JURNAL LOCUS: Penelitian & Pengabdian
Volume 5 No. 11 November 2026, pp 10481-10487
E-ISSN 2829-7334
DOI: 10.58344/locus.v5i11.6502

Development of Student Worksheets (LKS) Based on An Investigative Learning Model to Improve Understanding of Concepts and Communication Skills Mathematics Students of Grade V SDN 09 Padang

Rodi Chandra[1]* , Melani Disajati[2] , Karina Dwi Arista[3]
Universitas Dharmas Indonesia, Indonesia[1]
SMA N 1 TARUSAN Pesisir Selatan, Indonesia[2]
Universitas Ekasakti Padang, Indonesia[3]
Email : ypb.pesoan1@gmail.com[1]*

Keywords:
Student Worksheets (LKS); Investigation-Based Learning Models; Concept Understanding Skills and Communication Skills.

This is an open access article under the CC BY-SA license.

Copyright © 2026 by Author. Published by Riviera Publishing

ABSTRACT

The thing that causes the lack of students' ability to understand concepts and mathematical communication skills is that the learning activities carried out are not supportive. The difficulty in learning mathematics occurs because students consider many formulas to be memorized. Memorizing formulas alone does not guarantee that students can understand the material learned, even memorizing will make students passive and unskilled in developing their mindset. One of the learning models to make students not memorize and remember a set of facts but make students more active and skilled in acquiring mathematical concepts is the investigational learning model-based worksheet. The investigation-based learning model facilitates support so that students can construct their own understanding through investigation activities. The learning process will be carried out well because it is supported by the worksheets used. The available worksheets can still be developed again so that they can facilitate students to improve their ability to understand concepts and mathematical communication skills.

INTRODUCTION

Mathematics is one of the basic sciences that plays an important role in the formation of students' mindsets. This mindset can be formed in mathematics learning if every student is able to understand mathematics well. In addition, mathematics also has a very important role in the development of science and technology. Mathematics subjects need to be given to students with logical, systematic, critical and creative thinking skills as well as the ability to work together (Chandra, 2015b, 2015a; Ernest, 2004; Jaworski, 2003; Suherman, 2003).

Realizing the importance of the role of mathematics, various efforts have been made by the government to improve the quality of mathematics education, including by equipping learning facilities and infrastructure, providing training and training to mathematics teachers, improving the quality of teachers through certification, and providing opportunities for educational units to improve the curriculum to suit the needs and progress of the times. However, the various efforts that have been made have not shown satisfactory results (Cai & Rott, 2024; Sumarmo, 2003; Trianto, 2010; Yeo & Yeap, 2012; Zhang et al., 2022).

The curriculum at the education unit level in mathematics subjects has the goal that students have the ability to understand mathematical concepts, use reasoning on patterns and attitudes, be able to solve problems that include the ability to understand problems, and the ability to communicate ideas with symbols, to clarify situations or problems. Mathematics learning also aims to make students have an attitude of appreciating the usefulness of mathematics in life (Guo et al., 2024; Ölmez et al., 2025; Suhaimee et al., 2026; Zhang et al., 2024, 2025).

The purpose of learning mathematics can be achieved properly if every element related to the management of mathematics learning in schools understands its meaning. To understand the meaning of the purpose of the subject, it is necessary to understand the characteristics of mathematics material. These characteristics of mathematics require the understanding of mathematics subject teachers. With this understanding, subject teachers can relate mathematics characteristics to the objectives of mathematics lessons to be achieved and the implications so that student learning outcomes can be achieved optimally (Gómez-Chacón et al., 2024; Huang et al., 2021; Putri et al., 2022; Sugiharti et al., 2026; Ulya et al., 2024).

In fact, in some schools, especially at the elementary school (SD) level, low student learning outcomes are still a problem that continues to be faced by schools. The author also found this problem in SDN 09 Padang which occurred in grade V which said that students' understanding of concepts and communication skills was not satisfactory.

