

## Problem-Based Learning Integrated with 21st-Century Skills to Improve Students' Self-Efficacy and Numeracy Skills on Three-Variable Linear Equation Systems

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### Abstract

This study was motivated by the relatively low levels of students' numeracy skills and self-efficacy in mathematics learning, particularly in the topic of Three-Variable Linear Equation Systems (TVLES). These conditions indicate the need for an innovative instructional approach capable of simultaneously enhancing students' cognitive and affective competencies. Therefore, this study aimed to: (1) examine whether the improvement in students' numeracy skills taught through Problem-Based Learning (PBL) integrated with 21st-century skills was higher than that of students receiving conventional instruction; (2) analyze differences in students' self-efficacy between the two instructional models; (3) investigate the relationship between self-efficacy and numeracy skills; and (4) describe the implementation of PBL integrated with 21st-century skills during the learning process. This study employed a mixed-methods approach using an Embedded Experimental Model, combining a quantitative quasi-experimental design with qualitative classroom observations. The quantitative component adopted a nonequivalent control group design involving two Grade X classes at SMA Negeri 1 Cibadak selected through purposive sampling. The research instruments consisted of a numeracy test, a self-efficacy questionnaire, and observation sheets for monitoring learning implementation. Quantitative data were analyzed using descriptive statistics, normalized gain (N-Gain), normality and homogeneity tests, Independent Samples *t*-test, and Pearson Product-Moment correlation, while qualitative data were analyzed descriptively. The results demonstrated that students who participated in PBL integrated with 21st-century skills achieved significantly greater improvement in numeracy skills than those who experienced conventional learning. Students in the experimental group also exhibited significantly higher self-efficacy than those in the control group. Furthermore, a positive and significant correlation was identified between self-efficacy and numeracy skills, indicating that stronger self-belief was associated with better numeracy performance. Classroom observations further revealed that all phases of the learning model were implemented consistently and effectively throughout the intervention. These findings suggest that integrating Problem-Based Learning with 21st-century skills provides an effective



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instructional approach for improving students' numeracy skills, strengthening self-efficacy, and fostering meaningful mathematics learning aligned with the competencies required in the twenty-first century.

**Keywords:** Problem-Based Learning (PBL), 21st-century skills, numeracy skills, self-efficacy, Three-Variable Linear Equation Systems (TVLES).

### Abstrak

Penelitian ini dilatarbelakangi oleh masih rendahnya kemampuan numerasi dan self-efficacy siswa dalam pembelajaran matematika, khususnya pada materi Sistem Persamaan Linear Tiga Variabel (SPLTV). Kondisi tersebut menunjukkan perlunya penerapan model pembelajaran inovatif yang mampu meningkatkan kompetensi kognitif dan afektif siswa secara bersamaan. Penelitian ini bertujuan untuk: (1) menganalisis peningkatan kemampuan numerasi siswa yang memperoleh pembelajaran menggunakan Problem Based Learning (PBL) terintegrasi keterampilan abad ke-21 dibandingkan dengan pembelajaran konvensional; (2) menganalisis perbedaan self-efficacy siswa antara kedua model pembelajaran; (3) mengkaji hubungan antara self-efficacy dan kemampuan numerasi; serta (4) mendeskripsikan keterlaksanaan pembelajaran menggunakan PBL terintegrasi keterampilan abad ke-21. Penelitian menggunakan metode campuran (mixed methods) dengan desain Embedded Experimental Model yang mengombinasikan pendekatan kuantitatif melalui quasi experiment nonequivalent control group design dan pendekatan kualitatif melalui observasi pembelajaran. Sampel penelitian terdiri atas dua kelas X di SMA Negeri 1 Cibadak yang dipilih menggunakan teknik purposive sampling. Instrumen penelitian meliputi tes kemampuan numerasi, angket self-efficacy, dan lembar observasi keterlaksanaan pembelajaran. Analisis data kuantitatif dilakukan menggunakan statistik deskriptif, uji N-Gain, uji normalitas, uji homogenitas, uji Independent Samples t-test, dan korelasi Pearson Product Moment, sedangkan data kualitatif dianalisis secara deskriptif. Hasil penelitian menunjukkan bahwa peningkatan kemampuan numerasi siswa yang belajar menggunakan PBL terintegrasi keterampilan abad ke-21 secara signifikan lebih tinggi dibandingkan dengan pembelajaran konvensional. Self-efficacy siswa pada kelas eksperimen juga lebih baik dibandingkan kelas kontrol. Selain itu, terdapat hubungan positif dan signifikan antara self-efficacy dan kemampuan numerasi, yang menunjukkan bahwa semakin tinggi keyakinan siswa terhadap kemampuannya, semakin baik pula kemampuan numerasinya. Hasil observasi memperlihatkan bahwa seluruh sintaks pembelajaran terlaksana secara konsisten dan efektif selama penelitian berlangsung. Dengan demikian, PBL yang diintegrasikan dengan keterampilan abad ke-21 merupakan alternatif pembelajaran yang efektif untuk meningkatkan kemampuan numerasi, memperkuat self-efficacy, dan menciptakan pembelajaran matematika yang bermakna sesuai dengan tuntutan kompetensi abad ke-21.

