
The Implementation of the SOLE (Self-Organized Learning Environment) Learning Model in Answering Big Questions in Algebra Topics

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Abstract

The SOLE learning model facilitates students to learn independently through exploration and group discussion, with a focus on solving relevant and challenging problems. This community service activity aims to improve the competencies of both teachers and students in mathematics learning, particularly in algebra, through the implementation of the SOLE (Self-Organized Learning Environment) model based on Big Questions. The SOLE model is designed to encourage students to learn independently and collaboratively through open-ended questions that stimulate critical thinking and problem-solving skills. This activity was conducted at a partner junior high school, involving both teachers and students as participants in training and mentoring sessions. The methods employed in this program included the dissemination of the SOLE and Big Question concepts, training in lesson planning, and guided classroom implementation. The results of the activity showed an improvement in teachers' understanding of innovative teaching strategies, as well as positive responses from students, who demonstrated active engagement, increased curiosity, and better conceptual understanding of algebra. This community service initiative provides a tangible contribution to strengthening teachers' capacity in designing meaningful instruction and in creating a learning environment that promotes student autonomy and creativity. The application of the SOLE model based on Big Questions has proven to be an effective approach to delivering mathematics instruction in a more contextualized and enjoyable manner.

Keywords: SOLE, Algebra, Big Question

INTRODUCTION

Several factors influence the achievement of competency standards in mathematics learning. These include monotonous and unengaging learning processes, the over-reliance on teachers as the sole source of knowledge, and students' limited understanding of the real-world relevance of mathematics. Learning outcomes are defined as the level of achievement attained by students after undergoing a specific learning process. In the context of mathematics, meaningful learning requires not only cognitive engagement but also emotional and contextual relevance.

Educators are therefore expected to design a more enjoyable and student-centered learning environment to facilitate better comprehension and improved academic performance. One of the efforts to enhance students' interest and learning outcomes is through the implementation and integration of innovative learning models or approaches. A promising method is the use of Big Questions in combination with the SOLE (Self-Organized Learning Environment) model. This approach encourages students to work collaboratively, explore open-ended questions, and take ownership of their learning process.

In response to the observed decline in students' interest and performance in mathematics—often attributed to the teacher-centered paradigm where learners act as passive recipients—it is crucial to adopt pedagogical strategies that promote active participation and critical thinking. The SOLE model, by allowing students to learn independently and collaboratively through inquiry-based learning, is considered suitable for addressing these challenges. Therefore, a study titled *"The Implementation of the SOLE Learning Model in*

Answering Big Questions in Algebra for Junior High School Students” was conducted. This research aims to examine the effect of applying the SOLE model in mathematics instruction, particularly in helping students understand algebraic concepts through guided inquiry using Big Questions, thereby improving their algebra competencies.

Moreover, the rapid advancement of technology in the digital era should be perceived as an opportunity rather than a challenge. It calls for educators to leverage digital tools in designing learning experiences that are more dynamic, interactive, and relevant to students’ lives. By integrating technology, teachers can facilitate critical thinking, problem-solving, and deeper conceptual understanding, especially in abstract subjects such as algebra.

According to Rahayu (2021), students exhibit greater confidence in expressing their ideas when they are challenged with thought-provoking questions. This sense of confidence further increases when students are entrusted with peer-teaching responsibilities, fostering not only individual competence but also collaborative skills. Furthermore, Marcian (2021) emphasizes that the use of technology is indispensable in today’s society across all age groups—from children to adults. The integration of technology into mathematics education directly impacts students’ learning achievements. Unfortunately, many students have yet to fully utilize the available technological advancements, which may hinder their ability to learn effectively and independently.

In conclusion, the integration of the SOLE model and Big Questions, supported by technological tools, holds significant potential to transform mathematics education. It shifts the learning environment from being teacher-centered to learner-centered, thereby fostering autonomy, curiosity, and deep learning among students.

