Improving Statistics Learning Outcomes through a Differentiated Learning Approach for Students with Various Levels of Ability

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ARTICLE INFO	ABSTRACT
Keywords: Learning differentiation approach; Learning achievement; Statistics; Class VII students	Learning is a process of organizing, structuring the environment around students so that they can develop and encourage them to complete the learning process. The learning needs of students must always be the teacher's attention so that each learning process is carried out comfortably, happily and pleasantly, to be able to achieve and effectively implement the learning objectives to be achieved. Differentiated learning is an effort to adapt the learning process in the classroom to meet students' learning needs. Statistics allows students to understand and apply concepts relevant to data analysis, decision making, and problem solving in everyday life. A differentiation approach means providing assignments or activities with different levels of difficulty, providing additional reading materials or resources, and providing guidance or enrichment according to students' needs. Researchers found that the application of differentiated learning can help students to carry out learning activities more optimally. The aim of this research is to explain and evaluate the application of the learning differentiation approach in improving statistics learning outcomes for class VII students with various levels of ability. This research uses descriptive quantitative methods. The data collection methods for this research are observation, formative assessment and documentation. Data analysis uses simple statistical processing using the Sugiyono model. The results of this research show that there was an increase in the average achievement of students' learning objectives from pre-cycle by 71% to 80.65% in cycle I. In cycle II there was an increase in the average achievement of learning objectives by 88.71%. The differentiation learning approach can improve learning outcomes in statistics material in class VIIB UPT SMPN 14 Gresik with various levels of student ability.

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INTRODUCTION

Learning is basically a process, namely the process of organizing and structuring the environment around students so that it can develop and encourage students to complete the learning process (Pane & Dasopang, 2017; Ilyas & Syahid, 2018). Based on a psychological review, each student has different learning behaviors where learning styles, talents, interests, levels of intelligence and abilities are different (Rachmawati et al., 2019). The learning needs of students must always be the teacher's attention so that each learning process is carried out comfortably, happily and pleasantly, to be able to achieve and effectively implement the learning objectives to be achieved (Fauzi et al., 2023). Students with low abilities may have difficulty understanding complex concepts, while students with high abilities may feel hampered by learning activities that are too easy for them.

Studying statistics is an important component in mathematics. Statistics is a knowledge that contains data collection methods, data preparation techniques, how to analyze data that has been compiled and present data that has been analyzed (Rosyadi, 2018). Statistics allows students to understand and apply concepts relevant to data analysis, decision making, and problem solving in everyday life (Takaria & Talakua, 2018). Mathematical statistics can solve problems and communicate ideas through symbols, charts, graphs and more so that students can understand statistical concepts (Khasanah et al., 2023).

Differentiation learning uses various approaches in content, processes and products (Andini, 2016; Fitra, 2022). Content (input) relates to what students learn. Process is how students gather information and form ideas about what they are learning. Products (outcomes) about how students will demonstrate what they have learned (Wasih et al., 2020). In other words, different learning (differentiation) creates a diverse class by providing opportunities to absorb content, process ideas and improve the performance of each learner or student, so that they can learn more effectively (Suwartiningsih, 2021).

Differentiated learning (Differentiated instruction) is not a program, method, or strategy (Siburian et al., 2019). Differentiated learning is an effort or process to adapt the learning system in the classroom to the different learning needs, readiness and abilities of each student (Herwina, 2021; Fitra, 2022). The learning differentiation approach aims to meet the individual needs of students by providing materials, resources and learning strategies that are tailored to their ability level (Febrianti et al., 2023). The different learning needs of students in achieving learning goals is one of the aspects behind differentiated learning (Kamal, 2021; Amin et al., 2023). Differentiated learning can be used by an educator to ensure that learning occurs in the most effective way to meet the diverse learning needs of students (Pebriyanti, 2023). Differentiation learning means combining all differences to obtain information, generate ideas and express what they learn (Tomlinson, 2001). In the context of statistics learning, a differentiation approach can mean providing assignments or activities with different levels of difficulty, providing reading material or additional resources, and providing guidance or enrichment according to students' needs.

