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Enhancing Algebraic Reasoning in The Classroom: The Effects of Search, Solve, Create, and Share Strategy

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Abstract

Algebraic reasoning is a fundamental competency in mathematics learning; however, many students experience difficulties in applying algebraic concepts, particularly in quadratic functions. This study aims to enhance students' algebraic reasoning through the implementation of the SSCS (Search, Solve, Create, and Share) strategy, a structured problem-solving instructional approach that emphasizes systematic exploration, solution development, model construction, and mathematical communication. The study employed a collaborative classroom action research design involving Grade X senior high school students, conducted across two cycles consisting of planning, action, observation, and reflection stages. Students' algebraic reasoning was assessed using indicators that include pattern recognition, algebraic representation, manipulation of algebraic expressions, and logical justification. Data were collected through algebraic reasoning tests and classroom observation sheets. The findings reveal a substantial improvement in students' algebraic reasoning abilities, with the mean score increasing from 62.33 in the pre-cycle to 81.25 in Cycle II. Additionally, the percentage of students achieving mastery learning increased from 27.78% to 91.67%. These results indicate that the SSCS strategy effectively supports the development of algebraic reasoning by engaging students in structured problem-solving and reflective mathematical communication.

Keywords: algebraic reasoning, classroom action research, problem-solving, SSCS strategy.

INTRODUCTION

Algebraic reasoning is a fundamental component of mathematical thinking that enables students to recognize patterns, represent relationships symbolically, and construct mathematical models for real-world situations (Marasabessy, 2021; Mukuka et al., 2020; Putri et al., 2022). This ability plays a crucial role in developing conceptual understanding and higher-order thinking skills in mathematics education (Basir et al., 2022b; Kabadas & Mumcu, 2024; Lee et al., 2018). Students with strong algebraic reasoning are better equipped to interpret mathematical situations, justify solutions, and apply algebraic concepts flexibly across contexts. Consequently, algebraic reasoning is widely recognized as a core competency that supports both academic success in mathematics and effective problem solving in everyday life (Dinglasan et al., 2023; Jahudin & Siew, 2023).

Despite its importance, research consistently indicates that many students experience persistent difficulties in learning algebra (Inayah et al., 2024; Moon, 2023; Stemele & Jina Asvat, 2024). These difficulties include weak conceptual understanding, limited reasoning and problem-solving abilities, and challenges in connecting symbolic representations to contextual problems (Abakah & Brijlall, 2024; Ngaba et al., 2023). Students often rely on procedural strategies and rote memorization without fully understanding underlying algebraic concepts. Such learning patterns hinder students' ability to generalize, reason, and apply algebra meaningfully. Moreover, conventional teacher-centered instructional approaches tend to emphasize routine exercises and formula application, which are insufficient for developing students' algebraic reasoning abilities.

To address these challenges, various instructional strategies have been introduced, with particular attention given to problem-solving-oriented approaches. One such approach is the SSCS (Search–Solve–Create–Share) strategy, a structured problem-solving strategy that guides students through identifying problems, developing solutions, generating alternative representations, and communicating mathematical ideas (Basir et al., 2022a; Putra et al., 2024).

Previous studies have reported positive effects of SSCS on students' learning outcomes, problem-solving skills, and classroom engagement (Listia et al., 2025; Putra et al., 2025; Ruanthai et al., 2025). However, most existing studies have focused on general achievement or problem-solving performance, while empirical investigations that explicitly examine the role of SSCS in fostering students' algebraic reasoning—especially in specific algebraic topics such as quadratic functions—remain limited. In addition, few studies have explored SSCS through iterative classroom-based instructional improvement.

Based on this identified gap, the present study aims to examine the effectiveness of the SSCS strategy in improving students' algebraic reasoning abilities in learning quadratic functions. The study adopts established indicators of algebraic reasoning and employs SSCS as a structured instructional strategy that emphasizes active problem exploration, solution development, creative mathematical thinking, and reflective communication. Through this approach, the study seeks to contribute empirical evidence on how SSCS supports deeper algebraic reasoning and offers pedagogical implications for mathematics instruction at the secondary level.

METHODS

Research Design and Participants

The study employed a collaborative classroom action research design aimed at improving students' algebraic reasoning through the implementation of the SSCS strategy in learning quadratic functions. The research was conducted collaboratively between the researcher and the mathematics teacher to allow systematic reflection and instructional improvement. The participants consisted of 36 Grade X students from SMA Negeri 1 Ungaran.

