Guided discovery-based lkpd to enhance conceptual understanding and self-confidence in quadrilateral topics

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Abstract
The background of this research was the low level of students' conceptual understanding and self-confidence in mathematical learning. Guided discovery-based student worksheets were used as an alternative to improve both aspects. This study aimed to examine the improvement in students' conceptual understanding and self-confidence after the use of the worksheets. Classroom Action Research was employed as the research method, conducted in two cycles with a design consisting of planning, implementation, action, observation, and reflection. The subjects of this research were seventh-grade students at a junior high school in Bandung. The data collection instruments consisted of observation sheets, tests, questionnaires, and journals. The results of the tests, questionnaires, and observations were analyzed using percentage-based methods. Based on the analysis, it was concluded that both students' conceptual understanding and self-confidence improved after participating in instruction using guided discovery-based student worksheets.
Keywords: Student Worksheet Based on Guided Discovery; The Ability of Concept Understanding; Self-Confidence

Abstrak
Latar belakang penelitian ini adalah rendahnya tingkat pemahaman konseptual dan kepercayaan diri siswa dalam pembelajaran matematika. Lembar kerja siswa berbasis penemuan terpandu digunakan sebagai alternatif untuk meningkatkan kedua aspek tersebut. Penelitian ini bertujuan untuk mengkaji peningkatan pemahaman konseptual dan kepercayaan diri siswa setelah penggunaan lembar kerja. Penelitian Tindakan Kelas digunakan sebagai metode penelitian, dilakukan dalam dua siklus dengan desain yang terdiri dari perencanaan, pelaksanaan, tindakan, observasi, dan refleksi. Subjek penelitian ini adalah siswa kelas tujuh di sebuah SMP di Bandung. Instrumen pengumpulan data terdiri dari lembar observasi, tes, kuesioner, dan jurnal. Hasil tes, kuesioner, dan observasi dianalisis dengan menggunakan metode berbasis persentase. Berdasarkan analisis tersebut, disimpulkan bahwa pemahaman konseptual dan kepercayaan diri siswa meningkat setelah mengikuti pengajaran menggunakan lembar kerja peserta didik.

Kata Kunci: Lembar Kerja Mahasiswa Berdasarkan Penemuan Terbimbing; Kemampuan Pemahaman Konsep; Kepercayaan Diri

Introduction

Education is a process that is carried out consciously to acquire and disseminate knowledge, allowing cultural transfer from one generation to the next. According to Green (2013), the transfer of learning plays a crucial role in higher education, shaping students' ability to apply knowledge in various contexts. Over time, education has undergone rapid development, including increasingly sophisticated support devices. Vygotsky's sociocultural theory emphasizes that education is deeply embedded in cultural contexts, influencing cognitive development and learning processes (Kozulin et al., 2003; Nurmajumitasari, 2023).

Therefore, the changes that occur in society are one of the impacts of progress in the field of education. Rury (2002) highlights that education has historically been a driving force behind social change, shaping societal structures and opportunities. As education evolves, it continues to influence economic, technological, and cultural transformations, reinforcing its role as a catalyst for societal development.

Mathematics is one of the core subjects taught in schools, but understanding its concepts is often a challenge for students, including in quadrilateral contexts, where general learning difficulties such as a lack of visualization, understanding the properties of shapes, and contextual application of concepts often hinder their ability. them in solving mathematical problems (Erlita & Hakim, 2022). A good understanding of concepts will make it easier for students to study mathematics further (Suraji et al., 2018; Hidayat & Nuraeni, 2022).

According to the 2013 Curriculum, one of the goals of mathematics learning in schools is to develop students' abilities, especially in understanding and solving problems. In general, mathematics learning aims to ensure that students have competencies that are in accordance with the learning outcomes that have been set in the curriculum.

