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Heterogeneity of the Effect of Affective Aspects on Students' Mathematical Problem-Solving Ability

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Abstract: Mathematical Problem-Solving Ability (MPSA) is a crucial skill in mathematics learning, as it plays a role in understanding mathematical concepts and preparing students to face challenges in everyday life. This study aims to examine the heterogeneous influence of affective aspects such as self-efficacy (SE), self-regulated learning (SRL), self-concept (SC), and mathematical disposition (MD) on students' mathematical problem-solving ability (MPSA) through a systematic literature review. Data were collected from research articles published between 2019 and 2024, indexed in SINTA and Scopus, following the PRISMA guidelines. The analysis results indicate that SE has the strongest correlation with MPSA, followed by MD. Variability in SC highlights a context-dependent influence. This study also provides a comprehensive mapping related to publication years, sample sizes, educational levels, and research locations, showing trends in the variation of publications each year. These findings emphasize that educational interventions should integrate affective aspects of MPSA holistically, with strategies tailored to different educational levels and regional disparities. Therefore, recommendations for future research include developing more holistic learning strategies that integrate all four affective aspects to achieve better learning outcomes.

Keywords: mathematical problem-solving ability, self-efficacy, self-regulated learning, self-concept, mathematical disposition, systematic literature review.

▪ INTRODUCTION

Mathematical Problem-Solving Ability is one of the most important skills in learning mathematics. This skill helps students understand mathematical concepts and prepares them to face challenges in real life. It plays an important role in developing 21st-century skills such as critical thinking, creativity and the ability to deal with complex situations. By teaching mathematical problem-solving, students can learn systematic and logical ways of thinking that can be applied in various life contexts (Szabo et al., 2020). Mathematical problem-solving helps students to understand mathematical concepts more deeply. Through this process, students learn to connect various concepts and apply them in different situations, improving their understanding of the material taught (Pambudi et al., 2020).

MPSA is significantly influenced by several factors, namely learning difficulty (25%), attitude (14.44%), attention (9.61%), laziness (9%), formula usage (7.84%), response (7.29%), previous learning experience (6.76%), and motivation (5.76%) (Kudsiyah et al., 2017). Here, it can be seen that students' attitudes towards mathematics, including math beliefs and anxiety, have a significant relationship with their MPSA. A positive attitude towards mathematics increases MPSA (Guven & Cabakcor, 2013).

Of course, this MPSA is not necessarily owned by students. Various factors influence it. One factor influencing MPSA is the affective aspect, which relates to students' emotions, attitudes, interests and motivations.

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Research conducted by Pajares and Kranzler (1995) on the affective aspects of self-efficacy (SE) shows that SE strongly influences MPSA. Self-efficacy is a person's belief about his or her ability to perform a task or achieve a particular goal successfully. Albert Bandura introduced this concept in his Social Learning Theory and has become a highly effective predictor of student motivation and learning (Hidayanti, 2023; Kodden, 2020; Zimmerman, 2000).

Research Wulandari & Alyani (2022) also researched the relationship between the affective aspects of Self Regulated Learning (SRL) and obtained results showing that there is a significant relationship between SRL and problem-solving ability, where the improvement in the quality of SRL is directly proportional to the increase in MPSA. Self Regulated Learning is the process by which individuals actively regulate and control the cognitive, metacognitive, motivational, and behavioural aspects of their learning to achieve specific learning goals. SRL involves goal setting, time management, help-seeking, and self-evaluation (Andianti et al., 2021; Gambo & Shakir, 2021; Lee et al., 2019; Panadero, 2017).

Another affective aspect related to MPSA is Self Concept (SC). Self-concept is an individual's self-image formed through experience and interpretation of the environment (Theresia, 2018). In mathematics education, SC includes two main components: SC belief (beliefs about one's abilities) and SC affect (feelings or emotions related to these abilities). SC in the context of mathematics learning refers to individuals' perceptions and beliefs about their ability to understand and complete mathematical tasks. One of the studies that showed the relationship between SC and MPSA was conducted by Nurochmah & Kharisudin (2023), with the conclusion that SC has a positive influence of 41.3% on students' MPSA, where students with high SC are more likely to fulfil all MPSA indicators than students with low SC.