**Kata kunci:** Problem Based Learning (PBL), keterampilan abad ke-21, kemampuan numerasi, self-efficacy, Sistem Persamaan Linear Tiga Variabel (SPLTV).

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## Ringkesan

Panalungtikan ieu dilaksanakeun lantaran kamampuh numerasi jeung self-efficacy siswa dina pangajaran matematika, hususna dina matéri Sistem Persamaan Linear Tilu Variabel (SPLTV), masih kénéh kawilang handap. Kaayaan ieu nuduhkeun perluna modél pangajaran anu inovatif sangkan mampuh ngaronjatkeun kamampuh kognitif jeung aféktif siswa sacara babarengan. Tujuan panalungtikan ieu nyaéta: (1) nganalisis kanaékan kamampuh numerasi siswa anu diajar maké modél Problem Based Learning (PBL) nu diintegrasikeun jeung kaparigelan abad ka-21 dibandingkeun jeung pangajaran konvensional; (2) nganalisis bédana self-efficacy siswa antara dua modél pangajaran; (3) nalungtik hubungan antara self-efficacy jeung kamampuh numerasi; sarta (4) ngadéskripsikeun palaksanaan pangajaran maké PBL nu diintegrasikeun jeung kaparigelan abad ka-21. Méthode anu digunakeun nyaéta mixed methods kalayan desain Embedded Experimental Model anu ngahijikeun pendekatan kuantitatif ngaliwatan quasi experiment nonequivalent control group design jeung pendekatan kualitatif ngaliwatan observasi prosés pangajaran. Sampel panalungtikan ngawengku dua kelas X di SMA Negeri 1 Cibadak anu dipilih ku téhnik purposive sampling. Instrumén panalungtikan ngawengku tés kamampuh numerasi, angkét self-efficacy, jeung lambaran observasi palaksanaan pangajaran. Data kuantitatif dianalisis ngagunakeun statistik déskriptif, uji N-Gain, uji normalitas, uji homogenitas, uji Independent Samples t-test, sarta korelasi Pearson Product Moment, sedengkeun data kualitatif dianalisis sacara déskriptif. Hasil panalungtikan nétélakeun yén kanaékan kamampuh numerasi siswa anu diajar maké PBL nu diintegrasikeun jeung kaparigelan abad ka-21 leuwih hadé sacara signifikan tibatan siswa anu diajar ku modél konvensional. Self-efficacy siswa dina kelas ékspérimén ogé leuwih hadé tibatan kelas kontrol. Salian ti éta, kapanggih aya hubungan positif jeung signifikan antara self-efficacy jeung kamampuh numerasi, anu nuduhkeun yén beuki luhur kayakinan siswa kana kamampuh dirina sorangan, beuki hadé ogé kamampuh numerasina. Hasil observasi ogé nunjukkeun yén sakabéh léngkah pangajaran tiasa dilaksanakeun sacara konsistén jeung éféktif salila panalungtikan lumangsung. Ku kituna, modél PBL anu diintegrasikeun jeung kaparigelan abad ka-21 bisa dijadikeun salasahiji alternatif pangajaran anu éféktif pikeun ngaronjatkeun kamampuh numerasi, nguatkeun self-efficacy, sarta ngawujudkeun pangajaran matematika anu leuwih bermakna luyu jeung kabutuhan kompetensi abad ka-21.

**Kecap Galeuh:** Problem Based Learning (PBL), kaparigelan abad ka-21, kamampuh numerasi, self-efficacy, Sistem Persamaan Linear Tilu Variabel (SPLTV).