Mathematics has an abstract nature, which requires students to have a strong grasp of concepts. This understanding is crucial because, in mathematics, mastery of one concept often serves as the foundation for understanding subsequent concepts. Each concept is interconnected, so mathematics education must be conducted in a sequential and systematic manner. If students have a solid understanding of the basic concepts, they will find it easier to learn more complex concepts. Conceptual understanding plays a vital role in mathematics education, as it enhances students' ability to apply knowledge effectively (Bani Irshid et al., 2023). However, the reality in practice shows that many students tend to memorize formulas without understanding the rationale behind the solutions. This is

evident in the matter of the quadrangle, which is loaded with the use of formulas. The habit of memorizing without understanding causes students to easily forget and experience difficulties in mastering concepts as a whole. Research suggests that excessive reliance on memorization negatively impacts mathematical literacy and problem-solving skills (Magen-Nagar, 2016; Siregar, Siagian, & Syahlan, 2024). This independence will in turn shape the confidence of students. Confidence in solving math problems independently is hereinafter called self-confidence.

In particular, self-confidence in this study refers to a person's belief in his ability to perform an action to achieve a certain goal (Nuraeni & Afriansyah, 2021). In the context of mathematics learning, self-confidence refers to the confidence of students in solving mathematical problems independently until finding the right solution. A high level of confidence allows students to understand complex material and influences the thinking process used in solving problems. In addition to having an impact on improving learning outcomes, self-confidence also encourages students to apply the knowledge gained into daily life (Efwan et al., 2024). Therefore, self-confidence needs to be considered as one of the important components that support the process of understanding concepts in mathematics learning.

Realizing the importance of concept understanding and self-confidence skills in students, it is necessary to have facilities and infrastructure that support the development of these two abilities. According to Rahayu & Budiyono (2018). Books are not the only source of learning, teachers can provide learning resources to students in the form of LKPD by utilizing various other sources in the learning process. The purpose of this paper is to provide an understanding of LKPD, where LKPD can help with learning effectiveness. The Student Activity Sheet (LKPD) is one of the learning media that can help students understand the material, provide space to demonstrate knowledge, and develop process skills (Karsli & Sahin, 2009). Research conducted by Surbakti and friends (2016) shows that guided discovery-based LKPD has a positive impact on students' ability to understand concepts in rectangular flat building materials. Similar results were found in the research of Hasriani (2017), which showed that the application of guided discovery learning with the help of LKPD was effective in improving the understanding of mathematical concepts of grade VII students.

The LKPD used by teachers today generally only contains material summaries, sample questions, and practice questions. The LKPD tends to be less attractive because it is dominated by text and numbers without supporting visual elements, and is presented in a less varied format, such as without color. Research suggests that incorporating visual elements in educational materials enhances student engagement and comprehension (Mayer, 2021).

In addition, the questions presented in the LKPD do not have a real connection with daily life, so they are less helpful for students in understanding concepts contextually. Contextual learning has been shown to improve students' ability to relate academic concepts to real-world applications, fostering deeper understanding (Rahman et al., 2023). The development of LKPD based on contextual teaching and learning (CTL) has been found to be effective in reducing misconceptions and improving student learning outcomes (Astutik, 2021).

LKPD is defined as printed teaching materials in the form of sheets of paper containing materials, summaries, and instructions for the implementation of tasks that must be done by students, with reference to the basic competencies to be achieved (Prastowo, 2011:204). Meanwhile, according to (Dachi & Perdana 2021) LKPD is one of the teaching materials that contains materials, summaries, and instructions for the implementation of assignments in the form of tables as guidelines for students to carry out learning activities. Therefore, an effective LKPD in fostering students' ability to understand concepts should contain problems that can be studied together, direct students to formulate hypotheses, design and carry out experiments, collect and analyze data, and draw conclusions based on the results of the LKPD. This foundation of thinking is in line with the learning process that uses a guided discovery model.