Teachers must understand students' learning needs in order to have methods that suit the goals, conditions, types and functions and suit the various levels of maturity of students (Nasution, 2017). Differentiated learning is a learning activity that can facilitate children's diverse learning needs (Setyawati, 2022; Maulidia & Prafitasari, 2023). In classes with students who have varying levels of ability, the differentiation approach can help students with low abilities to gain insight and

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understanding through a more specific approach and more targeted steps. On the other hand, students with high abilities can be given more complex challenges to sharpen their understanding and skills.

Applying a differentiated learning approach can create an inclusive learning environment and support the development of students with different ability levels (Jayanti et al., 2022; Widyawati & Rachmadyanti, 2023). Inclusive education aims to create an inclusive learning environment where all individuals can learn together, support each other and reach their full potential (Juntak et al., 2023). However, further research is needed to determine the effectiveness of applying the learning differentiation approach in improving statistics learning achievement in class VII students with various levels of ability. With a deeper understanding of the benefits of this approach, teachers can develop more effective learning strategies in teaching statistics to class VII students.

This research aims to explain and evaluate the application of the learning differentiation approach in improving statistics learning outcomes for class VII students with various levels of ability. With a better understanding of the application of the differentiation learning approach, it is hoped that the statistics learning outcomes of class VII students will improve. Furthermore, the results of this research can also provide direction and recommendations for teachers and educational practitioners to design more effective learning strategies in the context of statistics learning.

METHOD

Subject, Time and Place of Research

The subjects of this research were 31 students of Class VIIB UPT SMP Negeri 14 Gresik for the 2022/2023 academic year, consisting of 16 girls and 15 boys.

This research will be carried out in the even semester of the 2022/2023 academic year. Carried out for two months starting from April 6 2023 to June 12 2023 on statistics material in class VIIB which begins with Pre-cycle, implementation of cycle I and Cycle II.

Implementation Steps

This research is a PTKK (Collaborative Classroom Action Research) which takes place in two cycles and begins with a pre-cycle. Pre-cycle is a class observation and orientation activity before conducting research. Researchers also provide cognitive diagnostic assessments to map students' learning needs based on their learning readiness.
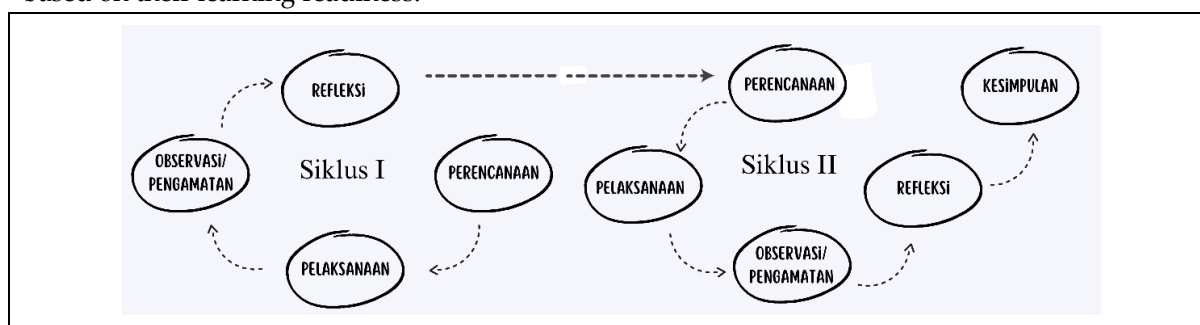
Figure 1. Kemmis and Taggart Model PTK Implementation Flow (Trianto, 2011; Arikunto, 2019)

This research uses a cycle design which includes planning, implementation, observation, reflection (Trianto, 2011; Arikunto, 2019). Implementation of classroom action research (PTK) is carried out collaboratively or in collaboration with colleagues to avoid subjectivity.

Implementation of Cycle I

Planning is the stage of defining and formulating problems. At this stage, we also prepare learning facilities and resources to carry out differentiated learning.

Implementation is the activity of implementing a differentiated learning plan on statistical material by involving collaborators, namely colleagues who act as observers. When carrying out differentiated learning, students are grouped according to their readiness to learn. The learning steps are in table 1 below.