In addition, Mathematical Disposition (MD), which is part of the affective aspect, also affects MPSA, as research by Ummah & Wahidin (2022) shows that students' MPSA is directly proportional to MD. MD includes attitude, interest, and motivation towards mathematics. This MD influences how students approach and solve mathematical problems, internal and external motivation, and positive attitudes towards mathematics, which ultimately contribute to MPSA (Özcan, 2016).

Mapping regional disparities and educational levels is very important to understand the variation in the impact of affective factors on students' mathematical problem-solving abilities. Factors such as access to educational resources, local policies, and learning culture can differ significantly between regions, with regions that have limited resources or face socio-economic challenges may experience obstacles that affect the development of affective aspects of students. In addition, the level of education also plays a large role, where at earlier levels, SC and MD may be more dominant, while at higher levels, SRL and SE are more influential. Tracing these disparities across regions and levels of education can provide a more comprehensive understanding of how affective factors affect mathematical problem-solving abilities, as well as contribute to more inclusive and effective education policies.

The results of these studies on the relationship between affective aspects and MPSA do not fully guarantee that affective aspects, especially SE, SRL, SC, and MD, have promising effectiveness in developing and improving MPSA. In some other studies, results were obtained. , a comprehensive review is needed to describe the relationship

between affective aspects and MPSA by conducting research in the form of a systematic review using the Systematic Literature Review (SLR) method.

SLR is designed to identify and summarize research thoroughly, based on specific questions, by following systematic, transparent, and replicable procedures at every stage (Juandi, 2021). Of course, there have been several previous SLR studies on affective aspects of MPSA, such as research conducted by Rifa Udin & Noriza Munahefi (2024) with the title Systematic Literature Review: Students' Problem-Solving Ability Given Students' Mathematical Disposition with Problem-Based Learning Model, Research by Leana et al., (2024) entitled Systematic Literature Review: The Effect of Self-Regulated Learning on Students' Mathematical Problem Solving Ability Based on Education Level, then research conducted by Faozan & Kusno (2023), entitled Systematic Literature Review: The Effect of Mathematical Self-Efficacy on Mathematical Problem Solving Ability. However, there is no comparative study that compares the relative influence of affective factors, SE, SRL, SC, and MD on MPSA. Most existing studies tend to separate the influence of each factor without examining how they interact with each other or which has a greater impact on the MPSA. By strengthening this gap analysis, this study aims to provide a more holistic understanding of the contribution of each affective factor, as well as to encourage more in-depth comparative studies in the future.

Research questions to be answered include: (1) How do SE, SRL, SC, and MD differently affect MPSA at various levels of education? (2) What is the trend in research on MPSA and affective aspects in mathematics learning in terms of year of research, Journal Accreditation, and material? (3) What regional and methodological trends exist in the study of affective factors and MPSA? (4) How can these findings inform holistic pedagogical strategies?

▪ METHOD

Research Design

This article uses the Systematic Literature Review (SLR) method. The data in this study are the results of a survey conducted on secondary data, namely the results of primary research on the relationship between affective aspects (SE, SRL, SC, MD) with MPSA in elementary, junior and senior high school students. Data searches were conducted in several electronic databases. This research design aims to identify, analyze, and summarize research results relevant to the topic. The SLR process followed a systematic, transparent, and replicable procedure, to ensure the quality and validity of the analysis conducted.