Based on these considerations, a learning approach has emerged that involves the discovery of concepts by students with guidance from teachers, namely the guided discovery learning model. This model provides students with the opportunity to actively construct their knowledge. Guided discovery learning is a teaching strategy designed in such a way that students can gain knowledge that they did not know before, either partially or completely, through the discovery process guided by the teacher. According to De Jong and Lazonder (2014), guided discovery learning enhances students' ability to integrate new information with prior knowledge, leading to deeper understanding and retention.

This model emphasizes the importance of the role of teachers in creating an interesting, creative, and innovative learning experience, so that students get optimal provisions in dealing with real-world complexities. Research suggests that effective teacher guidance in discovery learning significantly improves students' problem-solving skills and scientific literacy (Anggriani, 2020). The structured support provided by teachers ensures that students remain engaged and motivated throughout the learning process, fostering independent thinking and critical reasoning (Yuni, 2019).

Based on the conditions that occurred in class VII-B SMP Plus Al-Istiqomah in the 2018/2019 school year, several problems were found in the understanding of quadratic material. First, most students are not able to mention the definition of a square correctly. Second, students are less skilled in explaining the properties of various types of quadrangles, such as distinguishing between rhombus, parallelograms, and kites. Third,

students also have difficulty explaining the differences between the angles in a quadrangle. In fact, the material of the quadrangle is a topic that is often encountered and has a close relationship with situations in daily life.

Similarly, in the learning process, students are often reluctant to answer questions asked by teachers for fear of giving the wrong answer. They also showed a lack of courage to go to the front of the class in solving problems. In fact, the habit of asking questions almost never appears, so active interaction in learning becomes very minimal.

Based on these conditions, the author intends to increase students' interest in learning through the use of concrete media, namely quadrilateral materials, by implementing a learning process that allows students to experience and discover related concepts for themselves. This approach is realized through the implementation of guided discovery-based LKPD.

Method

This research uses a mixed approach, namely qualitative and quantitative. A quantitative approach is used to analyze data in the form of numbers that describe the extent of students' understanding of concepts, which is measured through formative test instruments in the form of description questions. Meanwhile, a qualitative approach was used for descriptive analysis and interpretation of non-numerical data, such as questionnaires and observation sheets, to determine the level of self-confidence of students after participating in learning using guided discovery-based LKPD.

The method used in this study is Classroom Action Research (PTK). According to Arikunto, et al. (2011:3), "Classroom action research is a scrutiny of learning activities in the form of actions, which are deliberately raised and occur in a class together. These actions are given by the educator or by the direction of the educator carried out by the student." This research was carried out in two cycles, namely Cycle I and Cycle II. Each cycle is designed through four stages, namely planning, implementation of actions, observation, and reflection.

To determine the improvement of students' conceptual understanding abilities, data was obtained from the results of formative tests analyzed in each cycle. Furthermore, for each indicator of the conceptual understanding abilities being studied, the total percentage of scores obtained by students is calculated. The calculation is performed using the formula proposed by Sudaryono et al. (2013) as follows:

$$Percentage\ of\ concept\ comprehension = \left(\frac{\sum Scores\ obtained\ by\ students}{\sum maximum\ total\ score}\right) \times 100\% \qquad (1)$$

Meanwhile, individual learning completeness can be obtained with the following formula:

$$Absorbency\ of\ learners = \frac{\sum score\ each\ question\ achieved}{\sum Ideal\ score} \times 100\% \quad (2)$$

The success of improving students' conceptual understanding and self-confidence through the implementation of guided discovery-based student liveworksheet is determined based on the following indicators:

a. The percentage of students in mathematics learning who reached the category of at least "high" was ≥ 75%, with an average self-confidence questionnaire score of > 3.00.
b. Classical absorption reaches ≥ 85% of all students.
c. The individual absorption of students reached ≥ 65%.

Result

The data analyzed in this data is students' self-confidence in mathematics learning before the implementation of the guided discovery-based student worksheet.

