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Deep Learning Supported by Desmos Classroom to Improve Problem-Solving Skills and Regulate Students' Emotions

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Informasi Artikel

Key Words:

deep learning, Desmos Classroom, mathematical problem solving skills, emotional regulation, linear equations..

ABSTRACT

Mathematical problem-solving skills are one of the key competencies students must possess in mathematics education. However, in reality, many students still struggle to solve mathematical problems, particularly those involving linear equations. In addition to cognitive factors, affective aspects—such as emotional regulation—also influence students' success in the learning process. Therefore, there is a need for instructional innovations capable of enhancing mathematical problem-solving skills while simultaneously supporting students' emotional regulation. This study aims to determine the effect of Desmos Classroom-assisted deep learning on students' mathematical problem-solving skills and emotional regulation regarding linear equations. This study employed a quasi-experimental method using a Nonequivalent Control Group Design. The study population consisted of eighth-grade students at SMP Negeri 3 Kalanganyar. The sample comprised an experimental class that received deep learning instruction supported by Desmos Classroom and a control class that received conventional instruction. The instruments used included a mathematical problem-solving ability test and a student emotional regulation questionnaire. Data analysis was conducted using descriptive and inferential statistics through hypothesis testing. The results indicate that deep learning instruction supported by Desmos Classroom has a positive effect on students' mathematical problem-solving skills. This is evidenced by an increase in the students' average score from 57.15 on the pretest to 71.63 on the posttest. The results of the hypothesis test also showed a significance value of 0.000, which is less than 0.05, indicating a statistically significant difference following the implementation of the instruction. In addition, students' emotional regulation achieved an average percentage of 76.08%, which falls into the "very good" category. Thus, deep learning instruction supported by Desmos Classroom can serve as an effective alternative for improving students' mathematical problem-solving skills while simultaneously supporting their emotional regulation when studying linear equations.

Informasi Artikel

Kata Kunci:

deep learning, Desmos Classroom, kemampuan pemecahan masalah matematis, regulasi emosi, persamaan garis lurus.

ABSTRAK

Kemampuan pemecahan masalah matematis merupakan salah satu kompetensi kunci yang harus dimiliki siswa dalam pendidikan matematika. Namun, pada kenyataannya, masih banyak siswa yang kesulitan menyelesaikan masalah matematis, khususnya yang berkaitan dengan persamaan linear. Selain faktor kognitif, aspek afektif—seperti regulasi emosi—juga memengaruhi keberhasilan siswa dalam proses pembelajaran. Oleh karena itu, diperlukan inovasi pembelajaran yang mampu meningkatkan kemampuan pemecahan masalah matematis sekaligus mendukung regulasi emosi siswa. Penelitian ini bertujuan untuk mengetahui pengaruh pembelajaran mendalam (*deep learning*) berbantuan *Desmos Classroom* terhadap kemampuan pemecahan masalah matematis dan regulasi emosi siswa pada materi persamaan linear. Penelitian ini menerapkan metode eksperimen semu (*quasi-experimental*) dengan desain *Nonequivalent Control Group Design*. Populasi penelitian terdiri dari siswa kelas VIII SMP Negeri 3 Kalanganyar. Sampel penelitian meliputi kelas eksperimen yang mendapatkan pembelajaran mendalam berbantuan *Desmos Classroom* dan kelas kontrol yang mendapatkan pembelajaran konvensional. Instrumen yang digunakan terdiri dari tes kemampuan pemecahan masalah matematis dan angket regulasi emosi siswa. Analisis data dilakukan menggunakan statistik deskriptif dan inferensial melalui pengujian hipotesis. Hasil penelitian menunjukkan bahwa pembelajaran mendalam berbantuan *Desmos Classroom* berpengaruh positif terhadap kemampuan pemecahan masalah matematis siswa. Hal ini dibuktikan dengan adanya peningkatan nilai rata-rata siswa dari 57,15 pada *pretest* menjadi 71,63 pada *posttest*. Hasil uji hipotesis juga menunjukkan nilai signifikansi sebesar 0,000 (lebih kecil dari 0,05), yang mengindikasikan adanya perbedaan yang signifikan secara statistik setelah penerapan pembelajaran tersebut. Selain itu, regulasi emosi siswa mencapai persentase rata-rata sebesar 76,08%, yang termasuk dalam kategori "sangat baik". Dengan demikian, pembelajaran mendalam berbantuan *Desmos Classroom* dapat menjadi alternatif yang efektif untuk meningkatkan kemampuan pemecahan masalah matematis siswa sekaligus mendukung regulasi emosi mereka dalam mempelajari persamaan linear.

