



The 7E Learning Cycle Model for Improving Mathematical Problem-Solving Skills: Systematic Literature Review

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A B S T R A K	A R T I C L E I N F O
<p><i>Kemampuan pemecahan masalah matematis merupakan salah satu kemampuan yang harus dimiliki siswa khususnya pada siswa jenjang menengah. Dalam meningkatkan kemampuan tersebut, diperlukan strategi yang tepat, salah satunya yaitu dengan menerapkan model Learning Cycle 7E. Penelitian ini bertujuan untuk mengkaji studi-studi kuantitatif dan kualitatif penerapan model Learning Cycle 7E dalam meningkatkan kemampuan pemecahan masalah matematis siswa pendidikan menengah yang dilakukan dalam jangka waktu 2016-2026. Metode penelitian yang digunakan adalah Systematic Literature Review (SLR) dengan pencarian dilakukan berdasarkan kriteria seleksi yang ditetapkan dengan pedoman PRISMA sebagai pedoman terhadap artikel-artikel penelitian yang terindeks dalam Google Scholar dan Crossref. Kajian difokuskan pada aspek geografis, tahun penelitian, jenjang pendidikan, pendekatan penelitian, serta temuan hasil penerapan model Learning Cycle 7E. Hasil penelitian menunjukkan bahwa penelitian terkait Learning Cycle 7E terhadap kemampuan pemecahan masalah matematis didominasi oleh wilayah Pulau Sumatera khususnya pada jenjang SMP. Berdasarkan sisi metodologi, sebagian besar penelitian menggunakan pendekatan kuantitatif dengan desain eksperimen. Publikasi penelitian umumnya terindeks pada jurnal SINTA tingkat menengah. Secara keseluruhan, hasil penelitian menunjukkan bahwa penerapan model pembelajaran Learning Cycle 7E memberikan pengaruh positif dan signifikan terhadap peningkatan kemampuan pemecahan masalah matematis siswa. Model ini lebih efektif dibandingkan pembelajaran konvensional karena mampu membantu siswa memahami masalah, merencanakan dan melaksanakan strategi penyelesaian, serta melakukan evaluasi hasil secara sistematis. Dengan demikian, model Learning Cycle 7E berpotensi meningkatkan kemampuan pemecahan masalah matematis siswa dan membuka peluang penelitian lanjutan pada jenjang dan wilayah yang lebih beragam.</i></p>	<p>Article History: Received: 2026-05-15 Revision: 2026-05-27 Accepted: 2026-05-31 Published: 2026-05-31</p> <p>Kata Kunci: Kemampuan Pemecahan Masalah Matematis Model Learning Cycle 7E Pendidikan Menengah Systematic Literature Review</p>

ABSTRACT	
<p><i>Mathematical problem-solving skills are one of the skills that students must have, especially at the secondary level. To improve these skills, appropriate strategies are needed, one of which is to apply the 7E Learning Cycle model. This study aims to review quantitative and qualitative studies on the implementation of the 7E Learning Cycle model in improving the mathematical problem-solving skills of secondary school students conducted between 2016 and 2026. The research method used was a Systematic Literature Review (SLR) with searches conducted based on selection criteria established using the PRISMA as a guideline for research articles indexed in Google Scholar and Crossref. The study focused on geographical aspects, year of research, education level, type of researches, and findings on the implementation of the Learning Cycle 7E model. The results showed that research related to the 7E Learning Cycle on mathematical problem-solving skills was dominated by the Sumatra region, especially at the junior high school level. In terms of methodology, most studies used a quantitative approach with an experimental design. Research publications are generally indexed in mid-level SINTA journals. Overall, the results show that the implementation of the Learning Cycle 7E model has a positive and significant effect on improving students' mathematical problem-solving skills. This model is more effective than conventional learning because it helps students understand problems, plan and implement solution strategies, and evaluate results systematically. Thus, the Learning Cycle 7E model is recommended for further research and implementation in mathematics education.</i></p>	<p style="text-align: right;">Keywords:</p> <p style="text-align: right;"><i>7E Learning Cycle Model Mathematical Problem-solving Skills Secondary Level Systematic Literature Review</i></p>

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1. INTRODUCTION

As a branch of science, mathematics has unique properties and characteristics that set it apart from other disciplines. These unique features are related to abstract ideas or concepts that are arranged in a sequential manner (Khotimah et al., 2018). Each concept is interconnected and builds upon the others in solving mathematical problems (Elsa et al., 2022). This indicates that understanding a mathematical concept cannot be separated from mastery of prerequisite concepts. Mastery of prerequisite concepts serves as a crucial foundation for students to develop a comprehensive and meaningful understanding of new concepts.