Table 1. Results of the analysis of educator activities

No	Activities	Percentage
1	Introduction	72,72%
2	Core activities	83,83%
3	Closing	80%
	Average	**78,68%**

Table 2. Percentage of the test of concept comprehension ability cycle i

No.	Indicators of Ability to understand concepts	Total Score
1	Restating the concepts that have been learned	98
2	Clarify objects based on whether or not the requirements that form the concept are met.	109
3	Apply concepts logically	87
4	Provide examples or examples of cons of the concepts studied.	60
5	Presenting concepts in various forms of mathematical concept representation	58
6	Relate several concepts in mathematics and outside mathematics	55
7	Developing the necessary and/or sufficient conditions of a concept	57
	Average	**16,90**
	Percentage	**60,37%**

Table 3. Class absorption percentage

Cycle I Test Results	Total	
Maximum Value	79	
Minimum Grade	25	
Class Absorbency (DSK)	45,16	
Number of students who completed	14	45,16%
Number of students who have not completed	17	54,84%

Table 4. Percentage of self-confidence questionnaire for cycle i students

No.	Assessment Aspects	Cycle I Score
1	Believe in abilities	386
2	Acting independently in decision-making	187
3	Have a positive sense of self	189
4	Brave enough to express an opinion	360
	Average	**36,2**
	Percentage	**75,40%**

Based on Table 4, the average self-confidence of students is 36.2 with a percentage of 75.40%, indicating that most students have a fairly sufficient level of confidence. However, students tend to be still passive in the learning process. This is reflected in the fact that there are still many students who feel embarrassed or hesitant in expressing their ideas and ideas.

After reflecting on the implementation of the first cycle, the learning plan was then adjusted by implementing a guided discovery-based LKPD. The steps in the planning include:

a. Preparation of learning tools, including the syllabus, Learning Implementation Plan (RPP) for cycle II, and revised Student Worksheets (LKPD). In its use, students are directed to actively discuss in groups and complete tasks on time.
b. Preparation of learning evaluation tools, namely the second cycle formative test questions. At the end of the meeting, students were reminded about the implementation of the test at the next meeting. The teacher also emphasized that students are not affected by other classes, so that they are able to work on questions calmly and not in a hurry.
c. Creation of teacher activity observation sheets, as an instrument to assess the implementation of the learning process during cycle II.
d. The formation of a learning group, which is as many as six groups consisting of 4 to 5 students each.

Educators carry out learning in accordance with the Learning Implementation Plan (RPP) and improvements that have been designed based on the results of previous evaluations. In the preliminary stage, educators condition the class and check the attendance of students. Furthermore, educators provide motivation, convey learning goals and indicators, and relate the material to be learned with the material that has been studied previously.

In the core activity, educators divide students into eight groups, each consisting of 4 to 5 people. At the problem presentation stage, educators provide LKPD to be done collaboratively in groups. During the activity, educators facilitate interaction between students to support the process of actively discovering concepts.

At the learning design stage, educators only had time to help some students in analyzing the rectangular flat shapes obtained. Students identify the flat building in accordance with the instructions contained in the LKPD. This condition occurs because educators need to record and monitor the responses of all students thoroughly. Nevertheless, educators still try to guide and direct students who have difficulties in solving problems in the LKPD.

After the students completed the LKPD, they were given the opportunity to present their findings. However, due to time constraints, only five groups got the opportunity to deliver presentations. Furthermore, the educator conveyed the conclusion of the overall discussion, especially regarding the trapezoid, rhombus, and kite materials. At the end of the session, educators also give assignments to students related to the next learning material.

Educators provide students with the opportunity to ask questions at the end of the activity and submit a learning plan for the next meeting. In addition, educators also emphasized that students are not late when doing formative tests 2. The analysis of the data from observations on educator activities in cycle I can be seen in the Table 5.

Table 5. Results of the analysis of educator activities

No.	Activity	Precentage
1	Introduction	90,90%
2	Core activities	83,83%
3	Closing	100%
	Average	**91,41%**

Based on Table 5, the average activity of educators is 91.41%. This indicates that, in general, educators conduct learning according to the stages or steps of the guided discovery learning model with good criteria. In addition, the observation sheet of educators in cycle II shows an improvement, indicating that educators have corrected previous mistakes.