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INTRODUCTION

Education is one of the key factors in efforts to improve the quality of human resources. Through education, individuals can develop the intellectual abilities, skills, attitudes, and character necessary to face life's various challenges. In the context of formal education, mathematics plays a strategic role because it serves not only as a means of mastering concepts and procedures but also as a vehicle for developing logical, critical, systematic, creative, and analytical thinking skills. These skills are essential in daily life as well as in keeping pace with the rapid advancements in science and technology.

Mathematics instruction is fundamentally aimed at helping students understand mathematical concepts and apply them in various situations. One of the key skills emphasized in mathematics education is mathematical problem-solving. This skill involves students' ability to understand a problem, design a solution strategy, implement the planned strategy, and verify the resulting solution. Mathematical problem-solving serves as a crucial indicator for assessing the success of mathematics education because it reflects students' ability to use their knowledge to solve problems effectively.

However, various studies indicate that students' mathematical problem-solving skills remain relatively low (Aropiq et al., 2025). Students often struggle to understand the information presented in problems, determine appropriate solution strategies, and connect the mathematical concepts they have learned to the problems they face. This situation leads students to tend to memorize formulas without understanding the underlying concepts. Consequently, when faced with problems that differ from the examples provided by the teacher, students struggle to find the correct solution. This issue is also evident in the teaching of linear equations, which is a key topic at the junior high school level.

The topic of linear equations requires students to understand the relationship between algebraic representations and visual representations in the form of graphs. In this topic, students are not only required to perform mathematical calculations but must also be able to interpret the meaning of the slope, determine the equation of a line, and connect various forms of mathematical representations. In practice, many students struggle to understand these concepts, which results in poor mathematical problem-solving skills.

In addition to cognitive aspects, success in mathematics learning is also influenced by affective aspects, one of which is emotional regulation. Emotional regulation is an individual's ability to recognize, understand, control, and manage emotions that arise in various situations (Amanda et al., 2025). In mathematics learning, emotional regulation plays a crucial role because students often face situations that cause stress, anxiety, or frustration when they struggle to solve problems. Students with good emotional regulation tend to be able to manage negative feelings, maintain their motivation to learn, and stay focused on completing assigned tasks. Conversely, students with poor emotional regulation tend to give up easily and lose self-confidence when facing learning difficulties.

Advances in digital technology offer opportunities to create more innovative and interactive mathematics learning experiences. One platform that can be utilized in mathematics education is Desmos Classroom. Desmos Classroom is a web-based learning platform that provides various interactive features to help students understand mathematical concepts visually and dynamically. Through Desmos Classroom, students can explore mathematical concepts directly, observe changes in graphs in real time, and actively participate in learning activities designed by teachers. The use of interactive learning tools like Desmos Classroom is expected to

increase student engagement in the learning process and help them build a deeper conceptual understanding.

In addition to leveraging technology, learning must also be designed using an approach that encourages students to understand concepts deeply. One such approach is deep learning. Deep learning emphasizes meaningful learning through concept exploration, active student engagement, reflection, and the ability to connect knowledge with real-world experiences (Nugraha, 2021). In this approach, students do not merely passively receive information but play an active role in building understanding and discovering concepts through various learning activities.

The combination of deep learning and Desmos Classroom is believed to create a more effective learning environment. Deep learning encourages students to think critically and understand concepts in depth, while Desmos Classroom provides visualization tools that help students understand the relationships between mathematical concepts (Nugraha, 2021; Fransye et al., 2022). Through this combination, students are expected to improve their mathematical problem-solving skills while developing better emotional regulation during the learning process.

Based on the results of preliminary observations and the issues identified in mathematics instruction, an instructional innovation is needed to address students' low mathematical problem-solving skills and support the development of their emotional regulation. Therefore, this study was conducted to examine the effect of deep learning instruction supported by Desmos Classroom on students' mathematical problem-solving skills and emotional regulation regarding linear equations.

The objectives of this study are to determine the effect of deep learning instruction supported by Desmos Classroom on students' mathematical problem-solving skills and to describe students' emotional regulation after participating in instruction on linear equations. The results of this study are expected to contribute to the development of more innovative and effective mathematics instruction that is oriented toward the development of students' cognitive and affective abilities..