Classroom Action Research is a form of research that is reflective by carrying out certain actions to improve and enhance learning practices in the classroom in a more professional manner (Dignath & Veenman, 2021). The action research followed the Kemmis and McTaggart model, which involves iterative cycles of planning, action and observation, and reflection. The cycles were repeated until the predetermined success indicators were achieved (Rabgay & Kidman, 2023; Thawinwong & Sanrattana, 2022).

The study was conducted in two cycles, each implemented over three classroom meetings (2 × 45 minutes per meeting). In each cycle, learning activities were organized according to the SSCS phases (Search–Solve–Create–Share).

During the planning stage, lesson plans, worksheets, and assessment instruments were prepared collaboratively. In the action and observation stage, the teacher implemented SSCS-based learning activities, while the researcher observed student engagement, teacher facilitation, and adherence to the instructional design. Students worked individually and in small groups to analyze contextual quadratic problems, develop solution strategies, create alternative representations, and share their reasoning through class discussions. The reflection stage focused on evaluating learning outcomes and identifying necessary revisions for the subsequent cycle. The activity flow diagram for each cycle is shown in Figure 1.

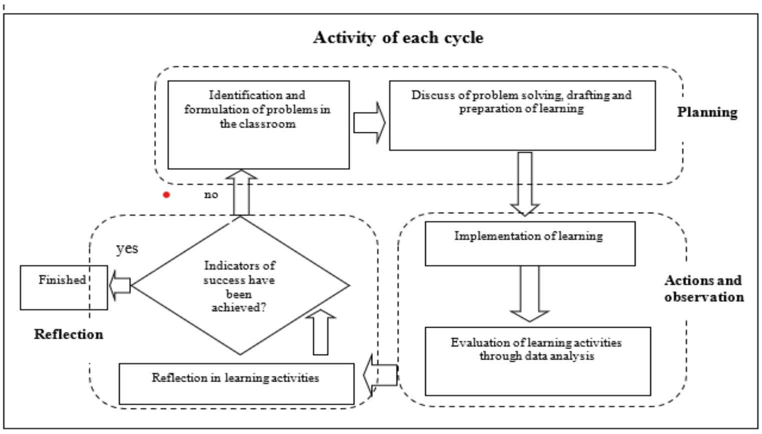

Figure 1. Flowchart of Activities for Each Cycle

From figure 1, The results of reflection in cycle one can be used as recommendation material to continue to the next cycle. The implementation of the cycle again starts from the stages of action planning, action implementation, observation, and reflection. The implementation of the cycle is carried out after the teaching module has been revised to suit the learning design in the class, but the learning model and method remain. If one cycle has not shown signs of change towards improvement (quality improvement), then the action activities are continued in the second cycle, and so on until the researcher is satisfied (Meesuk et al., 2020; Wright, 2021).

Instruments and Instrument Quality

Students' algebraic reasoning was assessed using established indicators adapted from prior studies. These indicators included: (1) applying basic numerical strategies such as counting and comparison; (2) using equivalent symbolic representations to manipulate formulas, expressions, equations, and inequalities; and (3) generalizing patterns and relationships in algebraic contexts. These indicators served as the basis for test construction and data analysis.

Data were collected using three algebraic reasoning tests administered at different stages and an observation sheet for SSCS implementation. The tests consisted of open-ended problems aligned with the algebraic reasoning indicators. Instrument validity was established through expert judgment by two mathematics education experts, ensuring content relevance and clarity. Reliability was examined through a limited pilot test, yielding acceptable internal consistency (Cronbach's Alpha > 0.70). A summary of the assessment schedule is presented in Table 1.

Table 1. Algebraic Reasoning Asessment Schedule

Test	Timing	Purpose
Test 1	Pre-cycle	Measure baseline algebraic reasoning
Test 2	End of Cycle 1	Evaluate improvement after initial SSCS implementation
Test 3	End of Cycle 2	Measure final algebraic reasoning achievement

Table 1 summarizes the assessment schedule used to measure students' algebraic reasoning throughout the research cycles. The pre-cycle test was administered to establish students' baseline algebraic reasoning prior to the implementation of the SSCS strategy. The second test, conducted at the end of Cycle 1, was intended to capture initial changes in students' algebraic reasoning following the first implementation of SSCS-based instruction. The final test, administered at the end of Cycle 2, was used to determine the extent of improvement after instructional refinement and to evaluate whether the predetermined success indicators had been achieved.