Students' self-confidence in mathematics learning using guided discovery-based LKPD was measured through questionnaires. The questionnaire was given to students after the learning in cycle II ended. The percentage of the results of the questionnaire regarding the mathematical disposition of students can be seen in the following Table 6.

Table 6. Percentage of student self-confidence questionnaire cycle ii

No.	Assessment Aspects	Cycle II Score
1	Believe in Ability	417
2	act independently in decision-making	212
3	memiliki rasa positif terhadap diri sendiri	205
4	Dare to express your opinion	395
	Average	**91,41%**
	Percentage	**82,59%**

Based on the Table 6, the average student learning interest score of 39.6 with a percentage of 82.59% shows that in general the mathematical disposition of students is relatively good. In addition, during the learning process in cycle II, educators consistently pay attention to and assess students' ability to understand concepts, starting from activities during learning to the processing of test scores. Data on students' concept comprehension ability was collected through tests carried out at the second meeting. As for the results of the test of concept comprehension ability after actions in cycle II, as shown in the table 7, showing that students' concept comprehension ability is in the good category, with a class absorption capacity (DSK) of 83.87%.

Table 7. Percentage of Concept Comprehension Ability Test Cycle II

No.	Indicators of Ability to understand concepts	Total Score
1	Restating concepts that have been learned	95
2	Clarify objects based on the fulfillment of the requirements that make up the concept	89
3	Applying the concept logically	95
4	Provide examples or examples of cons of the concepts studied	99
5	Presenting concepts in various forms of representation of mathematical concepts	95
6	Relate several concepts in mathematics and outside mathematics	93
7	Develop necessary and or sufficient conditions of a concept	85
	Average	**75,00%**
	Percentage	**83,87%**

Table 8. Percentage of class absorption

Cycle II Test Results	Total	
Maximum Value	85	
Minimum Grade	40	
Class Absorbency (DSK)	83,87	
Number of students who completed	26	83,87%
Number of students who have not completed	5	16,13%

Based on Table 8, in Cycle II, the Class Absorption Power (CAP) has met the established completion criteria. This indicates that the students have become more accustomed to answering formative assessment questions and have demonstrated a more optimal learning attitude throughout the learning process.

Discussion

Based on the results of data analysis, there was an increase in students' ability to understand concepts and self-confidence in mathematics learning through a guided discovery learning model from cycle I to cycle II. The average ability to comprehend concepts increased from 60.37 to 75.00, while confidence increased from 75.50 to 82.96.

The success achieved by students is due to their ability to adapt gradually to the learning model applied by educators. This encourages them to participate more actively in learning, explore creativity in concluding material, collaborate with group members, express opinions, pay attention to educators' explanations, be serious in learning, and be enthusiastic in conveying the difficulties faced when solving problems.

Educators also play a crucial role in achieving successful learning outcomes. This is evidenced by the readiness of educators to improve the learning process in each cycle based on previous reflection results. Gradually, educators are able to manage the classroom effectively, implement guided discovery learning steps, and optimally organize learning time. Based on the analysis of test results regarding students' conceptual understanding and self-confidence questionnaires, learning that applies guided discovery-based worksheets has been proven to enhance students' conceptual understanding and self-confidence. This improvement occurs because students independently discover the concepts being studied and thoroughly master their findings. In the learning process, educators play the role of providing guidance and encouraging students to think independently, enabling them to identify the general principles of quadrilateral material. The level of guidance provided is adjusted to the capabilities of the students as well as the complexity of the material being studied.

Conclusion

The application of LKPD based on guided discovery can improve the ability to understand concepts and self-confidence of students in grade VII B SMP Plus Al-Istiqomah in quadrilateral material.

Conflict of Interest

The authors declare that no conflict of interest regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely by the authors.

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