Most students are not serious in learning, one-way learning, learning feels boring, the enthusiasm for learning is lacking, students only memorize the formulas given without understanding them, so that students' understanding of concepts is lacking, afraid to ask, and do not dare to express opinions about the material that has not been understood. When the teacher gives exercises, most students who are not good at just copying have a friend who is smarter without asking for an explanation. In addition, if the form of the question is slightly different from the example of the question that has been given by the teacher after explaining the material, then students will have difficulty in doing it as a result of the students' understanding of concepts and communication skills is low.

They tend to be less motivated to understand the material to be learned before being taught by the teacher and do not want to ask questions. If the concepts explained by the teacher are not understood, it results in students having little understanding of the concepts in mathematics learning. In addition, students tend to be passive when required to be active in the learning process. This can be seen, when the teacher asks questions, only a few students try to answer and the person tends to be the same. Therefore, teachers must be able to overcome these problems by choosing and trying various learning strategies that can motivate students to be active and physically involved and have initial knowledge so that students can understand the lesson more easily.

As a result of the observation that the researcher has conducted at SD N 09 Padang, the researcher obtained an idea that learning is still centered on the teacher. This can be seen during the learning process, where the teacher dominates the learning activities in the classroom, resulting in a lack of optimal students' thinking skills. In addition, teachers lack variety in choosing and implementing learning strategies that can attract students' attention. This also results in most students only listening to and recording the subject matter delivered by the

teacher. Not only that, when learning is taking place, teachers have not optimally paid attention to the initial knowledge possessed by students.

The results of interviews with grade V teachers are related to the low learning outcomes of students, especially in mathematics lessons. That students still have many difficulties in doing the practice questions given by the teacher even though the teacher has provided examples of questions that are similar to the practice questions given, the researcher concludes that this is due to several factors, one of which is the lack of learning tools that can improve students' concept understanding and communication skills. So based on the above circumstances, the low learning outcomes are one of the factors that can show that the mastery of grade V students of SDN 09 Padang on understanding concepts and mathematical communication skills is still relatively low.

As a result of the observation that the researcher has conducted at SD N 09 Padang, the researcher obtained an idea that learning is still centered on the teacher. This can be seen during the learning process, where the teacher dominates the learning activities in the classroom, resulting in a lack of optimal students' thinking skills. In addition, teachers lack variety in choosing and implementing learning strategies that can attract students' attention. This also results in most students only listening to and recording the subject matter delivered by the teacher. Not only that, when learning is taking place, teachers have not optimally paid attention to the initial knowledge possessed by students.

The results of interviews with grade V teachers are related to the low learning outcomes of students, especially in mathematics lessons. That students still have many difficulties in doing the practice questions given by the teacher even though the teacher has provided examples of questions that are similar to the practice questions given, the researcher concludes that this is due to several factors, one of which is the lack of learning tools that can improve students' concept understanding and communication skills. So based on the above circumstances, the low learning outcomes are one of the factors that can show that the mastery of grade V students of SDN 09 Padang on understanding concepts and mathematical communication skills is still relatively low. Therefore, the Investigation learning model is the right learning model in the development of LKS. LKS with an investigative learning model can activate students in the learning process, namely providing more opportunities for students to be involved in learning, namely students find productive ways to adapt, modify, and describe specific problems. In addition, this LKS is also expected to be learned through a learning activity. This is the basis for the researcher's desire to develop the LKS with the Investigation model. This LKS is expected to be used as a learning medium for students and make it easier for teachers to deliver material.

METHOD

Research Types and Models

This research is a research and development (R&D) that aims to produce Student Worksheets (LKS) based on an investigative learning model to improve students' mathematical concept understanding and communication skills. The development model used is the RC model (Rochmad), which consists of five stages: preliminary analysis, product development, LKS validation, practicality test, and effectiveness test. The location of this research was carried out at SD Negeri 09 Padang for grade V students.