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## INTRODUCTION

Education in the twenty-first century demands learning environments that not only develop students' conceptual understanding but also cultivate higher-order

thinking skills, collaboration, communication, creativity, and self-confidence. In response to these challenges, the Indonesian government has implemented the Merdeka Curriculum, which emphasizes student-centered learning, contextual problem solving, and the development of competencies required for the twenty-first century. Within this framework, mathematics learning is expected to foster students' ability to apply mathematical knowledge in authentic situations rather than merely mastering procedural calculations (Yaniawati et al., 2022).

One of the essential competencies emphasized in the current curriculum is numeracy. Numeracy extends beyond computational skills, encompassing the ability to interpret quantitative information, formulate mathematical models, analyze relationships among variables, and make evidence-based decisions in various real-life contexts. These competencies are increasingly recognized as fundamental for preparing students to participate effectively in modern society and to meet the demands of higher education and future careers (OECD, 2023). Consequently, improving students' numeracy has become a major priority in mathematics education.

Despite these expectations, numerous studies indicate that Indonesian students continue to experience difficulties in numeracy-related tasks. Results from the National Assessment and the Programme for International Student Assessment (PISA) consistently reveal that many students struggle to interpret contextual mathematical problems, construct appropriate mathematical models, apply suitable solution strategies, and communicate their reasoning effectively (OECD, 2023). These findings suggest that conventional teacher-centered instruction remains insufficient for developing the complex mathematical competencies required in contemporary education.

The challenge becomes even more apparent in learning the topic of Three-Variable Linear Equation Systems (TVLES). This topic requires students to integrate conceptual understanding, algebraic reasoning, mathematical modeling, and problem-solving skills simultaneously. In practice, many students encounter difficulties in identifying variables, translating contextual situations into mathematical equations, selecting appropriate solution methods, and interpreting obtained solutions within the original problem context. Such difficulties indicate that learning approaches

emphasizing procedural practice alone are inadequate for developing meaningful mathematical understanding.

Preliminary observations conducted at SMA Negeri 1 Cibadak support these concerns. Analysis of students' Academic Competency Test results indicated that achievement in the Linear Equations and Inequalities domain remained relatively low. Students also demonstrated weaknesses in solving contextual problems involving multivariable linear equations, particularly in identifying relevant information, constructing mathematical models, selecting appropriate solution strategies, and interpreting final answers accurately. Classroom observations further revealed that many students experienced difficulties during group discussions and often relied heavily on teacher guidance when solving complex mathematical problems.

Besides cognitive challenges, affective factors also influence students' mathematical achievement. One important psychological construct is self-efficacy, defined as individuals' beliefs in their capabilities to organize and execute actions necessary to accomplish specific tasks (Bandura, 1997). Students with high self-efficacy generally demonstrate greater persistence, stronger motivation, higher resilience when facing difficulties, and greater confidence in solving mathematical problems. Conversely, students with low self-efficacy tend to avoid challenging tasks, experience greater anxiety, and give up more easily when encountering obstacles. Therefore, improving students' self-efficacy is considered equally important as enhancing their cognitive achievement in mathematics learning.

Problem-Based Learning (PBL) has been widely recognized as an instructional model capable of simultaneously promoting cognitive and affective development. Through authentic and meaningful problems, PBL encourages students to investigate, analyze information, collaborate with peers, formulate alternative solutions, and communicate their reasoning systematically. Such learning experiences actively engage students in knowledge construction rather than passive information reception, making mathematical learning more meaningful and applicable to real-life situations (Boye & Agyei, 2023).

Recent empirical studies consistently support the effectiveness of Problem-Based Learning in mathematics education. Mas Berlian Nst et al. (2023) reported that PBL significantly improved students' mathematical problem-solving ability and self-

efficacy compared with conventional instruction. Similarly, Nurlinda et al. (2024) found that PBL positively influenced students' mathematical reasoning and self-efficacy, while Melissa et al. (2024) demonstrated its effectiveness in enhancing students' numeracy and self-confidence through contextual learning activities. Furthermore, systematic reviews have concluded that PBL contributes positively to students' higher-order thinking skills, motivation, collaboration, and academic achievement across various educational settings (Abdullah et al., 2024).