<p align="center">**Table 1**. Learning Steps in Cycle I</p>

Activity	Steps

Preliminary activities	a. Teachers and students begin learning by greeting each other.
	b. The teacher asks how the students are doing and checks the students' attendance.
	c. Students prepare themselves, check their neatness and be disciplined in every learning activity.
	d. Provide apperception and motivation by asking stimulating questions:
	  • What should be done after data collection?
	  • What are the benefits of presenting data in the form of histograms and diagrams?
	e. The teacher explains the learning objectives and targets, namely using histograms and pie charts to present and interpret data.

Core activities	a. Students are given problems related to the interpretation and presentation of data. b. Students analyze the problems given by the teacher. c. Students are given the opportunity to discuss and ask questions if there is something they do not understand. d. The teacher provides LKPD containing problems which are then solved in groups according to the category of students' learning readiness (process differentiation). e. Students complete the LKPD by expressing the ideas they have with the teacher's guidance. f. Teachers provide assistance and guidance to students who have difficulty presenting data in the form of histograms and diagrams (process differentiation). g. Teachers observe and assess attitudes and skills. h. Several student representatives presented the results of their LKPD work. i. Students who do not make presentations provide responses/input so that questions and answers occur guided by the teacher. j. Students receive material reinforcement from the results of student presentations. k. The teacher gives appreciation to students who are active during learning. l. Students are asked to collect the results of their discussions. m. Students make conclusions about the types of data and how to collect data with teacher guidance.

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	a. Students together with the teacher reflect or evaluate the learning activities that have been carried out.
Closing Activities	b. The teacher delivers learning material at the next meeting, namely population and sample.
	c. The teacher closes the lesson with prayers and greetings.

Observation or observation includes two types of observation, namely the student learning process by the teacher (researcher), then differentiation learning activities observed by collaborators.

Reflection is a discussion activity or remembering what has been given, both advantages and disadvantages in implementing differentiated learning activities with collaborating teachers.

Implementation of Cycle II

Cycle II planning is the result of reflection from the cycle I learning process. Identify weaknesses in cycle I that need to be corrected in the cycle II learning process.

Implementation in cycle II is carrying out learning activities based on the results of the study of cycle I, with different learning objectives. The learning steps are in table 2 below.

Table 2. Learning Steps in Cycle II

Activity	Steps
Preliminary activities	a. Teachers and students begin learning by greeting each other. b. The teacher asks how the students are doing and checks the students' attendance. c. Students prepare themselves, check their neatness and be disciplined in every learning activity. d. Provide apperception and motivation by asking stimulating questions: • How much pocket money do you have in one week? • How much is your average pocket money in one week? e. The teacher explains the learning objectives and targets, namely: • Understand, differentiate the meaning, and apply the concepts of mean and median. • Understand, differentiate the meaning, and apply the concepts of mean, median, mode and range.
Core activities	a. Students are given problems related to mean, median, mode and range. b. Students analyze the problems given by the teacher. c. Students are given the opportunity to discuss and ask questions if there is something they do not understand. d. The teacher provides LKPD containing problems which are then solved in groups according to the category of students' learning readiness (process differentiation). e. Students complete the LKPD by expressing the ideas they have with the teacher's guidance. f. Teachers provide assistance and guidance to students who have difficulty understanding, distinguishing meaning, and applying the concepts of mean, median, mode and range. (process differentiation).

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	g. Teachers observe and assess attitudes and skills.
	h. Several student representatives presented the results of their LKPD work.
	i. Students who do not make presentations provide responses/input so that questions and answers occur guided by the teacher.
	j. Students receive material reinforcement from the results of student presentations.
	k. The teacher gives appreciation to students who are active during learning.
	l. Students are asked to collect the results of their discussions.
	m. Students make conclusions about the types of data and how to collect data with teacher guidance.
Closing Activities	a. Students together with the teacher reflect or evaluate the learning activities that have been carried out. b. The teacher delivers learning material at the next meeting, namely population and sample. c. The teacher closes the lesson with prayers and greetings.