Meaningful mathematics learning is not only focused on mastering the subject matter, but also on developing students' mathematical skills. NCTM (2000) identifies five standards of mathematical proficiency: (1) problem solving, (2) reasoning and proof, (3) communication, (4) connections, and (5) representation. This indicates that mathematical problem-solving skills are one of the most important skills in mathematics learning. Therefore, mathematical problem-solving skills need to be developed optimally because they play a role in helping students understand, analyze and solve various problems accurately and systematically.

In fact, numerous studies still indicate that problem-solving skills remain suboptimal among the majority of students. Through classroom observations and interviews with mathematics teachers, it was found that students' mathematical problem-solving skills are still not optimal (Darmawan et al., 2024). This is because most students still appear passive during the learning process. Conventional teaching methods have not been able to optimally improve students' mathematical skills, as they tend to focus solely on conveying concepts or theories. The state of students' mathematical problem-solving skills also reflected in previous research, which indicated that students still struggle to understand and solve contextual word problems, and that they continue to make errors in determining the correct steps to solve them as part of their problem-solving strategies (Arifin et al., 2019). Given these circumstances, students' poor problem-solving skills can be attributed to a lack of practice in following a structured and proper problem-solving process. Therefore, a learning model is needed that can optimize students' mathematical problem-solving skills.

The 7E Learning Cycle model provides students with opportunities to gain hands-on experience with their environment, enabling them to understand how the concepts they have learned can be applied to solve mathematical problems. This is based on the learning phases outlined in the 7E Learning Cycle. Ruseffendi (in Hasanah, 2018) argues that students' interest in mathematics will emerge when they understand its practical applications and the beauty inherent in it. Students' interest in mathematics encourages their engagement in learning, thereby enabling their mathematical problem-solving skills to develop optimally through the implementation of the 7E Learning Cycle model.

According to Eisenkraft, the learning process in the 7E Learning Cycle model begins by eliciting students' prior knowledge (elicit), engaging and capturing students' attention (engage), students acquire knowledge through hands-on experiences related to the concepts being studied (explore), giving students the opportunity to draw conclusions and present the results of their findings (explain), giving students the opportunity to apply their knowledge to new situations (elaborate), the teacher conducts an evaluation (evaluate), and students expand on the concepts they have understood (extend) (Tyas et al., 2015; Nur et al., 2020). Thus, this model consists of a series of systematically organized steps, enabling it to optimally support students' cognitive development in solving mathematical problems.

Although numerous primary studies have investigated the application of the 7E Learning Cycle in mathematics classrooms, the existing literature remains fragmented. Most empirical studies focus strictly on localized, post-test effectiveness without examining the macro-level variables that influence successful implementation. Prior literature reviews have yet to comprehensively synthesize how the model's efficacy varies across different school levels,

geographic contexts, or how it interacts with students' psychological attributes such as internal disposition, self-efficacy, and adversity quotient.

To bridge this research gap, a comprehensive and methodical synthesis is urgently required. This study employs a Systematic Literature Review (SLR) method to critically evaluate and integrate existing research on the 7E Learning Cycle model in secondary mathematics education. Specifically, this review aims to analyze the model's impact on students' mathematical problem-solving skills by mapping out underlying trends across five distinct analytical dimensions: publication year, educational level, geographical or demographic characteristics, type of researches, and publication indexing. By establishing this multi-dimensional synthesis, this study provides teachers and curriculum designers with evidence-based insights into the pedagogical limits, psychological prerequisites, and practical boundaries of deploying the 7E Learning Cycle to sustainably enhance mathematical problem-solving skills.

2. METHOD

This research method adapts the study conducted by Syaputra et al. (2024), using the Systematic Literature Review (SLR) method. This research method aims to comprehensively identify and synthesize research findings based on specific research questions through a systematic, transparent, and replicable procedure at every stage of the process (Ariati & Juandi, 2022). Therefore, this study using the SLR approach will focus on describing and identifying the implementation of the 7E Learning Cycle model in improving secondary school students' mathematical problem-solving skills.

This research method was conducted through a systematic review of journals based on predetermined steps. According to Zawackiricter, the procedures in this study are divided into several structured steps: (1) research question, (2) research strategy, (3) selection criteria, (4) select studies, (5) the quality of studies and (6) synthesis result (Nabilla & Fitriyana, 2022). Furthermore, here is an explanation of each step.

Research Question

There are two research questions (RQ) posed in this study, as follows:

RQ. (1) What are the characteristics of research on the implementation of the 7E Learning Cycle model to the mathematical problem-solving skills of secondary school students, as examined based on publication year (2016–2026), demographic characteristics, educational level, and publication index?

RQ. (2) How does the implementation of the 7E Learning Cycle model affect secondary school students' mathematical problem-solving skills?