Data Analysis and Success Indicators

Data were analyzed using descriptive analysis by comparing mean scores and mastery levels across the pre-cycle, Cycle 1, and Cycle 2. The success of the intervention was determined based on two operational criteria:

(1) the class mean score reached or exceeded the minimum mastery criterion of 75, and

(2) at least 80% of students achieved scores above the minimum mastery criterion.

RESULT & DISCUSSION

Overall Development of Students Algebraic Reasoning

The implementation of the SSCS (Search–Solve–Create–Share) strategy led to a consistent and meaningful improvement in students' algebraic reasoning across the classroom action research cycles. The progression of students' achievement was clearly evident from the pre-cycle to Cycle 1 and subsequently to Cycle 2, both in terms of mean scores and mastery percentages.

In the pre-cycle, students' algebraic reasoning was generally weak. The mean score of 62.33 was substantially below the minimum mastery criterion (MMC) of 75, and only 27.78% of students achieved mastery. This finding indicates that most students had not yet developed adequate abilities to interpret algebraic situations, manipulate symbolic expressions, or generalize relationships related to quadratic functions. Students' responses at this stage reflected fragmented understanding and a tendency to rely on procedural manipulation without coherent reasoning.

Following the initial implementation of the SSCS strategy in Cycle 1, students' performance improved noticeably. The mean score increased to 76.27, exceeding the MMC, while the mastery percentage rose to 58.33%. This improvement suggests that the structured phases of SSCS supported students in organizing their problem-solving processes more systematically. Nevertheless, 41.67% of students still failed to reach mastery, indicating that their conceptual understanding and algebraic reasoning required further instructional reinforcement.

In Cycle 2, after instructional refinements based on reflective evaluation, students' algebraic reasoning improved further. The mean score increased to 81.25, and the mastery percentage reached 91.67%, surpassing the predetermined success indicator. This result demonstrates that the vast majority of students were able to engage in algebraic reasoning effectively, particularly in applying symbolic representations, explaining solution strategies, and generalizing quadratic patterns.

To provide a clearer visualization of the progression in students' algebraic reasoning performance across the action research cycles, the trend of mean scores from the pre-cycle to Cycle 1 and Cycle 2 is illustrated in Figure 1.

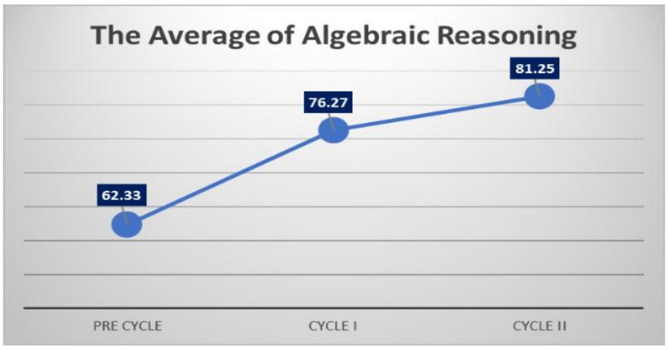

Figure 1. Progression of Students' Algebraic Reasoning Mean Scores Across Action Research Cycles

Figure 1 demonstrates a consistent upward trend in the average algebraic reasoning scores, increasing from 62.33 in the pre-cycle to 76.27 in Cycle 1 and further to 81.25 in Cycle 2. This pattern indicates a substantial improvement following the initial implementation of the SSCS strategy and a continued, though more moderate, enhancement after instructional refinement in Cycle 2. The trend suggests that students' algebraic reasoning developed progressively as they became more familiar with the structured problem-solving phases of the SSCS approach.

Gain Score Analysis

To examine the magnitude of improvement more rigorously, normalized gain scores (Hake's gain) were calculated. The gain from the pre-cycle to Cycle 1 was 0.37, categorized as medium improvement, indicating a meaningful initial impact of the SSCS strategy on students' algebraic reasoning. The gain from Cycle 1 to Cycle 2 was 0.21, categorized as low improvement, suggesting that learning in Cycle 2 emphasized consolidation and refinement rather than substantial conceptual change. Overall, the gain from the pre-cycle to Cycle 2 was 0.50, which falls within the medium category, reflecting an educationally significant improvement in students' algebraic reasoning.

This gain pattern indicates that the SSCS strategy exerted its strongest influence during the initial transition from conventional instruction to structured problem-solving, while subsequent cycles served to stabilize and deepen students' reasoning abilities.