This research procedure is carried out in 5 stages,

a) Preliminary Analysis Stage
b) Product Development Stage
c) Validation Stage
d) Practicality Test Stage
e) Effectiveness Test Stage

The research instruments used were LKS validation sheets, observation sheets, interview guidelines, student and teacher response questionnaires, concept comprehension tests and mathematical communication. The data analysis techniques used were validity, practicality and effectiveness.

RESULTS AND DISCUSSION

The research that has been carried out with the development of student worksheets based on investigative learning with the RC Model starts from the preliminary stage, the product development stage, the LKS validation stage, the preccability stage, and the effectiveness stage. The preliminary stage consists of problem analysis, concept analysis, student analysis, literature analysis, and product analysis. Problem analysis is carried out to identify problems and obstacles that occur in the learning process. From the results of interviews with mathematics teachers of SD Negeri 09 Padang, some information was obtained that the LKS used still has shortcomings to support the implementation of learning with an investigative learning model.

The current curriculum is KTSP. The analysis of this curriculum is carried out on two supporting aspects, namely Competency Standards (SK) and Basic Competencies (KD). The allocation of mathematics learning for grade V of SDN 09 Padang is 4 hours of lessons, with a conversion of 40 minutes per hour of lessons. The mathematics teacher of SDN 09 Padang stated that this time is still insufficient to be able to achieve basic competencies. The basic competencies for comparison materials are as shown in table 1 below.

Table 1. Basic Competencies of Comparative Materials

Basic Competencies	**Indicator**
6.1 Calculating the area of the trapezoid	6.1 Discovering trapezoidal and kite area formulas
6.2 Calculating the area of the kite	6.2 Using formulas to determine the area of trapezoids and kites
6.3 Calculating the volume of cubes and blocks	6.3 Finding the volume formula of cubes and blocks
	6.4 Using formulas to determine the volume of cubes and blocks
	6.5 Find the formula for looking for length, width, and height on the beam as well as on the ribs if any are already known
	6.6 Find the volume relationship of the block and the cube to find the length of the ribs.

Concept analysis aims to determine the content and subject matter needed in the development of LKS. The main concepts are (1) determining the area of trapezoids and kites,

(2) calculating the volume of cubes and blocks. The following is a concept map of the teaching materials of trapezoidal and kite areas in Figure 1, the volume of cubes and blocks in Figure 2.