RESEARCH METHODS

SOLE is an inquiry-based learning methodology. The SOLE process is designed to foster student autonomy and independence. It promotes learning by creating a collaborative environment that encourages innovation, discovery, and lifelong learning. At the postgraduate teaching level, SOLE can be utilized to develop higher-order thinking skills (HOTS) such as synthesis, evaluation, analysis, and application.

SOLE follows a three-stage process: questioning, investigating, and reviewing. This process provides a structured approach to advanced study, reflection, and the preparation of learning activities—whether in traditional classroom settings, flipped classrooms, or online environments. It can be implemented within a single class session or divided into segments over several days, either in class, online, or through individual learning.

The instructor determines the appropriate topic for inquiry within a set time frame. The flexibility of the SOLE process allows it to be adapted to different learning modalities and schedules. The diagram below illustrates the ongoing process involved in SOLE-based learning.

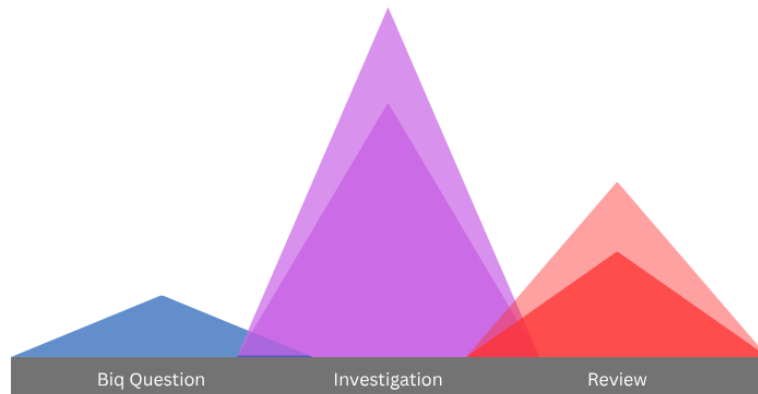


Figure 1. SOLE Learning Process

Table 1: Explanation of the SOLE Learning Model

Big Question	Investigation	Review
Providing Big Questions that can arouse students' curiosity about the material being taught, it is hoped that these Big Questions will also reduce more questions about the material being taught.	Students form small groups to collaborate and use a single internet connection to find answers to previously provided questions. If internet access is limited, students can use textbooks or their surroundings as objects of observation and investigation.	Each group presents the results of their findings regarding the questions given.

The Self-Organized Learning Environment (SOLE) is a student-centered learning model designed to promote independent and collaborative learning through exploration, inquiry, and problem-solving. A key component of SOLE is the use of Big Questions—open-ended, thought-provoking questions that encourage students to think critically and seek answers

How Teachers Prepare Big Questions

To support effective SOLE-based learning, teachers must prepare high-quality Big Questions. The following are recommended strategies for designing such questions:

1. Create questions with multiple possible answers, encouraging diverse perspectives and interpretations.
 2. Include stimuli—such as images, videos, or short texts—to trigger student thinking.
 3. Relate questions to students' everyday experiences, making learning more meaningful and contextual.
 4. Design questions that allow for further exploration, enabling the generation of additional sub-questions.
 5. Focus on the problem or issue itself, rather than on producing a specific answer.
 6. Use brainstorming techniques to create questions around central themes, concepts, or ideas.
- By following these strategies, teachers can create a learning environment that promotes curiosity, independence, and deep thinking.

Benefits of SOLE Implementation for Teachers

Implementing the SOLE model in the classroom provides several professional advantages for teachers:

- Enhancement of inquiry-based questioning skills, especially in formulating effective Big Questions.
- Improved insight into student interests and learning motivations.
- Stimulation of student curiosity through student-driven inquiry.
- Expanded understanding of student learning potential, especially in independent learning contexts.

Through these outcomes, SOLE provides a holistic approach to student development, supporting both academic achievement and personal growth.