Observation or observation includes two types of observation, namely the student learning process by the teacher (researcher), then differentiation learning activities observed by collaborators.

Reflection in cycle II is the process of re-analyzing an experience, examining the advantages and disadvantages in implementing learning activities as a consideration for continuing to the next cycle or phase.

Data collection technique

a. Observation/observation

Observations were made on students' activities when the differentiated learning process was implemented. Observation functions to complement quantitative data collection which is carried out using observation sheets.

b. Formative assessment

In the implementation of the independent curriculum, the term Minimum Completeness Criteria is not recognized (Kemdikbudristek, 2022). Therefore, formative assessment (assessment for learning) gets a higher proportion than summative assessment. Formative assessment is an assessment during learning to improve learning and obtain student feedback (Basuki & Hariyanto, 2016). Formative assessment is carried out in various forms, including: direct and written questions in the form of short answers and descriptions, discussion sheets and teacher notes.

c. Documentation

Documentation is notes and data that already exist or have been documented by the teacher.

Data analysis

Data analysis techniques include two aspects, namely quantitative and qualitative. Quantitative Data based on formative learning results, qualitative data based on observation sheets. After the data is obtained, it is then analyzed by data reduction followed by presenting the data and drawing conclusions. The data processing process with simple statistics is formulated as follows:

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$$P = \frac{f}{N} \times 100\%,\qquad(1)$$

Where:

P =percentage of variables studied

F =total scores obtained from respondents

N =maximum score

(Sugiyono, 2019)

RESULTS AND DISCUSSION

Results

Precycle

Pre-cycle was carried out to identify problems that occurred in class VIIB UPT SMPN 14 Gresik. The pre-cycle is carried out on statistics material with different learning objectives from cycle I and cycle II. In the pre-cycle formative test results, there are still many students who have not been able to meet the criteria for achieving learning objectives (KKTP). The criteria are adequate or meet the achievement of jointly determined learning objectives, namely a score of 75 for one learning objective. The data obtained is presented in table 3 below:

Table 3. Data on pre-cycle learning outcomes

Aspect	Description
Number of students who took the formative test	31
The number of students who have fulfilled the KKTP	22
Number of students who do not meet the KKTP	9
The highest score	90
Lowest Value	50
Total Score	2278
Average	73.48
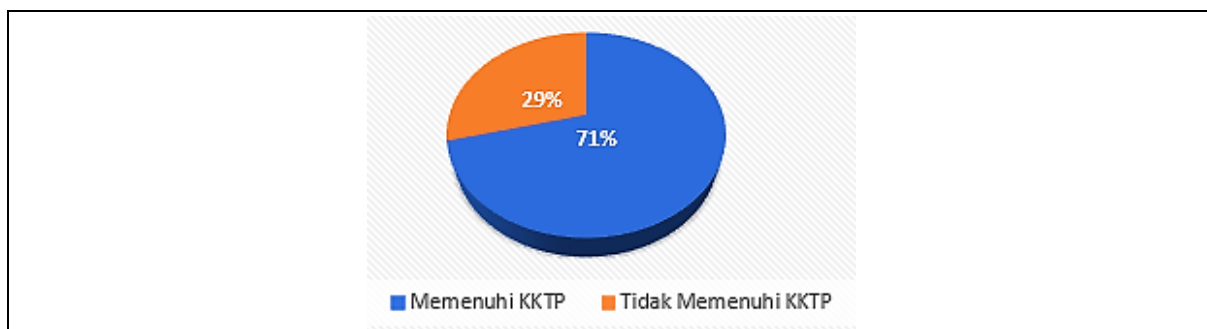
Figure 1. Precycle Classical Completion Diagram

Table 4. Learning achievement in Cycle I and Cycle II

Cycle	Learning objectives	Criteria	Adequate		Inadequate	
			F	P (%)	F	P (%)