Research Strategy

This stage is used to obtain data that aligns with the RQ. The research strategy was carried out using the Publish or Perish software, which utilizes the Crossref and Google Scholar databases, by applying the specific search string "7E Learning Cycle Model" in the keyword field. Based on the initial search results, 34 articles were found regarding the implementation of the 7E Learning Cycle model in mathematics education in accredited journals, with 8 of them conducting research on mathematical problem-solving skills among secondary school students. Although the screening process originally accommodated both qualitative and quantitative approaches, no purely qualitative studies met the inclusion criteria. Therefore, this study systematically analyzes the selected literature consisting exclusively of quantitative and mixed-methods designs. The step-by-step literature filtering and selection process are visually detailed in Figure 1.

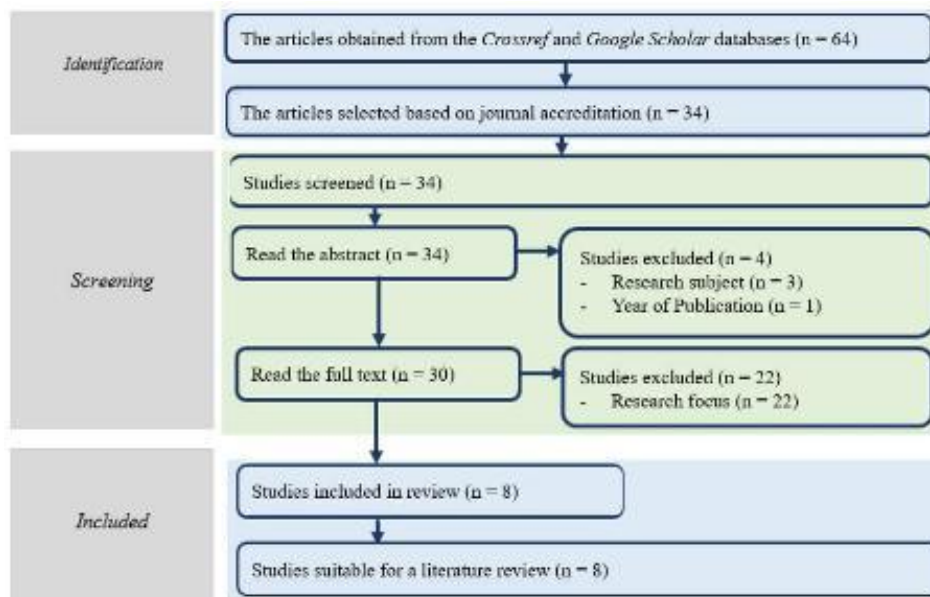


Figure 1. PRISMA: A Study of the 7E Learning Cycle Model on Improving Mathematical Problem-Solving Skills Among Secondary School Students

Based on the PRISMA diagram in Figure 1, the identification phase yielded 64 articles from the Crossref and Google Scholar databases, which were then reduced to 34 articles based on journal accreditation. Subsequently, during the screening phase, a selection was made based on specific criteria, resulting in 34 articles, with 4 articles eliminated due to mismatches in subject matter and year of publication. A total of 30 articles were thoroughly analyzed, and 22 articles were excluded because the research focus was not relevant to the 7E Learning Cycle model in improving mathematical problem-solving skills, resulting in 8 articles that met the criteria and were used in the literature review.

Selection Criteria

To obtain data consistent with the research objectives, inclusion criteria must be established. The inclusion criteria used in this study are as follows: (1) Studies discussing the implementation of the 7E Learning Cycle model in mathematics education; (2) Articles examining mathematical problem-solving skill as the main variable or one of the research variables; (3) The research subjects are secondary school students (junior high school (SMP/MTs) and/or senior high school (SMA/MA/vocational high school); (4) Articles published between 2016 and 2026; (5) Articles published in accredited or indexed journals (e.g., Crossref, Google Scholar, SINTA, or Scopus); (6) The type of research conducted (qualitative or mixed-method); (7) Articles written in Indonesian or English.

Articles that do not meet the inclusion criteria are further classified under the exclusion criteria, as follows: (1) Articles that do not discuss the 7E Learning Cycle model in mathematics education, particularly regarding students' mathematical problem-solving skills; (2) Research subjects outside of secondary school students; (3) Articles published outside the 2016–2026 timeframe; (4) Articles that are not indexed or do not meet journal quality criteria.

Select Studies

The study selection phase was conducted through a step-by-step screening process of articles based on predetermined inclusion and exclusion criteria. The selection process began with a review of the titles and abstracts to identify the relevance of the research topics, followed by a reading of the full texts to ensure that the research focus, subjects, variables, and learning context aligned with the research objectives.