Search Strategy

Data were collected from electronic databases using the Publish or Perish (PoP) search engine on Google Scholar, Scopus, Sematic Scholar, and Web of Science. Manual searches were also conducted on Sage, Taylor & Frech, and Eric databases. The selection of these databases was based on the reputation and coverage of the indexed journals, which cover various disciplines such as mathematics education and educational psychology. Google Scholar was chosen for its ease of access and wide coverage, while Scopus and Web of Science were chosen for their high indexing quality and international peer-reviewed articles. Semantic Scholar offers advanced search algorithms and open access, while Sage and Taylor & Francis have many high-impact journals in the field of

education. ERIC, as one of the largest education databases, provides relevant articles on teaching and learning, including affective aspects. In addition, the open-access criteria were chosen to reduce accessibility bias, allowing all relevant articles to be freely accessible to researchers and practitioners worldwide. The use of open-access articles ensures transparency and replicability of research, and allows for wider dissemination of findings without cost or access limitations.

The keyword combinations used are: ("self-efficacy" OR "self-regulated learning" OR "self-concept" OR "mathematical disposition") AND ("mathematical problem solving ability" OR "mathematical problem solving ability") AND ("affective aspects" OR "affective aspects"). I also did a search with separate keywords, namely: "Self efficacy and Mathematical Problem Solving Ability", "Self Efficacy and Problem solving ability", "Self Regulated Learning and Mathematical Problem Solving Ability", "Self Regulated Learning and Problem Solving ability", "Self Concept and Mathematical Problem Solving Ability", "Self concept and Problem Solving ability", "Mathematical Disposition and Mathematical Problem Solving Ability", "Mathematical Disposition and Problem Solving Ability". The use of keywords one by one does not use the "Or" operator because the search must contain both aspects, namely affective aspects and MPSA. Manual searches were conducted using the same keywords.

The data obtained was then stored in RIS format and then filtered based on predetermined inclusion and exclusion criteria. The article screening stage was KPMPSAied out through the help of the Covidence online platform. The step by step research is as shown in the following PRISMA chart:

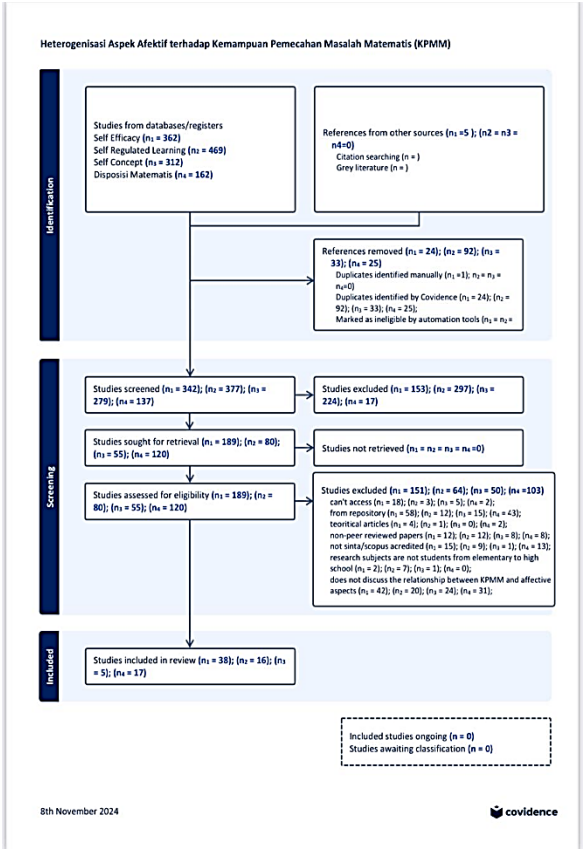

Figure 1. PRISMA flow chart from covidence

Inclusion and Exclusion Criteria

Table 1. Inclusion and exclusion criteria

Inclusion criteria	Exclusion Criteria
This article is the result of mathematics research at the elementary, junior high, and high school levels.	Articles not in the field of mathematics or study levels other than elementary, junior high, high school level
Articles published in the 2019-2024 period	Articles published outside of 2019-2024
Articles that discuss the relationship between affective aspects (SE, SRL, SC, MD) and MPSA	Does not discuss the relationship between affective aspects and MPSA
Articles published in SINTA and SCOPUS indexed journals and open access	Not sinta/scopus acredited. Not open access.
Article in Indonesian or English	Articles in languages other than Indonesian or English
Not a theoretical article, sourced from a repository, and non-peer reviewed	Theoretical article, from repository, non-peer reviewed article