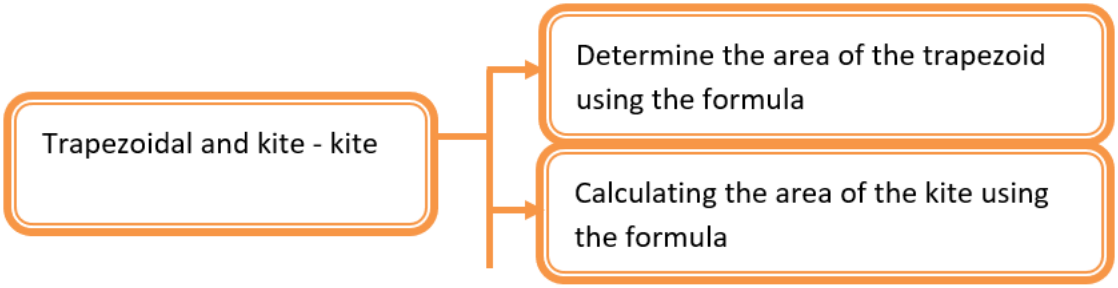


Figure 1. Trapezoidal and Kite Concept Map

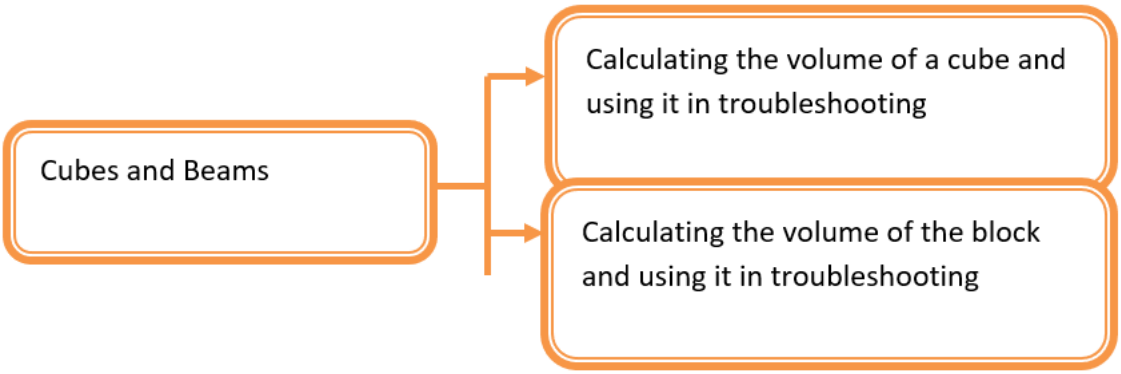


Figure 2. Cube and Beam Concept Map

The analysis of student characteristics in this study was carried out on aspects of student language development, intellectual development, and things that can increase student learning motivation. Analyzing the level of student language development is used for consideration in compiling language in the LKS. Analyzing students' intellectual development is used for consideration in compiling the level of difficulty of problems in the LKS. Meanwhile, analyzing student learning motivation is used for consideration in designing the presentation of LKS that invites students' interest or motivation to learn.

In the literature analysis, this analysis was carried out to analyze books/literature that support the development of LKS based on the investigative learning model. Product analysis was carried out by evaluating the LKS used in mathematics learning in grade V elementary school used in elementary school. This evaluation aims to find out whether the LKS used is in accordance with the applicable curriculum, the way the LKS is presented, the questions used in the LKS and the principles of the investigation approach that can develop the ability to understand concepts and communicate.

This Investigative Learning Model-based worksheet has a size of 29.7 cm x 21 cm. The type of writing used in this worksheet is Comic Sans MS. The presentation of the worksheet begins with a picture of the use or application of learning materials in life and digging questions. The next page contains Sub-chapters, KD, indicators and instructions for the use of WORKSHEETS. The next page contains various fun activities or activities. Investigative activities in the LKS are limited to data information collection, proofing, knowing, solving, and conclusions. These activities are expected to foster students' interest or motivation in learning.

CONCLUSION

Based on the results of the research, it was obtained that the LKS based on the investigative learning model to improve conceptual skills and communication skills are in the valid category in terms of content and construction. Based on the experiments carried out, in terms of practicality, the LKS meets the practical criteria from the aspects of presentation, ease of use of devices, the use of language and the time used. This can be seen from the results of observations on the use of LKS in learning, interviews and student and teacher response questionnaires. The effectiveness of LKS is seen from the understanding of concepts and communication skills, the results of the study illustrate that there is an increase in students' concept understanding and mathematical communication skills. Thus, it can be concluded that the LKS based on the investigation learning model developed is valid, practical, and practical.

FUNDING

This research does not receive special funding from government, private, or other organizations.

CONFLICT OF INTEREST

The authors state that there is no conflict of interest in the research, writing, or publication of this article.

AUTHOR CONTRIBUTIONS

All authors contributed to the preparation of this article. Rodi Chandra, Melani Disajati and Karina Dwi Arista played a role in the conceptualization of the research, played a role in data collection and analysis, played a role in the interpretation of the results and the preparation of the manuscript, while other authors contributed to the review, editing, and final approval of the manuscript.

GENERATIVE AI STATEMENT

The author states that no generative artificial intelligence was used in the preparation of this article.

REFERENCES

Cai, J., & Rott, B. (2024). On understanding mathematical problem-posing processes. *ZDM – Mathematics Education*, *56*(1), 61–71. https://doi.org/10.1007/s11858-023-01536-w

Chandra, R. (2015a). *Development of investigation-based learning model to develop students' mathematical skills*. Universitas Negeri Padang.

Chandra, R. (2015b). *Investigation-based learning model*. Blue Ocean.