Quality of Studies

This stage aims to assess the methodological quality of articles that have passed the initial screening. The quality assessment was conducted using a structured quality assessment rubric adapted from standard synthesis guidelines. This rubric evaluated each study across three critical domains: (1) the clarity of the research objectives, (2) the appropriateness of the research design and methods, and (3) the transparency and rigor of the data collection and analysis procedures.

Synthesis Results

The synthesis was conducted by integrating and summarizing the main findings from the articles that met the selection and quality criteria. The synthesis was conducted using a descriptive-qualitative approach by grouping the research results based on relevant aspects, such as the forms of implementation of the 7E Learning Cycle model, its impact on mathematical problem-solving skills, and the characteristics of the studies, thereby providing a comprehensive overview of the reviewed research findings.

3. RESULT AND DISCUSSION

This section focuses on presenting and analyzing the results based on the research questions that have been formulated. Each research question is analyzed systematically by referring to the key findings of the studies selected for review, in order to gain a comprehensive understanding of the implementation of the 7E Learning Cycle model to the mathematical problem-solving skills of high school students.

RQ (1): What are the characteristics of research on the implementation of the 7E Learning Cycle model to the mathematical problem-solving skills of secondary school students, as examined based on publication year (2016–2026), demographic characteristics, educational level, and publication index?

Studies by Year of Publication

An analysis based on publication year was conducted to identify trends in research on the implementation of the 7E Learning Cycle model to the mathematical problem-solving skills of high school students between 2016 and 2026. This analysis aims to illustrate the distribution of publications from year to year and the patterns of research focus over that period. The detailed annual distribution of these selected studies is illustrated in Figure 2.

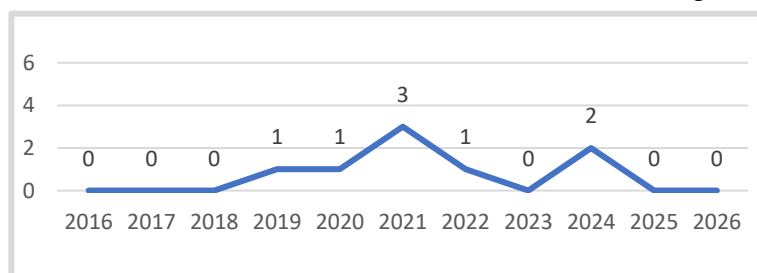


Figure 2. Research Data on the 7E Learning Cycle Model and Its Impact on Secondary Students' Mathematical Problem-Solving Skills, by Year of Publication

Based on the data shown in Figure 2, there has been a change in the number of studies on the 7E Learning Cycle Model and its impact on secondary school students' mathematical problem-solving skills published over the past 10 years, specifically from 2016 to 2026. This indicates that the number of publications has varied from year to year.

Between 2016 and 2018, no studies addressing this topic were found. Publications began to appear in 2019 and increased gradually, reaching a peak of three publications in 2021. Following this period, the number of studies declined in 2022 and 2023, then increased again in 2024. However, no relevant publications were found in 2025 and 2026. These findings indicate that the research focus on the 7E Learning Cycle model in the context of secondary

school students' mathematical problem-solving skills tended to strengthen in the early 2020s but has not yet shown stable continuity through the end of the observation period.

Studies by Demographic Characteristics

The characteristics of the study need to be analyzed from a demographic perspective. Demographic analysis is important because the geographic context and socio-educational background of the research setting can influence the implementation of the learning model as well as students' mathematical problem-solving skills. By identifying the distribution of the research areas, this study can provide an overview of the dominant context for the implementation of the 7E Learning Cycle model and demonstrate the representativeness of the research results regarding educational conditions in various regions. The mapping of these geographic and demographic distributions is presented in Figure 3.

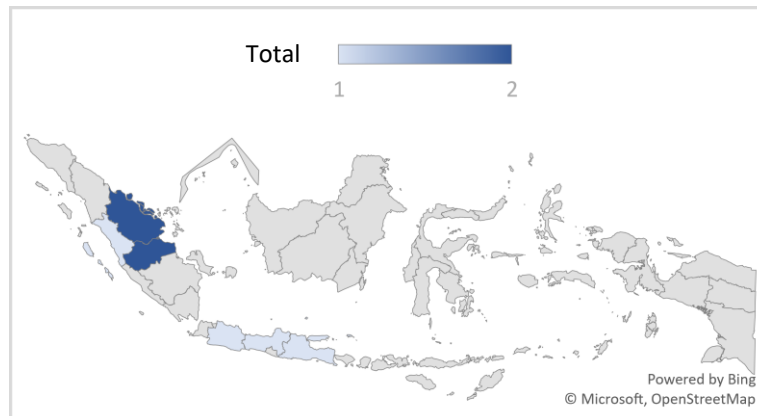


Figure 3. Research Data on the 7E Learning Cycle Model's Effect on Secondary Students' Mathematical Problem-Solving Skills Based on Demographic Characteristics

Based on the geographical distribution in Figure 3, research on the implementation of the 7E Learning Cycle model to the mathematical problem-solving skills of secondary school students is spread across several provinces in Indonesia, with the main concentration in the Java region and parts of Sumatera. The figure shows that the darker the color intensity in a region, the greater the number of studies conducted, while regions with lighter colors indicate a relatively small number of studies.