Articles indexed in SINTA and Scopus are selected because they have high quality standards and are internationally recognized, with journals that have gone through a rigorous peer-review process.

Data Analysis

Data analysis was KPMPSAied out through the stages of identification, screening, eligibility, and finally included. First, article identification was KPMPSAied out by searching for relevant articles in various databases using a combination of keywords previously described and obtained articles as many as 1,310 articles, with 175 duplications. Second, at the screening stage, as many as 1,135 articles found were selected based on the title and abstract to ensure their relevance to the research topic. Third, at the eligibility stage, 444 articles that passed the screening were read in more depth to ensure they met the inclusion criteria. Finally, at the included stage, 76 articles that met all the criteria were forwarded for further analysis and used in the study. The included data was then analyzed using a characteristic analysis sheet to summarize the findings from the articles. Each article was analyzed to answer the research questions consisting of year, type of research, level of study, material, location, sample size, journal accreditation, and research findings.

▪ RESULT AND DISSCUSSION

This section outlines the research findings on the influence of affective aspects, namely SE, SRL, SC, and MD, on MPSA. This section outlines the findings reviewed based on the 4 research questions posed. The review results are as follows:

How do SE, SRL, SC, and MD differently affect MPSA at various levels of education?

Based on the Figure 2, studies focusing on the affective aspects of MPSA primarily are conducted at the junior high school level, especially on the SE aspect, with 25 studies far exceeding other aspects, such as SRL and MD, which have 7 and 10 studies,

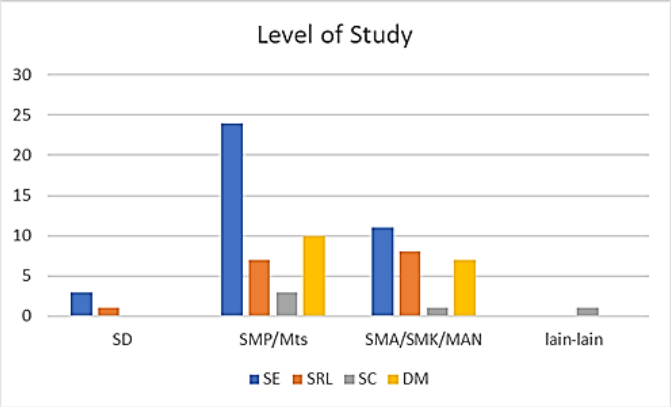

Figure 2. Level of study

respectively. At the SMA/SMK/MAN level, the SE aspect remains dominant with 11 studies, followed by SRL and MD, which have 8 and 7 studies, respectively. However, research at the primary school level is still minimal, with only four studies related to SE and 1 study related to SRL. Research in the miscellaneous category (unknown level of study) shows minimal contributions to SC and SE, suggesting that affective studies focus on the secondary education level.

The findings showing the dominance of research on the SE aspect at the junior high school (SMP/Mts) and senior high school (SMA/SMK/MAN) levels can be linked to the psychological characteristics of students in that age range. During adolescence, individuals tend to undergo a phase of intense identity development and independence. SE plays an important role in building students' self-confidence to manage their learning independently, especially in facing increasingly complex academic challenges at the secondary education level. On the other hand, the prominence of SRL and MD aspects at the senior high school level reflects students' need to manage time, learning strategies, and decision-making related to academic and MPSAeer choices. This aligns with Piaget's cognitive development theory, where adolescents begin to enter the formal operational stage characterized by the ability to think abstractly, reflectively, and strategically, thus supporting the development of SRL and MD aspects. Meanwhile, the limited research at the elementary school level can be attributed to students' limitations in developing complex learning independence, as they are still in the concrete operational stage of cognitive development, which tends to rely on teacher guidance. Thus, the differences in the dominance of affective aspects at each educational level reflect the unique

psychological development characteristics of students at each phase, which have implications for the optimal strategies in improving MPSA according to the relevant educational level.