Beyond the improvement in mean scores and normalized gain values, changes in students' mastery distribution across the research cycles are further illustrated in Figure 2.

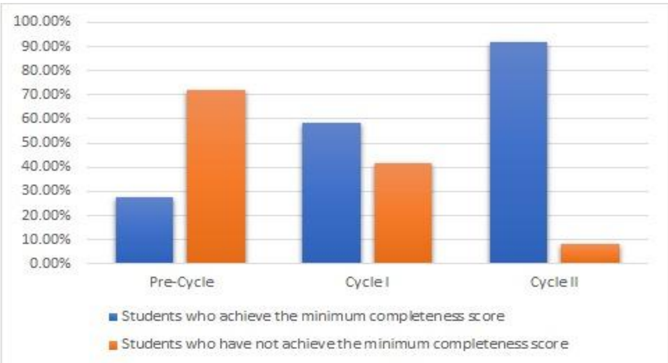

Figure 2. Distribution of Students' Mastery Achievement Across Cycles

Figure 2 shows a substantial shift in students' mastery levels following the implementation of the SSCS strategy. The proportion of students meeting the minimum mastery criterion increased steadily from the pre-cycle to Cycle 1 and reached a dominant majority in Cycle 2, while the percentage of students who did not achieve mastery decreased markedly. This distributional change indicates that the observed improvement was not limited to average performance but was also reflected in broader individual mastery across the class.

Quality of the Learning Process

Classroom observations revealed qualitative improvements in the learning process across cycles. During Cycle 1, students were still adapting to the SSCS stages, particularly during the Create and Share phases. Some students hesitated to present ideas, experienced difficulty articulating mathematical reasoning, or required additional time to complete tasks. Classroom discussions were present but had not yet reached an optimal level of effectiveness.

In Cycle 2, substantial improvements were observed. Students demonstrated higher levels of engagement, more active participation in group discussions, and increased confidence in presenting and defending their solutions. Mathematical communication became clearer and more precise, with students increasingly using appropriate algebraic symbols and representations. At the same time, the teacher's role shifted more effectively toward facilitation and scaffolding, allowing students to assume greater responsibility for constructing and communicating mathematical ideas.

Discussion

Development of Algebraic Reasoning through SSCS

The findings of this study provide robust empirical evidence that the SSCS strategy effectively supports the development of students' algebraic reasoning in learning quadratic functions. Algebraic reasoning extends beyond procedural competence to include the ability to interpret problems, represent relationships symbolically, manipulate expressions meaningfully, and generalize patterns. The low pre-cycle performance indicates that many students initially lacked these competencies, a finding that is consistent with previous research on persistent difficulties in algebra learning.

The improvement observed in Cycle 1 suggests that the Search and Solve phases of SSCS played a critical role in supporting students' transition from superficial engagement to more structured reasoning. During the Search phase, students were required to identify relevant information and make sense of the problem context, aligning with theoretical perspectives that emphasize sense-making as a foundational element of algebraic reasoning (Alam & Mohanty, 2023; Hinojosa & Bonner, 2021). This phase encouraged students to move beyond immediate formula application toward deeper conceptual understanding.

The Solve phase further supported reasoning by guiding students to apply appropriate algebraic procedures while justifying their solution steps. This structured problem-solving process reduced students' reliance on rote memorization and promoted more intentional use of symbolic manipulation. These findings are consistent with previous studies suggesting that explicit problem-solving frameworks can enhance mathematical reasoning by providing cognitive scaffolding (Kusmaryono et al., 2020; Stefan et al., 2023; Tay & Toh, 2023).

Consolidation of Reasoning in Cycle 2

Although the gain score from Cycle 1 to Cycle 2 was classified as low, this result should not be interpreted as limited effectiveness. Instead, the reduced gain reflects a pedagogical shift from initial conceptual change toward consolidation and stabilization of understanding. By Cycle 2, many students had already achieved a foundational level of algebraic reasoning, and instructional refinements focused on deepening understanding and improving mathematical communication.

The success of Cycle 2 can be attributed to targeted scaffolding and improved classroom interaction. The Create phase encouraged students to generate alternative solution strategies and representations, supporting theoretical views that creativity and flexibility are integral components of algebraic reasoning (Krishnan & Eng, 2024; Thuneberg et al., 2018). By constructing their own approaches to problem solving, students engaged in higher-order thinking that strengthened conceptual understanding.