The effectiveness of Problem-Based Learning becomes even more relevant when integrated with twenty-first-century skills, particularly the 4C competencies consisting of critical thinking, creativity, communication, and collaboration. Integrating these competencies enables students not only to solve mathematical problems accurately but also to develop essential lifelong learning skills needed in rapidly changing social and technological environments (Yaniawati et al., 2022). Consequently, mathematics instruction should integrate both meaningful problem-solving experiences and twenty-first-century competencies to optimize students' cognitive and affective development simultaneously.

Although previous studies have demonstrated the effectiveness of Problem-Based Learning, limited research has specifically examined the integration of PBL with twenty-first-century skills in improving both numeracy and self-efficacy within the context of Three-Variable Linear Equation Systems. Most previous investigations have focused on either cognitive outcomes or affective variables independently, leaving limited empirical evidence regarding the interaction between these two important educational constructs.

Therefore, this study aims to investigate the effectiveness of Problem-Based Learning integrated with twenty-first-century skills in improving students' numeracy and self-efficacy on the topic of Three-Variable Linear Equation Systems. Specifically, this study examines differences in numeracy achievement and self-efficacy between students taught through the integrated PBL approach and those receiving conventional instruction, as well as the relationship between numeracy and self-efficacy. The findings are expected to contribute both theoretically and practically to the development of innovative mathematics instruction aligned with the objectives of the Merdeka Curriculum and the educational vision of Indonesia Emas 2045.



## METHODS

This study applied a mixed methods approach with a concurrent embedded strategy, combining quantitative and qualitative techniques simultaneously (Yaniawati, 2019). The research design was a Pretest–Posttest Control Group Design (Sugiyono, 2011), where the experimental class received Discovery Learning with Scramble, while the control class did not (Table 1)

This study employed a mixed-methods approach using an Embedded Experimental Model, in which quantitative data served as the primary source of analysis and qualitative data were used to strengthen the interpretation of the findings. The quantitative component applied a quasi-experimental design with a nonequivalent control group, while qualitative data were collected through classroom observations to examine the implementation of the learning process. This design enables researchers to obtain a comprehensive understanding of the effectiveness of the learning model by integrating numerical outcomes with classroom evidence (Creswell & Plano Clark, 2018).

The research was conducted at SMA Negeri 1 Cibadak, Sukabumi, West Java, Indonesia, during the 2026/2027 academic year. Two Grade X classes were selected using purposive sampling. Class X-1 served as the experimental group and received instruction through Problem-Based Learning (PBL) integrated with 21st-century skills, whereas Class X-2 functioned as the control group and was taught using conventional learning methods.

The implementation of the PBL model followed the five instructional phases proposed by Arends (2012), namely: (1) orienting students to the problem, (2) organizing students for learning, (3) guiding individual and group investigations, (4) developing and presenting solutions, and (5) analyzing and evaluating the problem-solving process. Throughout these phases, 21st-century skills (4C)—critical thinking, creativity, communication, and collaboration—were systematically integrated into classroom activities (Yaniawati et al., 2022).

The research instruments consisted of: (1) a numeracy test developed based on the revised Bloom's Taxonomy and numeracy competency indicators, (2) a self-efficacy questionnaire adapted from Bandura's theory (1997), and (3) observation sheets used to evaluate the implementation fidelity of the learning process.

Quantitative data were analyzed using descriptive statistics, normalized gain (N-Gain), Shapiro–Wilk normality test, Levene's homogeneity test, Independent Samples *t*-test, and Pearson Product-Moment correlation analysis. Qualitative observation data were analyzed descriptively to support and explain the quantitative findings.

**Table 1. Research Design**

| Component             | Description                                                                                                          |
|-----------------------|----------------------------------------------------------------------------------------------------------------------|
| Research approach     | Mixed Methods (Embedded Experimental Model) (Creswell & Plano Clark, 2018)                                           |
| Research design       | Quasi-experimental, Nonequivalent Control Group Design                                                               |
| Research site         | SMA Negeri 1 Cibadak, Sukabumi, Indonesia                                                                            |
| Participants          | Two Grade X classes (36 students per class; $N = 72$ )                                                               |
| Experimental group    | Problem-Based Learning integrated with 21st-century skills                                                           |
| Control group         | Conventional learning                                                                                                |
| Sampling technique    | Purposive sampling                                                                                                   |
| Research instruments  | Numeracy test, Self-efficacy questionnaire, Observation sheets                                                       |
| Quantitative analysis | Descriptive statistics, N-Gain, Shapiro–Wilk, Levene's test, Independent Samples <i>t</i> -test, Pearson correlation |
| Qualitative analysis  | Descriptive analysis of classroom observation                                                                        |

This methodological framework provides both statistical evidence and classroom-based observations to evaluate the effectiveness of Problem-Based Learning integrated with 21st-century skills in improving students' numeracy skills and self-efficacy on the topic of Three-Variable Linear Equation Systems (TVLES).