West Java, Central Java, and East Java provinces each contributed one study, while Riau and Jambi provinces showed relatively higher research intensity with two studies in each region. Additionally, West Sumatra contributed one study. This distribution pattern indicates that empirical studies are still dominated by regions with relatively developed access to education and research activities, while other regions in Indonesia are not yet evenly represented. This situation suggests the potential for geographical disparities in mathematics education research that need to be addressed in future studies.

Studies by Educational Level

Studies that analyze data by educational level focus on secondary school students—specifically those in junior high school (SMP) and senior high school (SMA)—who serve as the subjects in the studies under review. It is important to conduct an analysis by educational level to understand the context of the implementation of the 7E Learning Cycle model as well as the characteristics of students' mathematical problem-solving skills at different educational levels. The comparison and percentage distribution of the reviewed research based on these educational levels are visually presented in Figure 4.

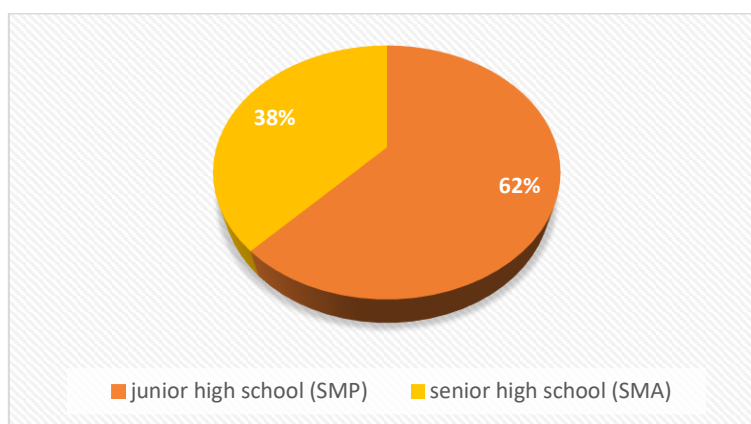


Figure 4. Research Data on the 7E Learning Cycle Model's Impact on Secondary Students' Mathematical Problem-Solving Skills by Educational Level

Based on Figure 4 above, studies that applied the 7E Learning Cycle model to students' mathematical problem-solving skills at the secondary level indicate that the majority of studies were conducted at the junior high school (SMP) level. Of the total eight studies analyzed, five (62%) focused on junior high school students, while three (38%) were conducted at the senior high school (SMA) level. This indicates that junior high school students were more frequently selected as research subjects than senior high school students in the analyzed studies.

Studies by Research Type

This study focuses on categorizing research based on the research methods employed. The discussion aims to provide an overview of the predominant research approaches used in examining the implementation of the 7E Learning Cycle model to students' mathematical problem-solving skills. The comprehensive distribution and percentage of the reviewed publications based on research type are visually mapped out in Figure 5.

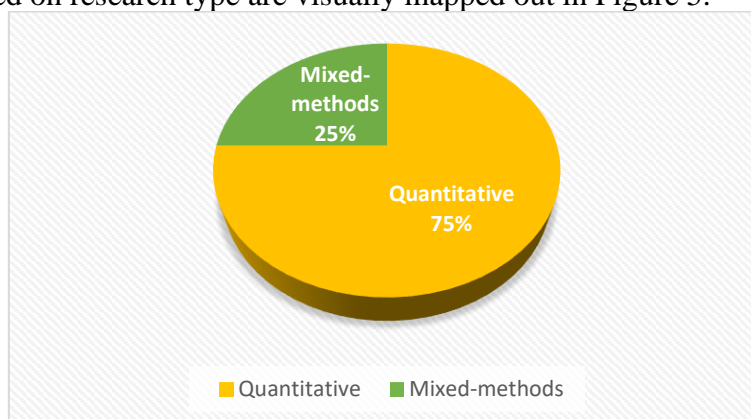


Figure 5. Research Data on the 7E Learning Cycle Model's Impact on Secondary Students' Mathematical Problem-Solving Skills by Research Type

Based on Figure 5 above, quantitative research clearly dominates the empirical literature regarding the implementation of the 7E Learning Cycle model to enhance mathematical problem-solving skills, with six studies accounting for 75% of the total dataset. The remaining 25% is comprised of two mixed-methods studies, whereas no purely qualitative studies were retrieved during the systematic screening. Consequently, to maintain strict analytical consistency and ensuring data comparability, this SLR study is intentionally focused on synthesizing quantitative and mixed-methods research designs. This methodological focus aligns with the current trend in mathematics education, which heavily emphasizes measuring the causal effectiveness and statistical impact of structural learning models through empirical and quantitative lenses.