Figure 3 shows the distribution of the samples by education level (elementary, middle and high school) and the four research categories: SE, SRL, SC, and MD. Only the SE (135 samples) and SRL (122 samples) categories were recorded at the primary

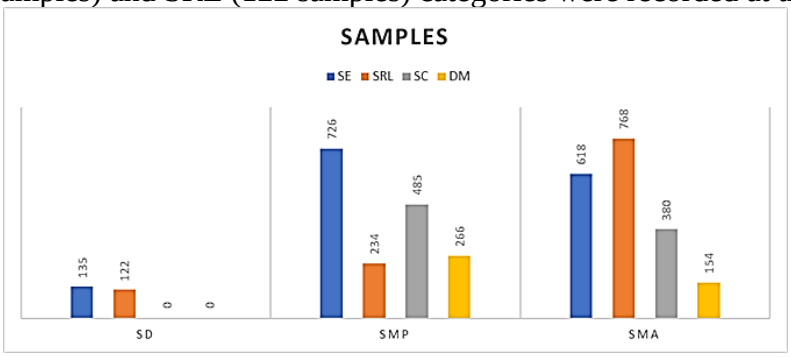

Figure 3. Samples distribution

school level, while SC and MD were absent. At the junior high school level, the SE category had the highest number of samples (726), followed by SC (485), MD (266) and SRL (234). At the senior high school level, SRL dominated with 768 samples, followed by SE (618), SC (380) and MD (154).

Figure 3 provides a clear picture of the distribution of the number of samples related to SE, SRL, SC and MD aspects at each level of education. At the primary school level, the number of samples related to SE is more dominant, but there are no studies highlighting other aspects, such as SRL, SC, and MD, which may be due to the early stage of students' cognitive and affective development. At the junior high school level, SE remains the most dominant aspect, followed by SRL and MD, reflecting that students are starting to learn to self-regulate their learning, although they still need a lot of guidance. At the senior high school level, a larger sample size was seen in SE and SRL, with SRL experiencing a significant increase compared to junior high school, indicating a strengthening of students' ability to organize their learning, along with a growing maturity of thinking. The increased sample size in senior high school also reflects a shift from a focus on affective aspects towards the development of more complex metacognitive skills, such as decision-making and learning organization. Overall, this graph illustrates how the differences in the number of samples in each affective and cognitive aspect at each educational level indicate significant changes in the influence of psychological factors on students' MPSA, in line with their cognitive and affective development.

What is the trend in research on MPSA and affective aspects in mathematics learning in terms of year of research, journal accreditation, and material

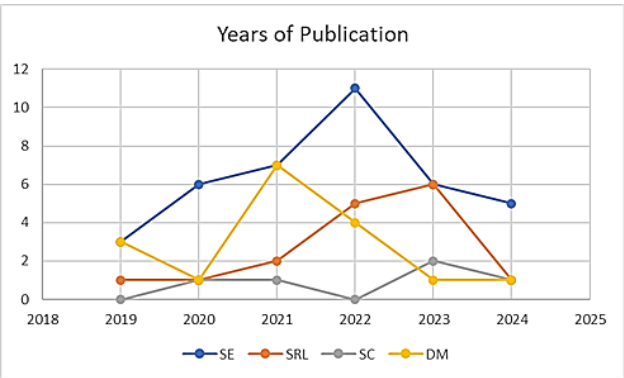

Figure 4. Years of publication

Based on Figure 4, SE shows the highest research trend, with a significant increase peaking in 2022 (11 publications) before declining again in 2023-2024. SRL experienced a gradual increase until 2023 (6 publications) but declined drastically in 2024. Meanwhile, SC-related research was relatively low, with limited contributions, peaking only in 2023 (2 publications). MD shows fluctuations, with a significant spike in 2021 (7 publications) before declining again.