Ernest, P. (2004). *The philosophy of mathematics education*. RoutledgeFalmer, Taylor & Francis Group.

Gómez-Chacón, I. M., Bacelo, A., Marbán, J. M., & Palacios, A. (2024). Inquiry-based mathematics education and attitudes towards mathematics: Tracking profiles for teaching. *Mathematics Education Research Journal*, *36*(3), 715–743. https://doi.org/10.1007/s13394-023-00468-8

Guo, Y., Yan, J., Zhou, W., & Dang, G. (2024). The selections and differences in mathematical

problem-posing strategies of junior high school students. *Humanities and Social Sciences Communications*, *11*, Article 575. https://doi.org/10.1057/s41599-024-03084-4

Huang, L., Doorman, M., & van Joolingen, W. (2021). Inquiry-based learning practices in lower-secondary mathematics education reported by students from China and the Netherlands. *International Journal of Science and Mathematics Education*, *19*(7), 1505–1521. https://doi.org/10.1007/s10763-020-10122-5

Jaworski, B. (2003). *Investigating mathematics teaching: A constructivist enquiry* (5th ed.). The Falmer Press, Taylor & Francis Group.

Ölmez, İ. B., Han, J., Hwang, S., & Cai, J. (2025). Mathematical problem-posing research: Revisiting some answered and unanswered questions. *Avances de Investigación En Educación Matemática*, *28*, 11–30. https://doi.org/10.35763/aiem28.8124

Putri, R. I. I., Zulkardi, Z., & Riskanita, A. D. (2022). Students' problem-solving ability in solving algebra tasks using the context of Palembang. *Journal on Mathematics Education*, *13*(3), 549–564. https://doi.org/10.22342/jme.v13i3.pp549-564

Sugiharti, A., Rahmawati, D., & Anwar, R. (2026). Trends in mathematical problem-solving skills in mathematics learning. *International Journal of Studies in Education and Science*, *7*(2), 188–201. https://doi.org/10.46328/ijses.6725

Suhaimee, N. R. A., Zakaria, M. I., Ismail, N., & Hanafi, N. H. (2026). Inquiry based learning in mathematics education: A bibliometric study. *International Journal of Education in Mathematics, Science and Technology*, *14*(2), 519–540. https://doi.org/10.46328/ijemst.5352

Suherman, E. (2003). *Contemporary mathematics learning strategies*. JICA Universitas Pendidikan Indonesia.

Sumarmo. (2003). *Research procedures of a practical approach*. Bumi Aksara.

Trianto. (2010). *Integrated learning model: Concepts, strategies, and its implementation in the curriculum at the education unit level (KTSP)*. Bumi Aksara.

Ulya, H., Sugiman, S., Rosnawati, R., & Retnawati, H. (2024). Technology-based learning interventions on mathematical problem-solving: A meta-analysis of research in Indonesia. *International Journal of Evaluation and Research in Education*, *13*(1), 292–301. https://doi.org/10.11591/ijere.v13i1.26380

Yeo, J. B. W., & Yeap, B. H. (2012). *Characterising the cognitive processes in mathematical investigation*. National Institute of Education, Nanyang Technological University.

Zhang, L., Cai, J., Song, N., Zhang, H., Chen, T., Zhang, Z., & Guo, F. (2022). Mathematical problem posing of elementary school students: The impact of task format and its relationship to problem solving. *ZDM – Mathematics Education*, *54*(3), 497–512. https://doi.org/10.1007/s11858-021-01324-4

Zhang, L., Song, N., Wu, G., & Cai, J. (2025). Understanding the cognitive processes of mathematical problem posing: Evidence from eye movements. *Educational Studies in Mathematics*, *118*(3), 449–478. https://doi.org/10.1007/s10649-023-10262-9

Zhang, L., Stylianides, G. J., & Stylianides, A. J. (2024). Enhancing mathematical problem posing competence: A meta-analysis of intervention studies. *International Journal of STEM Education*, *11*, Article 48. https://doi.org/10.1186/s40594-024-00507-1