Studies by Publication Index

The following figure shows the distribution of studies, categorized by journal index, that examine the implementation of the 7E Learning Cycle model to students' mathematical problem-solving skills. The detailed classification of these publications based on their respective journal databases and national indexing tiers is visually structured in Figure 6.

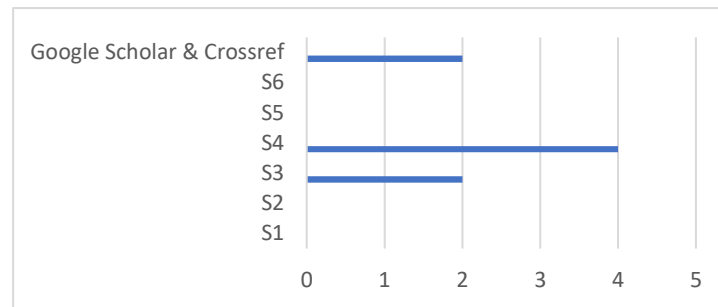


Figure 6. Research Data on the 7E Learning Cycle Model's Impact on Secondary Students' Mathematical Problem-Solving Skills Based on Journal Indexing

Based on Figure 6 above, the structural distribution shows that the majority of the reviewed studies were published in SINTA 4 (S4) indexed journals with a total of 4 articles, followed by SINTA 3 (S3) and non-SINTA journals from Google Scholar & Crossref databases which contributed 2 articles each. Conversely, there were absolutely no articles found (zero publications) published in the SINTA 1 (S1), SINTA 2 (S2), SINTA 5 (S5), and SINTA 6 (S6) indices. This distribution model signifies that research examining the 7E Learning Cycle model in secondary mathematics education is predominantly concentrated within medium-tiered national journals (S3 and S4).

RQ (2): How does the implementation of the 7E Learning Cycle model affect secondary school students' mathematical problem-solving skills?

The research was analyzed based on the focus of the studies and the main findings regarding the implementation of the 7E Learning Cycle model to students' mathematical problem-solving skills at the secondary education level. A total of 8 articles were identified that conducted research on the topic under review. To provide a comprehensive overview of the contributions of each study and to facilitate the identification of relevant research results, the extracted data and primary findings are systematically compiled in Table 1.

Table 1. A Study of the 7E Learning Cycle Model on Improving Mathematical Problem-Solving Skills Among Secondary School Students

Title and Author	Journal Title	Research Findings
Pengaruh Penerapan Model <i>Learning Cycle</i> 7E terhadap Kemampuan Pemecahan Matematis berdasarkan Kemandirian Belajar Siswa SMPN 31 Pekanbaru	Juring (<i>Journal for Research in Mathematics Learning</i>)	The 7E Learning Cycle model is effective in improving mathematical problem-solving skills based on the learning autonomy of students at SMPN 31 Pekanbaru in the topic of quadrilaterals. These findings indicate that instruction using the 7E Learning Cycle model is more effective than conventional instruction, as evidenced by the average posttest scores for each class. Furthermore, there was no difference in mathematical problem-solving skill among students with high, moderate, and low levels of learning autonomy, and there was no correlation between the 7E Learning Cycle model and
Nufus, Wira, & Kurniati, 2019)		