Cycle I	1. Use histograms and pie charts to present and interpret data.	a. Collaboration in discussions	24	77.42	7	22.58
		b. Understanding of bar charts	26	83.87	5	16,13
		c. Understanding of line diagrams	25	80.65	6	19.35
		d. Understanding of pie charts	25	80.65	6	19.35
Number and average percentage of Cycle I			100	80.65	24	19.35
Cycle II	1. Understand, differentiate the meaning, and apply the concepts of mean and median.	a. Collaboration in discussions	27	87.10	4	12.90
		b. Understanding of the mean (average)	27	87.10	4	12.90
		c. Understanding the median	27	87.10	4	12.90
	2. Understand, differentiate the meaning, and apply the concepts of mean, median, mode and range.	d. Collaboration in discussions	27	87.10	4	12.90
		e. Understanding of the mode	28	90.32	3	9.68
		f. Understanding of range	29	93.55	2	6.45
Number and average percentage of Cycle II			165	88.71	21	11.29

Discussion

Based on the results of the research and learning process in the Classroom Action Research stages that have been carried out, it can be explained as follows:

Planning

The application of differentiated learning is something new in Statistics material in class VIIB UPT SMPN 14 Gresik. As one of the implementations of the Merdeka Curriculum, students feel the benefits of differentiated learning in statistics material. This material requires not only understanding but also skills in presenting and interpreting data. The learning needs of class VIIB students at UPT SMPN 14 Gresik are very diverse in terms of their learning readiness and cognitive abilities. Based on their learning readiness, class VIIB students at UPT SMPN 14 Gresik consist of 4 (four) categories. The first category is students with lagging cognitive abilities. They are students who still have difficulty reading and carrying out basic level arithmetic operations such as multiplication and division involving two-digit numbers. The second category is students with low abilities. They are students who are not ready to take part in learning activities because they have not completed the prerequisite material to receive statistics material. The third category is students with medium or regular abilities. They are students who are ready to receive statistics material and take part in learning activities. The fourth category is students with high or advanced cognitive abilities. This category is filled by students who already have some insight and knowledge regarding the learning objectives to be studied.

By looking at the very diverse distribution of students' cognitive abilities in class VIIB UPT SMPN 14 Gresik, the researchers designed differentiated learning to meet the learning needs of each student according to their learning readiness. By implementing differentiated activities, it is hoped that each student will get learning opportunities that are appropriate to their learning readiness. A differentiated learning approach in a process can provide a meaningful learning experience for all students even with different learning readiness. Class VIIB UPT SMPN 14 Gresik has a distribution of learning readiness

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with different abilities in its students. The gap in cognitive abilities of students in class VIIB UPT SMPN 14 Gresik is very high. After identifying the problem, at the planning stage, students' learning needs are mapped and learning instruments are prepared.

Implementation

Implementation in Cycle I, students are given student worksheets (LKPD) according to their learning readiness and reading material as a guide in learning. Student worksheets (LKPD) for the underdeveloped cognitive ability category are designed to provide learning experiences for students to understand the basic concepts of the learning objectives presented. Student worksheets (LKPD) for the low cognitive ability category are prepared with simpler displays and illustrations of problems so that students can build their own understanding of these learning activities. Student worksheets (LKPD) for the medium or regular cognitive ability category are prepared with illustrations of problems and higher learning activities compared to LKPD given to students with low cognitive ability. Student worksheets (LKPD) for the high or advanced cognitive ability category are prepared to improve students' ability to understand and solve problems in the context of the learning objectives being studied. Each student receives learning activities presented on the student worksheet (LKPD) according to their learning readiness. Students also receive guidance and assistance according to their learning readiness. Students who are ready to learn behind are given intensive guidance. Students with low learning readiness are given more guidance than those with regular learning readiness. Students with high learning readiness are given the opportunity to explore the material independently while still being supervised.

