the Mann-Whitney test:

Hipotesis:

H0 = There is no difference between the Control group and the Experiment group

H1 = There is a difference between the Control group and the Experiment group

Decision-Making Policy:

If value Sig. < 0.05, so H0 is rejected and H1 accepted

If value Sig. > 0.05, so H0 is accepted and H1 rejected

The results of Table 10 are obtained as follows based on data analysis using the Mann-Whitney test and SPSS 26 software.

Table 10. Hypothesis Results

Variable	Group		P-Value
	Control (Mean ± SD)	Experiment (Mean ± SD)	
Pretest	24.538 ± 3.215	29.653 ± 9.736	0.004
Posttest	69.269 ± 13.756	78.846 ± 9.548	0.006

In the presentation analysis in Table 10 above, information was obtained that in the pretest, the control group's mean was 24,538, while the experimental group's mean was 29,653. This indicates that the average score of the Control group is lower than that of the Experiment group. In addition, a p-value of 0.004 was also obtained, the value < 0.05, meaning that H0 was rejected and H1 was accepted. Thus, the final decision significantly differed between the control and experimental groups in the pretest.

In the post-test, the Control group's mean was 62,269, while the Experiment group's mean was 78,846. This indicates that the average score of the Control group is lower than that of the Experiment group. In addition, a p-value of 0.006 was also obtained, the value < 0.05, meaning that H0 was rejected and H1 was accepted. Thus, this research found a substantial difference between the control and the experimental group in the post-test. The research aligns with Huda (2014) and Soeprajitno et al. (2019) that significant score control and experiment group.

CONCLUSIONS AND SUGGESTIONS

This analysis concludes that the process-based differentiation learning model positively influences student learning outcomes at SMA POMOSDA Tanjunganom. The validity and reliability assessment demonstrated that the questionnaire employed in this study was both valid and reliable. In addition, the analysis of discriminatory power and difficulty level showed that the research instrument effectively measured the variables studied. The findings of this research are anticipated to contribute to developing more efficient learning methods in the educational environment.

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