Title and Author	Journal Title	Research Findings
Pengaruh <i>Learning Cycle 7E</i> disertai <i>Mind Mapping</i> Terhadap Kemampuan Pemecahan Masalah Matematika ditinjau dari <i>Adversity Quotient</i>	Jurnal Pendidikan Matematika	autonomy regarding mathematical problem-solving skill. The results of the study indicate that the 7E Learning Cycle model combined with mind mapping has a positive effect on mathematical problem-solving skills. Furthermore, there is an interaction between the implementation of this model and the Adversity Quotient (AQ) in enhancing students' problem-solving skills. Thus, the 7E Learning Cycle model combined with mind mapping can be applied to students with the climber, camper, and quitter AQ types.
(Anshori, Syaiful, & Sofyan, 2020)		
Analisis <i>Learning Cycle 7E</i> Untuk Meningkatkan Kemampuan Pemecahan Matematis dan <i>Self Regulated Learning</i> Ditinjau Berdasarkan AQ	AXIOMA: Jurnal Program Studi Pendidikan Matematika	The 7E Learning Cycle has been shown to be more effective than conventional instruction in improving mathematical problem-solving skills, particularly among students with a Climber AQ and SRL, as well as students with a Camper AQ transitioning to Climber. Teacher and student activities demonstrated good implementation across all phases, although the Extend phase was relatively lower. Overall, the 7E Learning Cycle model is effective with moderate improvements; however, its implementation is less than optimal for students with Camper AQ, so it is necessary to strengthen responsibility in group work to improve students' AQ.
(Maulani, 2021)		
Penerapan <i>Learning Cycle 7E</i> Berbantuan Kartu Soal Dapat Meningkatkan Kemampuan Pemecahan Materi Fungsi Komposisi Kelas X SMA Negeri 2 Semarang	Dimensi Pendidikan	The implementation of the 7E Learning Cycle model, supported by question cards, is effective in enhancing students' engagement and problem-solving skills, particularly when teaching the concept of composite functions. The stages of the 7E Learning Cycle facilitate students in gradually connecting prior knowledge with new concepts, thereby encouraging active engagement in learning. The use of question cards reinforces student engagement, which leads to improved problem-solving skills, as evidenced by the increase in the class average score from the pre-cycle to Cycle II and the achievement of improved mathematical problem-solving skills among students.
(Krisnaningsih, 2021)		
Pemecahan Matematis Siswa dalam <i>Learning Cycle 7E</i> Ditinjau dari <i>Self Efficacy</i>	Juring (<i>Journal for Research in Mathematics Learning</i>)	The mathematical problem-solving skills of students who learn through the 7E Learning Cycle model differ significantly from those of students who follow conventional instruction. Students who received the 7E Learning Cycle instruction demonstrated superior performance in understanding problems, planning strategies, and solving mathematical problems. Additionally,

Title and Author	Journal Title	Research Findings
(Rukmana, Nurdin, & Kurniati, 2021)		differences in problem-solving skill were found among students with high, moderate, and low levels of self-efficacy; however, no interaction was found between the instructional model and self-efficacy.
Kemampuan Pemecahan Masalah Matematis dan <i>Self-Regulated Learning</i> dengan Model Pembelajaran <i>Learning Cycle 7E</i>	Jurnal Cendekia: Jurnal Pendidikan Matematika	The results of the study indicate that the mathematical problem-solving skills of students in the experimental class were higher than those in the control class as a result of implementing the 7E Learning Cycle model. In addition, this model also contributed to the development of students' self-regulated learning throughout all phases of the learning process. These findings reinforce the results of previous studies that highlight the effectiveness of the 7E Learning Cycle in improving mathematical problem-solving skills.
(Utami, Eliza, & Warahma, 2022)	<i>Mathematical Disposition and The Impact of Learning Cycle 7E on Problem-Solving Skills in Mathematics</i> <i>International Journal Of Humanities Education And Social Sciences (IJHESS)</i>	Research shows that the 7E Learning Cycle model is effective for all students, regardless of their mathematical aptitude. This model enhances problem-solving skills through student-centered learning, contextual problem-solving experiences, collaboration, appropriate guidance, and the creation of a positive learning environment. Therefore, the 7E Learning Cycle is worthy of widespread implementation to improve the quality of mathematics education.
(Yustikarinda, Widodo, & Katminingsih, 2024)	<i>The Effect of Implementing Models Cycle 7e on Mathematical Problems-Solving Ability</i> <i>Asian Journal of Education and Social Studies</i>	Research findings indicate that the 7E Learning Cycle model is more effective than direct instruction in improving students' mathematical problem-solving abilities. This effectiveness is supported by students' active engagement in each phase of learning, which facilitates the systematic processes of problem analysis, strategy planning, problem-solving implementation, and outcome evaluation. These results align with previous research findings that confirm the superiority of the 7E Learning Cycle over conventional instruction.

Problem-solving skills play a crucial role in mathematics education, as they enable students to accurately understand real-world problems, apply basic mathematical knowledge more easily, and master the concepts needed to solve mathematical problems in everyday life. The indicators of mathematical problem-solving skills targeted across the reviewed studies encompass identifying sufficient data, creating mathematical models, selecting and applying strategies, interpreting results, and applying mathematics meaningfully (Rukmana et al., 2021). A critical synthesis of the eight reviewed articles reveals distinct demographic, geographical, pedagogical, and psychological patterns that explain how the 7E Learning Cycle fundamentally enhances these problem-solving indicators compared to conventional methods.