The Share phase played a particularly significant role in Cycle 2. Through peer discussion and presentation, students were required to verbalize their reasoning, justify their solutions, and respond to critical questions. This process aligns with sociocultural theories of learning, which emphasize the role of social interaction and language in the development of mathematical reasoning (Felice et al., 2022; Smit et al., 2023). Explaining ideas to peers helped students clarify their own thinking and recognize conceptual connections more explicitly.

Connection to Core Components of Algebraic Reasoning

The observed improvements correspond closely with the core components of algebraic reasoning adopted in this study. Students demonstrated enhanced ability to apply numerical strategies and comparisons when interpreting quadratic contexts. Their manipulation of symbolic representations became more accurate and meaningful, as reflected in improved handling of equations and expressions. Additionally, students showed greater capacity to generalize patterns, particularly when analyzing relationships among coefficients, roots, and graphical representations of quadratic functions.

These findings indicate that the SSCS strategy supports algebraic reasoning in a holistic manner rather than addressing isolated skills. By engaging students in iterative cycles of problem exploration, solution construction, creative representation, and reflective communication, SSCS promotes integrated development of conceptual understanding, procedural fluency, and reasoning.

Theoretical Implications

From a theoretical perspective, the findings support constructivist views of learning, which emphasize that knowledge is actively constructed through engagement with meaningful tasks. The SSCS strategy operationalizes constructivist principles by positioning students as active participants who explore, create, and communicate mathematical ideas. At the same time, the structured nature of SSCS provides systematic guidance, balancing student autonomy with instructional support.

Moreover, the results align with contemporary research on mathematical reasoning that highlights the importance of problem-solving contexts, multiple representations, and mathematical discourse (Anjani & Izzati, 2023; Post & Prediger, 2024; Santos-trigo, 2024). SSCS integrates these elements into a coherent instructional framework, making it particularly well suited for fostering algebraic reasoning in secondary mathematics classrooms.

Pedagogical Implications and Future Directions

The findings suggest several important implications for mathematics instruction. Teachers are encouraged to adopt structured problem-solving strategies such as SSCS to support the development of algebraic reasoning. Adequate time allocation for discussion and reflection—particularly during the Share phase—is essential, as mathematical communication plays a central role in reasoning development. Additionally, the use of classroom action research enables teachers to refine instruction responsively based on students' learning needs.

Despite its contributions, this study is limited by its focus on a single classroom context. Future research may involve larger samples, quasi-experimental designs, or technology-enhanced implementations of SSCS. Further studies could also explore the impact of SSCS on other dimensions of mathematical thinking, such as metacognition, creativity, or long-term retention.

CONCLUSION

This study confirms that the SSCS (Search–Solve–Create–Share) strategy effectively improves students' algebraic reasoning in learning quadratic functions. The consistent increase in achievement and mastery across cycles indicates that structured problem-solving supports students' progression from procedural understanding to deeper conceptual reasoning. Theoretically, the findings align with constructivist and socio-cognitive perspectives, as each SSCS phase promotes key components of algebraic reasoning, including conceptual understanding, symbolic manipulation, generalization, and mathematical communication. Instructional scaffolding and reflective refinement further strengthened learning outcomes. Overall, SSCS represents a theory-informed and pedagogically sound approach for fostering higher-order algebraic reasoning in secondary mathematics education.

REFERENCES

Abakah, F., & Brijlall, D. (2024). Misconceptions of mathematical concepts vis-a-vis how they pose as barriers to developing students conceptual understanding. *Gulf Journal of Mathematics*, *16*(2), 81–99. https://doi.org/10.56947/gjom.v16i2.1871

Alam, A., & Mohanty, A. (2023). Educational technology: Exploring the convergence of technology and pedagogy through mobility, interactivity, AI, and learning tools. *Cogent Engineering*, *10*(2). https://doi.org/10.1080/23311916.2023.2283282

Anjani, D., & Izzati, N. (2023). Comparing student problem-solving in math: Double-loop vs. multi-representational discourse models. *EduMa: Mathematics Education Learning And Teaching*, *12*(2), 225–234. https://doi.org/http://dx.doi.org/10.24235/eduma.v12i2.13965

Basir, M. A., Waluya, S. B., Dwijanto, & Isnarto. (2022a). Algebraic reasoning in marzano's taxonomy cognitive system. *KnE Social Sciences*, *2022*, 96–105. https://doi.org/10.18502/kss.v7i14.11957