RESULTS AND DISCUSSION

This qualitative study employed a Classroom Action Research (CAR) design to examine the effectiveness of the SOLE (Self-Organized Learning Environment) learning model in teaching algebra at the junior high school level. The study was conducted in a real classroom setting, involving teacher-facilitated group work and inquiry-based learning activities.

Learning Process Implementation

In the learning process, the teacher divided students into six groups, with four students in each group. The teacher then explained how the lesson would be conducted using the SOLE approach. Each group was given a Big Question related to algebra and was instructed to explore answers using the internet. The goal was for students to formulate open-ended questions that would lead to deeper inquiry and the generation of further sub-questions.

Table 2: Process of Answering Biq Questions

Big Question	"How does algebra help us understand and solve problems in everyday life?"
Investigation Phase	<p>Students were guided to investigate the Big Question through the following inquiry prompts:</p> <p>What is algebra, and why is it important in everyday life?</p> <p>How are the concepts of variables and equations used to solve real-life problems?</p> <p>In what situations can algebra help us make better decisions?</p> <p>How does algebra assist in managing personal finances, such as budgeting or saving?</p> <p>What are patterns in daily life, and where can we find them?</p> <p>How can patterns be expressed using numbers or symbols?</p> <p>What is the relationship between patterns and algebra?</p> <p>What is a variable, and how is it used to express patterns?</p> <p>How do we write patterns in the form of equations or algebraic expressions?</p> <p>Why are patterns important in science, technology, and economics?</p> <p>How are patterns used in fields like architecture, music, or science?</p>

<p>Review Phase</p>	<p>Based on students' investigations and group discussions, the following insights were gathered and reviewed collectively: Algebra is a crucial tool in everyday life because it helps us recognize patterns, analyze relationships, and solve problems in a more systematic way. By using concepts such as variables, equations, and functions, algebra allows us to model real-world situations, make predictions, and make more rational decisions. Some applications of algebra in daily life include: Financial Management → Assists with budgeting, saving, loans, and analyzing profit and loss in business. Science and Technology → Applied in data analysis, computer programming, artificial intelligence, and engineering. Health and Medicine → Used in calculating medication dosages, analyzing cell population growth, and conducting scientific research. Prediction and Data Analysis → Helps understand trends, patterns, and correlations in fields like economics, weather forecasting, and social statistics. Decision-Making → Understanding variable relationships supports more informed decisions, from business strategies to personal life planning.</p>
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Patterns in everyday life can be observed in numbers, shapes, and events. Algebra helps us to identify, express, and predict these patterns using mathematical symbols, operations, and equations.

For students, engaging in SOLE-based learning with Big Questions offers a wide range of educational and personal development benefits, including:

- Enhanced independent learning experience.
- Improved reading comprehension, attitudes, language development, creativity, and problem-solving skills.
- Increased digital literacy and proficiency in using technology for learning.
- A deeper understanding of how algebra relates to real-life situations.
- Strengthened memory recall abilities.
- Improved interpersonal communication and presentation skills.
- Greater trust in teachers and adults, fostering positive student-teacher relationships

CONCLUSION

The integration of Big Questions within the SOLE learning model offers a transformative approach to mathematics education, particularly in abstract topics such as algebra. By preparing effective Big Questions and embracing the principles of SOLE, teachers can foster a more meaningful, engaging, and independent learning experience. The benefits of this model extend to both educators and learners, making it a valuable strategy for 21st-century education.

From the Big Question is that algebra is not merely a branch of mathematics taught in school, but a fundamental skill involving critical and logical thinking that enables individuals to address real-life challenges in a more structured and efficient way. A strong understanding of algebra fosters analytical thinking, supports innovative problem-solving, and helps individuals adapt to the complexities of the modern world.

Based on observations during the learning process, students were noticeably more active in group communication and showed high levels of enthusiasm in answering the Big Question. Their involvement in investigation and discussion reflected increased engagement, curiosity, and improved understanding of algebraic concepts.

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