The first notable pattern is the prominent cluster of research conducted at the Junior High School (SMP) level compared to higher secondary education. This structural trend is closely

linked to the cognitive developmental stage of students aged 12–15 years. According to Piaget's theory of cognitive development, transition-age students are moving from concrete operational to formal operational thinking (Hamilton & Ghatala, 1994). Since mathematical problem-solving requires high-level abstract reasoning, the structured guidance of the 7E phases becomes essential scaffolding. The early phases (Elicit and engage) allow younger secondary students to safely bridge their concrete prior knowledge with abstract mathematical models before they attempt complex tasks. Geographically, the heavy dominance of these studies emerging from the Sumatera region (e.g., Pekanbaru, Jambi, and Padang) can be synthesized as a strategic pedagogical response to regional educational challenges. National assessment trends frequently highlight disparities in Higher-Order Thinking Skills (HOTS) between Java and non-Java regions. Consequently, researchers in Sumatra have targeted the 7E Learning Cycle as an intervention to disrupt traditional, teacher-centered routines that historically hindered non-Java students from mastering critical problem-solving indicators.

From a pedagogical perspective, the 7E Learning Cycle offers superior instructional mechanics for mathematical problem-solving compared to other constructivist frameworks, such as Problem-Based Learning (PBL) or the traditional 5E Model, due to two explicit additions, namely Elicit and Extend. While other models assume students are ready to explore, the Elicit phase in the 7E model isolates and extracts prior knowledge, ensuring students have the correct cognitive baseline before formulating new mathematical concepts (Sitepu et al., 2024). This prevents fatal mathematical misconceptions early on. Furthermore, while models like PBL stop at evaluation, the Extend phase forces students to transfer their newly acquired mathematical concepts to completely novel contexts or everyday situations. This phase directly fulfills the highest indicator of mathematical problem-solving: applying mathematics meaningfully and verifying answers across shifting contexts.

Finally, the synthesis reveals the 7E model does not operate in a psychological vacuum; its efficacy is heavily moderated by students' internal traits, creating a dynamic interaction where the Elicit and Engage phases activate student self-efficacy, the Explore and Elaborate phases demand high Adversity Quotient (AQ) to overcome mathematical blocks, and the Extend and Evaluate phases build self-regulated learning. Because the 7E cycle demands immense cognitive resilience during complex, non-routine tasks, students with a "climber" AQ naturally excel as they view cognitive disequilibrium as a challenge (Anshori et al., 2020; Maulani, 2021). Conversely, "camper" students tend to stagnate during the Extend phase because their drive to expand concepts is limited. This explains why the 7E model is robust, yet teachers must actively embed peer-collaboration or learning media such as the worksheet and question cards noted by Krisnaningsih (2021) to scaffold "camper" and "quitter" students through the more grueling phases of mathematical inquiry.

In conclusion, the successful implementation of the 7E Learning Cycle model relies on the interplay between active external scaffolding and students' internal psychological capacities, fostering both learning autonomy and self-regulated learning throughout the process (Nufus et al., 2019; Utami et al., 2022). Rather than serving as a generic instruction, the model transforms mathematical problem-solving from a mechanical memorization of steps into an active, iterative cognitive habitus. Therefore, the implementation of the 7E Learning Cycle model is worth considering as an effective and sustainable learning strategy for comprehensively improving secondary students' mathematical problem-solving skills (Hairini et al., 2024; Yustikarinda et al., 2024).

4. CONCLUSION

Research on the implementation of the 7E Learning Cycle model in improving secondary school students' mathematical problem-solving skills has garnered significant attention, particularly in 2019 and 2021. The research is predominantly conducted in the demographic context of the Sumatera region, particularly at the junior high school level. Based on educational level, junior high school students are more frequently selected as research subjects compared to senior high school students, indicating that the 7E Learning Cycle model is more often tested in the early stages of secondary education. In terms of research characteristics, the majority of studies employ a quantitative approach with an experimental design; meanwhile, purely qualitative research is entirely absent, and mixed-methods studies remain limited. Based on journal indexing, publications are dominated by SINTA-indexed journals at the intermediate level. Overall, these findings indicate that research on the 7E Learning Cycle remains concentrated in specific regions, educational levels, and approaches, thereby opening opportunities for further research in more diverse demographic contexts, at the high school level, and for publication in higher-reputation journals.

Furthermore, various research findings indicate that the implementation of the 7E Learning Cycle model has a positive and significant impact on improving students' mathematical problem-solving skills. This model has proven to be more effective than conventional learning because it facilitates students in understanding problems, planning and implementing solution strategies, and systematically evaluating results. Hence, the 7E Learning Cycle model has a tangible impact on improving students' mathematical skills, particularly in enhancing their mathematical problem-solving skills.

Future research is recommended to expand the scope and level of study, particularly at the high school level, and to employ qualitative or mixed-methods approaches to gain a more comprehensive understanding. In addition, mathematics educators are advised to implement the 7E Learning Cycle model as an alternative teaching approach, as it has been proven effective in improving students' mathematical problem-solving skills.

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