METHOD

This study employed a quasi-experimental research design with a quantitative approach. The quasi-experimental design was chosen because the researcher could not fully randomize the subjects when assigning them to research groups. The purpose of this study was to determine the effect of implementing Desmos Classroom-assisted deep learning on students' mathematical problem-solving skills and emotional regulation when studying linear equations.

The research design used is the Nonequivalent Control Group Design, which involves two groups: an experimental group and a control group. Both groups took a pretest to assess students' initial abilities before the intervention was administered. Subsequently, the experimental group received deep learning instruction supported by Desmos Classroom, while the control group received conventional instruction. After the learning process was completed, both groups took a posttest to assess changes in students' mathematical problem-solving abilities following the intervention.

Class	Pretest	Treatment	Posttest
Eksperimen	O	x	O
Kontrol	O		O

Description
O_1 = Pretest for the experimental class
O_2 = Posttest for the experimental class
O_3 = Pretest for the control class

O_4 = Posttest for the control class

X = Deep learning instruction using Desmos Classroom

The study was conducted at Kalanganyar State Junior High School 3 during the even semester of the 2024/2025 academic year. The study population consisted of all eighth-grade students at Kalanganyar State Junior High School 3. The sample was selected using purposive sampling, a technique based on specific considerations tailored to the research needs. The sample comprised two classes: one serving as the experimental group and the other as the control group. The sample was selected by ensuring that the students' academic characteristics were similar so that the two groups could be compared objectively.

Data collection in this study was carried out in several stages. First, a pretest was administered to both groups to assess the students' initial abilities. Second, instruction was delivered according to the predetermined treatment for each group. Third, a posttest was administered to measure mathematical problem-solving abilities after the instruction was completed. Fourth, an emotional regulation questionnaire was distributed to students in the experimental group after the entire instructional sequence was completed.

The data obtained were analyzed using descriptive and inferential statistics. Descriptive statistical analysis was used to describe the data on students' mathematical problem-solving abilities and emotional regulation through mean, maximum, minimum, and standard deviation values. Furthermore, before hypothesis testing, the data were first tested using prerequisite tests, including normality and homogeneity tests, to determine whether the data met the assumptions required for parametric analysis.

Through these research stages, it is hoped that a comprehensive picture can be obtained regarding the effectiveness of deep learning facilitated by Desmos Classroom in improving students' mathematical problem-solving skills and supporting their emotional regulation when studying linear equations.

RESULTS AND DISCUSSION

This study aims to determine the effect of Desmos Classroom-assisted deep learning on students' mathematical problem-solving skills and emotional regulation regarding linear equations. Research data were collected through mathematical problem-solving tests administered before and after the intervention (pretest and posttest) and an emotional regulation questionnaire administered to students after the learning process was completed.

Students' mathematical problem-solving skills were measured using tests administered before and after the instruction. The results of the descriptive statistical analysis showed an improvement in students' skills after participating in deep learning instruction supported by Desmos Classroom.

Table 1. Descriptive Statistics of Pretest and Posttest Results

Data	N	Minimum	Maksimum	Rata-Rata	Standar Deviasi
Pretest	60	45	71	57,15	6,289
Posttest	60	55	93	71,63	9,353

Based on Table 1, it can be seen that the average posttest score was higher than the average pretest score. The students' average score increased from 57.15 to 71.63. In addition, the highest score also increased from 71 on the pretest to 93 on the posttest. These results indicate that after participating in deep learning instruction facilitated by Desmos Classroom, students' mathematical

problem-solving skills improved significantly.

This improvement in learning outcomes suggests that students were able to understand the concept of linear equations better than before receiving the intervention. Instruction that emphasizes conceptual exploration and active student engagement provides students with the opportunity to build their understanding independently, thereby making the concepts they learn more meaningful.

Table 2. Hypothesis Test Results

Variabel	Mean	Standar Deviasi	Sig
Pretest	55,650	6,178	0,000
Posttest	70,133	8,924	0,000

Based on the analysis results in Table 2, a significance value of 0.000 was obtained. This value is smaller than the significance level of 0.05 (0.000 < 0.05). Thus, the alternative hypothesis is accepted and the null hypothesis is rejected. These results indicate that there is a significant effect of Desmos Classroom-assisted deep learning on students' mathematical problem-solving skills regarding linear equations.