Basir, M. A., Waluya, S. B., Dwijanto, & Isnarto. (2022b). How students use cognitive structures to process information in the algebraic reasoning? *European Journal of Educational Research*, *11*(2), 821–834. https://doi.org/10.12973/eu-jer.11.2.821

Dignath, C., & Veenman, M. V. J. (2021). The role of direct strategy instruction and indirect activation of self-regulated learning—evidence from classroom observation studies. *Educational Psychology Review*, *33*(2), 489–533. https://doi.org/10.1007/s10648-020-09534-0

Dinglasan, J. K. L., Caraan, D. R. C., & Ching, D. A. (2023). Effectiveness of realistic mathematics education approach on problem-solving skills of students. *International Journal of Educational Management and Development Studies*, *4*(2), 64–87. https://doi.org/10.53378/352980

Felice, S. De, Hamilton, A. F. D. C., Ponari, M., Vigliocco, G., Felice, D., Hamilton, D. C., & Felice, S. De. (2022). Learning from others is good , with others is better : the role of social interaction in human acquisition of new knowledge. *Phil. Trans. R. Soc. B*, *378:202103*. https://doi.org/10.1098/rstb.2021.0357/1279033/rstb.2021.0357.pdf

Hinojosa, D. M., & Bonner, E. P. (2021). The community mathematics project : Using a parent tutoring program to develop sense - making skills in novice mathematics educators. *Mathematics Education Research Journal*, *0123456789*. https://doi.org/10.1007/s13394-021-00401-x

Inayah, S., Jupri, A., Darhim, D., & Prabawanto, S. (2024). Exploring students learning difficulties in linear function: A diagnosis of grade 9. *JTAM (Jurnal Teori Dan Aplikasi Matematika)*, *8*(1), 84. https://doi.org/10.31764/jtam.v8i1.17259

Jahudin, J., & Siew, N. M. (2023). An algebraic thinking skill test in problem-solving for seventh graders. *Problems of Education in the 21st Century*, *81*(2), 223–243. https://doi.org/10.33225//pec/23.81.223

Kabadas, H., & Mumcu, H. Y. (2024). Examining the process of middle school math teachers diagnosing and eliminating student misconceptions in algebra. *Journal of Theoretical Educational Science*, *17*(July), 563–591. https://doi.org/http://doi.org/10.30831/akukeg.1323295

Krishnan, S., & Eng, F. K. (2024). Creative Teaching in Mathematics : An Example in Linear Algebra. *International Journal of Academic Research in Progressive Education and Development*, *13*(3), 726–736. https://doi.org/10.6007/IJARPED/v13-i3/21426

Kusmaryono, I., Ubaidah, N., & Basir, M. A. (2020). The role of scaffolding in the deconstructing of thinking structure: a case study of pseudo-thinking process. *Infinity Journal*, *9*(2), 247. https://doi.org/10.22460/infinity.v9i2.p247-262

Lee, Y., Capraro, M. M., Capraro, R. M., & Bicer, A. (2018). A meta-analysis: Improvement of students' algebraic reasoning through metacognitive training. *International Education Studies*, *11*(10), 42. https://doi.org/10.5539/ies.v11n10p42

Listia, K., Fitriani, Azizah, N., Baharudin, & Octafiona, E. (2025). The sscs learning model (search, solve, create, and share): Its effectiveness on students' learning outcomes at smp negeri 5 bandar lampung. *Journal of Educational Sciences*, *9*(3), 1781–1794. https://doi.org/https://doi.org/10.31258/jes.9.3.p.1781-1794 This

Marasabessy, R. (2021). Study of mathematical reasoning ability for mathematics learning in schools: A literature review. *Indonesian Journal of Teaching in Science*, *1*(2), 79–90. https://doi.org/10.17509/ijotis.v1i2.37950

Meesuk, P., Sramoon, B., & Wongrugsa, A. (2020). Classroom action research-based instruction: The sustainable teacher professional development strategy. *Journal of Teacher Education for Sustainability*, *22*(1), 98–110. https://doi.org/10.2478/jtes-2020-0008

Moon, K. (2023). Developing knowledge of student thinking: Understanding big ideas behind students' difficulties with connecting representations in algebra. *International Journal for Mathematics Teaching and Learning*, *24*(1), 1–16. https://doi.org/10.4256/ijmtl.v24i1.439