Overall, publications on SE saw a significant spike in 2022, reflecting increased interest and recognition of the importance of affective aspects in mathematics learning. SRL also showed a clear increase in the same years, reflecting the emphasis on students' learning independence at the secondary level. On the other hand, MD and SC showed smaller fluctuations, with some years seeing a decrease in publications, especially in 2023. This reflects a shift in focus in research towards more in-depth cognitive and affective development, as well as a decrease in interest in social influence and decision-making in the context of mathematics learning.

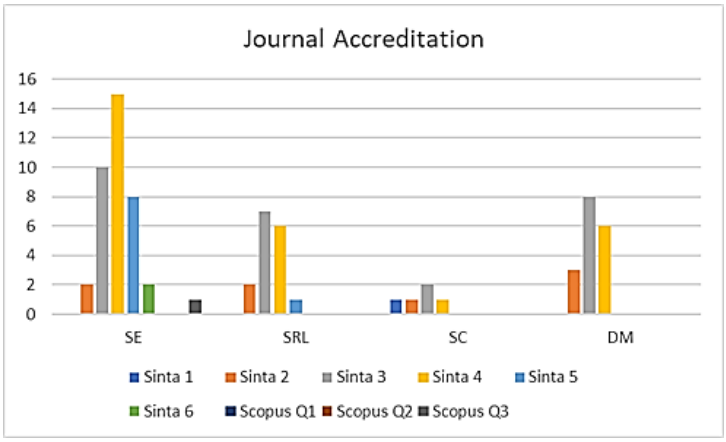

Figure 5. Journal accreditation

Based on Figure 5, the distribution of SE, SRL, SC, and MD shows variations in the number and quality of publications. For SE, Sinta 4 journals dominate (15 journals), followed by Sinta 3 (10 journals) and Sinta 5 (8 journals), suggesting that research in this area is more widely published in medium accreditation journals. In SRL, Sinta 3 and Sinta 4 journals have six publications each, while Scopus journals are limited. SC has publications in several journals, including Sinta 2, Sinta 4, and Scopus Q3. MD is

dominated by Sinta 3 (8 journals) and Sinta 4 (6 journals), steadily contributing to medium accreditation journals.

From Figure 5, it can be seen that SE-related research dominates journals with Sinta 1 and Scopus Q1 accreditation, indicating that this research is mostly published in journals with high influence. SE is also widely published in journals with low accreditation levels such as Sinta 5 and Scopus Q3, indicating that although this research is published in various journals, its quality still varies greatly. Meanwhile, aspects of SRL were more evenly distributed across journals with medium accreditation, such as Sinta 2 and Sinta 3. This reflects the wider acceptance of this topic across different levels of journals. MD and SC were more frequently published in journals with lower accreditation, suggesting that despite their importance, these topics have not received equal attention in higher-ranked journals.