Cycle I learning outcomes can be seen from 1 (one) learning objective with 4 (four) criteria for achieving these learning objectives, where classically students experience improvement from pre-cycle. In the classical pre-cycle, the completion percentage was 71%, meaning that classically class VIIB UPT SMPN 14 Gresik had not achieved the expected learning outcomes. The percentage of completion of classical learning objectives in cycle I was 80.65%, meaning that students were able to fulfill the learning objectives. From the results of cycle I, it can be seen that there are indications of success in learning activities in class VIIB UPT SMPN 14 Gresik by implementing differentiated learning. To strengthen this argument, the research was continued in cycle II activities by making improvements based on evaluations of the implementation of learning activities in cycle I. In cycle II there was an increase in 6 (six) learning objective criteria, amounting to 88.71% of students had fulfilled the achievement of learning objectives. . Similar to the implementation of learning activities in cycle I, in cycle II, students also receive student worksheets (LKPD) according to their learning readiness. Formative assessments are also given with variations, including direct and written questions, as well as note sheets so that students can identify strengths and weaknesses in a lesson.

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Figure 2. Differentiated Learning Process

Observation/Observations

Based on observations of the increase in learning achievement from cycle I and cycle II in the application of differentiated learning, it is influenced by internal and external factors. Internal factors come from students themselves, namely readiness to learn, interest in learning and motivation to understand the material well. Students get different learning experiences according to their learning readiness so that they feel comfortable and enthusiastic in carrying out learning activities provided by the teacher. Students have more motivation to learn and build their understanding because the learning activities presented are in accordance with their learning readiness. Students are also given guidance and opportunities to explore their abilities so as to minimize learning boredom, especially for students with high or advanced cognitive abilities. External factors include the teacher's role in identifying student problems in cycle I and cycle II. After the teacher identified the problems in class VIIB UPT SMPN 14 Gresik, namely the diverse readiness and cognitive abilities of students, the teacher then carried out mapping and provided appropriate learning activities to lead students to the same learning goals. Apart from that, the learning environment and facilities also influence the success of students in achieving learning goals. The physical learning environment is in the form of a comfortable classroom for learning activities. In this case, the teacher and students arrange seating (tables and chairs) so that students are comfortable in carrying out learning activities. The teacher also presents material and instructions or information regarding a series of learning activities with interesting power point presentations so that students feel happy and enthusiastic in studying the material. The non-physical learning environment is a positive learning climate. Teachers and students build pleasant and directed communication so that students feel comfortable communicating learning difficulties. From this, students will get solutions to the obstacles they face immediately and receive guidance from the teacher so that problems do not pile up and disrupt their learning process.

Reflection

The advantage of each cycle in implementing differentiated learning in statistics material in class VIIB UPT SMPN 14 Gresik is that there is a mapping of students' abilities based on their learning readiness before implementing learning through cognitive diagnostic tests. From the mapping of students' learning readiness, researchers always provide student worksheets (LKPD) and guidance according to students' learning readiness. This ensures that students have their learning needs met and can develop a better understanding of the material. Students also get learning experiences in accordance with their learning readiness so that those with low learning readiness do not feel too burdened and students with high learning readiness do not feel bored.

The shortcoming that occurred in the implementation of cycle I learning activities was time efficiency. In cycle I, the implementation of learning activities was paused by break time, so teachers needed to make efforts to recondition students to be ready to continue learning activities after break time. In the first cycle of learning activities, there are activities where students draw graphs and diagrams. Many students are not ready to carry out this activity because they do not bring the necessary equipment such as a ruler and protractor. This hampers learning activities because students have to take turns completing activities on student worksheets (LKPD).

In cycle II, researchers provide material in the form of reading material that students can study one day before the lesson is implemented. This makes students more prepared to carry out learning activities in cycle II with maximum results than in cycle I.

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CONCLUSION

Differentiated learning is learning that takes into account students' interests, talents and learning readiness. Through differentiated learning, educators try creatively to adapt learning in the classroom so that it can meet the learning needs of different students. Differentiated learning can be used as an effort to provide an inclusive learning experience to each student so that they can achieve the expected learning goals. These results are shown in the increase in the classical class average score obtained by observation, formative assessment and documentation in each cycle to measure students' achievement of learning goals. The process differentiation learning approach also increases student activity to be active in learning. The application of differentiated learning in Statistics material in class VIIB UPT SMPN 14 Gresik provides benefits in improving the learning outcomes of students with various levels of ability.

THANK-YOU NOTE:

CONFLICT OF INTEREST

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