Mukuka, A., Balimuttajjo, S., & Mutarutinya, V. (2020). Exploring students' algebraic reasoning on quadratic equations: Implications for school-based assessment. *International Conference to Review Research in Science, Technology and Mathematics Education*, *2008*, 130–138. https://episteme8.hbcse.tifr.res.in/proceedings/

Ngaba, A. L., Dewi, N. R., & Waluya, S. B. (2023). Student's algebraic thinking ability in solving mathematical problems based misconceptions. *Journal of Educational Sciences*, *7*(3), 465. https://doi.org/10.31258/jes.7.3.p.465-473

Post, M., & Prediger, S. (2024). Teaching practices for unfolding information and connecting multiple representations : the case of conditional probability information. In *Mathematics Education Research Journal* (Vol. 36, Issue 1). Springer Netherlands. https://doi.org/10.1007/s13394-022-00431-z

Putra, F. G., Saregar, A., Diani, R., Misbah, M., Widyawati, S., & Imama, K. (2024). Enhancing mathematical reasoning: role of the search, solve, create, and share learning. *Journal of Education and Learning*, *18*(3), 967–975. https://doi.org/10.11591/edulearn.v18i3.21399

Putra, F. G., Widyawati, S., Imama, K., & Ardhita, R. (2025). Enhancing mathematical problem-solving skills : The impact of the SSCS learning model integrated with GeoEnzo. *Indonesian Journal of Science and Mathematics Education*, *08*(July), 301–312. https://doi.org/10.24042/ijsme.v8i2.26631

Putri, R. I. I., Zulkardi, & 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

Rabgay, T., & Kidman, G. (2023). Multiple iterations and messiness in the implementation of action research by Bhutanese secondary science teachers. *Discover Education*, *2*(1). https://doi.org/10.1007/s44217-023-00077-4

Ruanthai, W., Insombat, B., & Hombubpha, S. (2025). The effect of sscs learning management combined with brainstroming technique on problem-solving ability and mathematical learning achievement of grade 6 students. *International Journal of Industrial Education and Technology*, *7*(1), 46–58. https://doi.org/http://doi.org/10.55003/JIET.2025.7106

Santos-trigo, M. (2024). Problem solving in mathematics education : Tracing its foundations and current research-practice trends. *ZDM – Mathematics Education*, *56*, 211–222. https://doi.org/https://doi.org/10.1007/s11858-024-01578-8

Smit, R., Dober, H., Hess, K., Bachmann, P., Birri, T., Smit, R., Dober, H., Hess, K., Bachmann, P., & Birri, T. (2023). Research in mathematics education supporting primary students ' mathematical reasoning practice : the effects of formative feedback and the mediating role of self-efficacy. *Research in Mathematics Education*, *25*(3), 277–300. https://doi.org/10.1080/14794802.2022.2062780

Stefan, H., Ortal, S., Tamar, N., & Kohen, Z. (2023). Scaffolding practices for modelling instruction in STEM - related contexts : insights from expert and novice teachers. *ZDM – Mathematics Education*, *55*(7), 1351–1364. https://doi.org/10.1007/s11858-023-01529-9

Stemele, B. P., & Jina Asvat, Z. (2024). Exploring learner errors and misconceptions in algebraic expressions with grade 9 learners through the use of algebra tiles. *African Journal of Research in Mathematics, Science and Technology Education*, *28*(1), 153–170. https://doi.org/10.1080/18117295.2024.2334989

Tay, Y. K., & Toh, T. L. (2023). A model for scaffolding mathematical problem-solving : From theory to practice. *Contemporary Mathematics and Science Education*, *4*(2), Article ep23019. https://doi.org/https://doi.org/10.30935/conmaths/13308

Thawinwong, C., & Sanrattana, W. (2022). Teachers and participatory action research for developing learning environments. *World Journal of Education*, *12*(3), 17. https://doi.org/10.5430/wje.v12n3p17

Thuneberg, H. M., Salmi, H. S., & Bogner, F. X. (2018). How creativity, autonomy and visual reasoning contribute to cognitive learning in a STEAM hands-on inquiry-based math module. *Thinking Skills and Creativity*, *29*(July), 153–160. https://doi.org/10.1016/j.tsc.2018.07.003

Wright, P. (2021). Transforming mathematics classroom practice through participatory action research. *Journal of Mathematics Teacher Education*, *24*(2), 155–177. https://doi.org/10.1007/s10857-019-09452-1