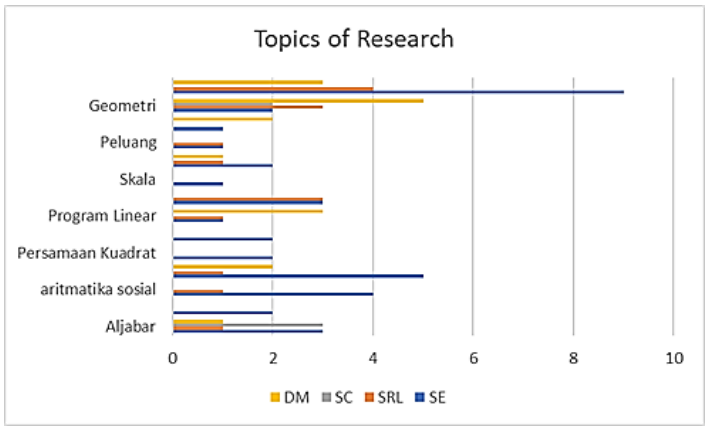

Figure 6. Topics of research

Based on Figure 6, the topic of Geometry has the highest frequency with a dominant contribution from the SE category with nine publications, followed by MD and SRL with almost equal numbers. The Linear Program topic shows a more even distribution between SRL and SE, indicating attention to self-regulation and self-efficacy in mathematical problem-solving. In contrast, topics such as Chance and Scale have a lower frequency with a predominance of contributions to the SE and MD categories, while the SC aspect is still minimally explored. The topic of Social Arithmetic was prominent in the SE category but relatively low in the other categories, while Quadratic Equations and Algebra showed a more even distribution between categories.

Figure 6 shows the distribution of MPSA-related research topics, with geometry being the most researched topic, particularly in the context of SE and SRL. Geometry-related research more often involves SE, reflecting the need for students to build confidence in solving more abstract mathematical problems. Chance, linear programs and quadratic equations came next, with an emphasis on SC and MD, indicating the importance of decision-making and social influence in the learning of these topics. Meanwhile, topics such as social arithmetic and algebra showed a smaller proportion of research, but still showed significant relationships with SE and SRL, reflecting the importance of aspects of independence and self-efficacy in overcoming basic mathematical challenges. This trend suggests the increasing applicability of affective

aspects, particularly SE and SRL, in more complex materials along with higher levels of education.

What regional and methodological trends exist in the study of affective factors and MPSA

Based on Figure 7, the frequency of SE-related research shows a clear disparity between provinces in Indonesia. The province with the largest contribution is West Java (JaBar) with 24%, followed by East Java (JaTim) with 21%, and Central Java with 11%. Jakarta also has a fairly high percentage, at 8%. Meanwhile, regions such as Maluku, West Papua and North Maluku only contributed 3% each, indicating the low

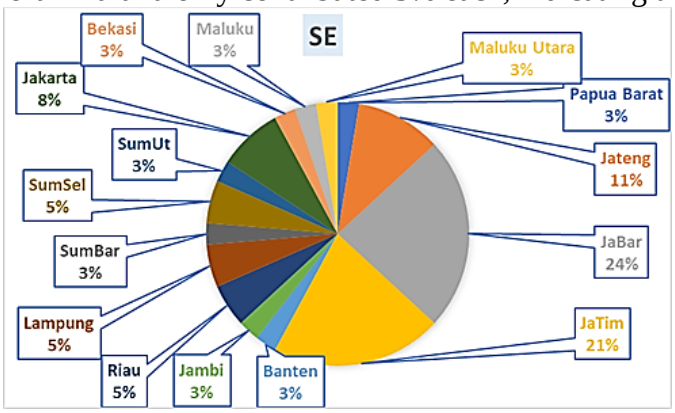

Figure 7. SE study data based on research location

representation of research in these areas. This imbalance most likely reflects the disparity in access to education and research resources between developed regions and more isolated or less developed regions.

Socio-economic factors and local education policies can play a big role in this disparity. In regions with lower economic levels, such as Papua and Maluku, access to adequate educational facilities and research funding is often limited. This can affect the quality and quantity of research conducted in these regions. In addition, education policies that focus more on urban and densely populated areas often overlook the needs of remote areas, hindering the potential for research based on local contexts.

To address this imbalance, it is suggested that collaboration between universities in more and less represented regions is encouraged. Universities in developed areas, such as in Java, could partner with universities in underrepresented areas, such as in Papua or Maluku. This collaboration could include resource sharing, research methodology training and human resource capacity building in these areas, thus enriching the diversity of perspectives and broadening the scope of research related to SE in mathematics learning.