The results of the hypothesis testing indicate that the intervention administered during the study was able to bring about positive changes in students' abilities to understand problems, plan solutions, implement solution strategies, and review the results obtained.

In addition to mathematical problem-solving skills, this study also examined students' emotional regulation after participating in deep learning facilitated by Desmos Classroom.

Table 3. Results of Students' Emotional Regulation

Variabel	Persentase	Kategori
Regulasi Emosi	76,08 %	Sangat Baik

Based on Table 3, the average percentage of students' emotional regulation was 76.08%, which falls into the "very good" category. These results indicate that students possess strong abilities to recognize, control, and manage their emotions during the learning process.

Good emotional regulation skills are crucial in mathematics learning because students often face challenges in the form of problems that require high concentration and deep thinking. Good emotional regulation helps students stay focused, confident, and resilient when facing difficulties in solving math problems..

DISCUSSION

The research results show that deep learning instruction supported by Desmos Classroom has a positive impact on students' mathematical problem-solving skills. This is evident from the increase in students' average scores after receiving the intervention. This improvement indicates that the instructional approach used helps students understand concepts more deeply than conventional instruction.

In deep learning, students do not merely receive information from the teacher but are also actively engaged in the learning process. Students are encouraged to identify problems, explore various possible solutions, discuss with peers, and reflect on their learning outcomes. These activities help students build a stronger conceptual understanding, thereby allowing their mathematical problem-solving skills to develop optimally.

The improvement in mathematical problem-solving skills is also influenced by the use of Desmos Classroom as a learning tool. Desmos Classroom provides various interactive features that allow students to visualize the concept of linear equations directly (Erviana et al., 2024). Through dynamic graphical visualizations, students can more easily understand the relationship between algebraic equations and their graphical representations.

Furthermore, the use of Desmos Classroom also increases student participation in the learning process (Pujiastuti & Faturrohman, 2023). Interactive learning activities make students more interested in participating in lessons and more active in completing assigned tasks. Students' active engagement during the learning process contributes to the improvement in their mathematical problem-solving skills.

The research results indicate that students' emotional regulation falls into the "very good" category, with a percentage of 76.08%. This finding suggests that the implemented learning approach impacts not only students' cognitive aspects but also their affective aspects. The use of Desmos Classroom also helps foster a more enjoyable learning atmosphere. Engaging visual displays and interactive learning activities helped reduce student boredom during the learning process. These conditions contributed to better emotional regulation, enabling students to manage negative emotions that might arise when facing learning difficulties.

Furthermore, discussion- and collaboration-based learning provides students with opportunities to help one another understand the material. Positive interactions among students can boost self-confidence and reduce the anxiety that often arises in mathematics learning. Consequently, students feel more comfortable participating in the learning process and are better prepared to face academic challenges.

The research results show that improvements in mathematical problem-solving skills were accompanied by emotional regulation rated in the "very good" category. These findings indicate that deep learning facilitated by Desmos Classroom can support the simultaneous development of cognitive and affective aspects. Learning success is determined not only by mastery of the material but also by students' ability to manage their emotions during the learning process. Therefore, teachers need to consider using instructional models and media that not only focus on achieving learning outcomes but also create positive learning experiences for students.

CONCLUSION

Based on the results of the study, it can be concluded that deep learning instruction supported by Desmos Classroom has a positive effect on students' mathematical problem-solving skills regarding linear equations. This is evidenced by an increase in students' average learning outcomes from a pretest score of 57.15 to 71.63 on the posttest. Hypothesis testing results also showed a significance value of 0.000, which is less than 0.05; therefore, it can be concluded that the implementation of deep learning instruction supported by Desmos Classroom has a significant effect on students' mathematical problem-solving skills.

In addition to impacting cognitive aspects, the implemented learning approach also yielded positive results in students' affective aspects. Students' emotional regulation achieved an average percentage of 76.08% and fell into the "very good" category. These results indicate that students were able to manage their emotions, maintain their motivation to learn, and face the challenges of mathematics learning more positively throughout the learning process.

Based on the findings of this study, it is recommended that mathematics teachers utilize innovative teaching approaches and interactive learning technologies as a means to improve the quality of instruction. Future research is also expected to further develop the application of deep learning facilitated by Desmos Classroom in other mathematics topics and at different educational levels to achieve more comprehensive results..

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