## RESULTS AND DISCUSSION

### 3.1 Results

The quantitative findings indicate that the implementation of the Problem-Based Learning (PBL) model integrated with 21st-century skills produced better learning outcomes than conventional instruction. Before treatment, both groups demonstrated relatively similar initial numeracy abilities, as reflected by comparable pretest mean



scores. After the intervention, both groups showed improvement; however, the experimental group achieved a higher posttest mean, indicating that PBL integrated with the 4C competencies (critical thinking, creativity, communication, and collaboration) was more effective in enhancing students' numeracy skills.

**Table 2. Descriptive Statistics of Numeracy Test Scores**

| Group                                    | N  | Pretest Mean | Posttest Mean | Gain  |
|------------------------------------------|----|--------------|---------------|-------|
| Experimental (PBL + 21st-Century Skills) | 36 | 37.22        | 75.19         | 37.97 |
| Control (Conventional Learning)          | 36 | 39.44        | 73.89         | 34.45 |

The descriptive statistics indicate that both groups experienced learning improvement after the instructional intervention. Nevertheless, the experimental class obtained a greater increase in mean score, suggesting that integrating PBL with 21st-century skills provides richer learning experiences through contextual problem-solving, collaborative discussion, and reflective learning.

Prior to hypothesis testing, the data were examined using normality and homogeneity tests. The results indicated that all datasets were normally distributed (Shapiro–Wilk,  $p > 0.05$ ) and homogeneous (Levene's Test,  $p > 0.05$ ), thereby satisfying the assumptions for parametric analysis.

**Table 3. Summary of Inferential Statistical Analysis**

| Analysis                       | Statistical Test                   | Result                   | Interpretation                                       |
|--------------------------------|------------------------------------|--------------------------|------------------------------------------------------|
| Normality                      | Shapiro–Wilk                       | $p > 0.05$               | Normally distributed                                 |
| Homogeneity                    | Levene's Test                      | $p > 0.05$               | Homogeneous variance                                 |
| Numeracy Difference            | Independent Samples <i>t</i> -test | $p < 0.05$               | Significant difference                               |
| Self-Efficacy Difference       | Independent Samples <i>t</i> -test | $p < 0.05$               | Significant difference                               |
| Relationship between Variables | Pearson Correlation                | Positive and significant | Better self-efficacy associated with higher numeracy |

The Independent Samples *t*-test confirmed that students taught through the integrated PBL model achieved significantly higher numeracy performance than those receiving conventional instruction ( $p < 0.05$ ). Likewise, students in the experimental class demonstrated significantly higher self-efficacy scores.

Furthermore, Pearson Product Moment analysis revealed a positive and statistically significant correlation between self-efficacy and numeracy achievement, indicating that students with stronger confidence in their mathematical abilities tended to achieve better numeracy performance.

Qualitative classroom observations further supported these findings. Across all instructional meetings, the implementation of the PBL syntax was consistently conducted according to the lesson plan. Students actively participated in identifying problems, collaborating in groups, communicating mathematical reasoning, and presenting solutions, demonstrating effective integration of the four core competencies of 21st-century learning.

### **3.2 Discussion**

The findings demonstrate that the implementation of Problem-Based Learning integrated with 21st-century skills effectively enhances students' numeracy abilities. This improvement can be attributed to the characteristics of PBL, which encourages learners to construct mathematical knowledge through authentic problem-solving rather than merely memorizing procedures. Students actively analyze information, formulate mathematical models, evaluate alternative solutions, and communicate their reasoning, thereby strengthening higher-order thinking skills.

These findings are consistent with the constructivist perspective, which argues that meaningful learning occurs when students actively construct knowledge through authentic experiences rather than passively receiving information. Consequently, contextual mathematical problems facilitate deeper conceptual understanding and improve students' ability to apply mathematical concepts in real-life situations.

The present findings support those reported by Mas Berlian Nst et al. (2023), who found that Problem-Based Learning significantly improved mathematical problem-solving ability and students' self-efficacy compared with conventional instruction. Similarly, Boye and Agyei (2023) concluded that PBL creates a more

meaningful mathematics learning environment by encouraging active participation, collaborative inquiry, and independent knowledge construction.

The integration of 21st-century skills into every stage of the learning process also contributed substantially to students' achievement. Throughout classroom activities, students practiced critical thinking, communication, collaboration, and creativity (4C), competencies recognized as essential for successful learning in the twenty-first century (Yaniawati et al., 2022). Rather than simply obtaining correct answers, students were encouraged to justify arguments, exchange ideas, evaluate peers' solutions, and reflect on their own thinking processes.

The improvement in numeracy ability is also consistent with previous studies emphasizing contextual mathematics learning. Widiyantari et al. (2022) reported that contextual mathematical instruction significantly enhances numeracy by enabling students to connect mathematical concepts with everyday experiences. Likewise, Ladyawati (2022) demonstrated that Problem-Based Learning effectively improves mathematical literacy and numeracy because students continuously engage in authentic problem-solving activities.

Beyond cognitive achievement, the present study found that the integrated PBL model significantly strengthened students' self-efficacy. According to Bandura (1997), self-efficacy develops through mastery experiences, social persuasion, vicarious experiences, and positive emotional conditions. During the learning process, students repeatedly experienced successful problem-solving, collaborative discussions, classroom presentations, and constructive feedback from both teachers and peers. These experiences contributed to stronger confidence in their mathematical abilities.

The present findings agree with those of Firmansyah et al. (2020), who reported that Problem-Based Learning enhances mathematical communication, mathematical connections, and self-efficacy simultaneously. Likewise, Eric et al. (2023) argued that integrating 21st-century competencies into classroom instruction promotes students' confidence, independence, adaptability, and lifelong learning skills.

Another important finding is the positive relationship between numeracy and self-efficacy. Students with higher confidence in their abilities tended to achieve better numeracy performance, while successful completion of mathematical tasks further

reinforced their confidence. This reciprocal relationship supports Bandura's (1997) social cognitive theory, which emphasizes that cognitive achievement and self-beliefs mutually influence one another throughout the learning process.

Overall, the findings provide empirical evidence that integrating Problem-Based Learning with 21st-century skills offers an effective instructional approach for simultaneously improving numeracy achievement and self-efficacy. The novelty of this study lies in combining the complete PBL learning syntax with the 4C competencies within mathematics instruction and examining both cognitive and affective outcomes simultaneously. Therefore, this integrated learning model may serve as an effective pedagogical alternative for mathematics education aligned with the objectives of the Merdeka Curriculum and the competency demands of twenty-first-century education.

## CONCLUSION

This study demonstrates that the implementation of Problem-Based Learning (PBL) integrated with 21st-century skills is more effective than conventional instruction in improving students' numeracy skills on the topic of Three-Variable Linear Equation Systems (TVLES). The learning model provides meaningful learning experiences through authentic problem-solving, collaborative activities, and active student participation, enabling learners to develop deeper conceptual understanding and higher-order thinking skills.

The findings also indicate that students who learned through the integrated PBL approach exhibited significantly higher self-efficacy than those receiving conventional instruction. Furthermore, a positive and significant relationship was identified between self-efficacy and numeracy skills, suggesting that stronger confidence in one's mathematical abilities contributes to better numeracy performance. Overall, the integration of Problem-Based Learning with 21st-century skills offers an effective instructional approach for simultaneously developing students' cognitive competencies and affective attributes, making it a promising strategy for mathematics education in the context of 21st-century learning.

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## Declarations

|                        |                                                                                                                                                                                                                                                                                                                                                 |
|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Author Contribution    | : Author 1 (Deni Setiadi): Conceptualization, Investigation, Data Curation, Formal Analysis, Writing – Original Draft, Visualization.<br>Author 2 (Bana G. Kartasasmita): Supervision, Methodology, Writing – Review & Editing, Validation.<br>Author 3 (Eka Firmansyah): Formal Analysis, Validation, Writing – Review & Editing, Supervision. |
| Funding Statement      | : This research received no external funding and was conducted independently by the authors as part of the requirements for completing the Master's Degree in Mathematics Education at Universitas Pasundan, Indonesia.                                                                                                                         |
| Conflict of Interest   | : The authors declare that there is no conflict of interest regarding the publication of this paper.                                                                                                                                                                                                                                            |
| Additional Information | : The data supporting the findings of this study are available from the corresponding author upon reasonable request.                                                                                                                                                                                                                           |

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