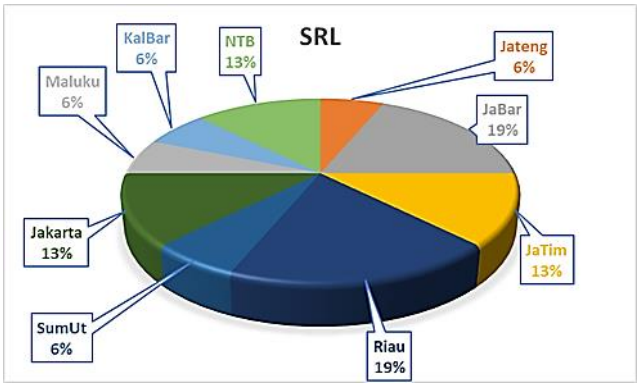

Figure 8. SRL study data based on research location

Based on Figure 8, the distribution of SRL-related research shows that West Java (19%) and Riau (19%) have the highest contribution. This is followed by NTB, Jakarta, and East Java, each with the same percentage of 13%. Meanwhile, Central Java, North Sumatra, West Kalimantan and Maluku contributed less, at 6% each.

While this study was successful in identifying a significant regional distribution of SRL, there are some limitations in the primary study that need to be considered. Most of the studies analyzed used a quantitative approach, which often relies on large samples to obtain more representative results. However, the samples used in some of the primary studies may not be fully representative of the student population at large, given the variability in SRL ability levels that have not been fully identified. In addition, the instruments used in these studies may have limitations in measuring SRL thoroughly and accurately, which may affect the reliability of the findings. Research with poorly validated instruments or discrepancies in measurement may decrease the validity of the results obtained. Therefore, a more critical evaluation of the research design, sample size, and instruments used in the primary research would be helpful to better understand how the results of this study can be generalized and applied in the context of mathematics learning. Future research should pay more attention to the use of more valid and representative instruments, as well as consideration of the risk of bias to improve the quality of the findings in this study.

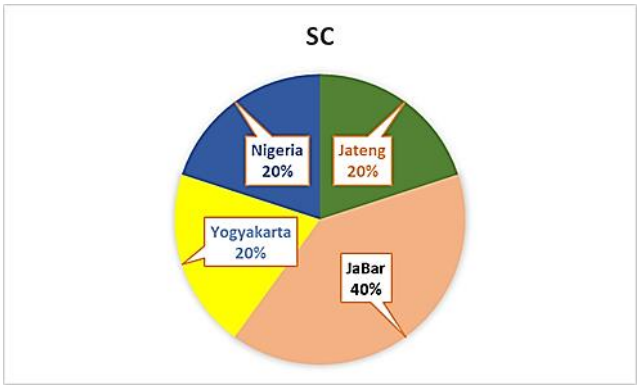

Figure 9. SC study data based on research location

Figure 9 shows the distribution of SC category research contributions across the four regions: West Java (40%), Nigeria, Central Java and Yogyakarta (20% each). The

dominance of West Java indicates a significant role compared to the other regions, while the balanced distribution in the other three regions indicates an even distribution of contributions.

There is limited research on the relationship of SC to MPSA, especially in underrepresented regions. The dominance of West Java in this study may be related to the availability of better facilities and resources, while other regions, such as Nigeria, despite their significant contributions, suggest that different educational contexts may influence this study. The limited number of studies on SC indicates that this aspect still receives less attention compared to other affective aspects, such as SE or SRL. Therefore, it is recommended that research on SC be expanded across different regions, especially in underrepresented areas, to provide a deeper understanding of how SC affects MPSA across different educational contexts.

Figure 10 shows the distribution of MD category contributions from different regions. East Java has the largest share at 35%, followed by West Java at 18% and NTB at 12%. The regions of Central Java, South Sumatra, West Sumatra, Riau, Banten, and

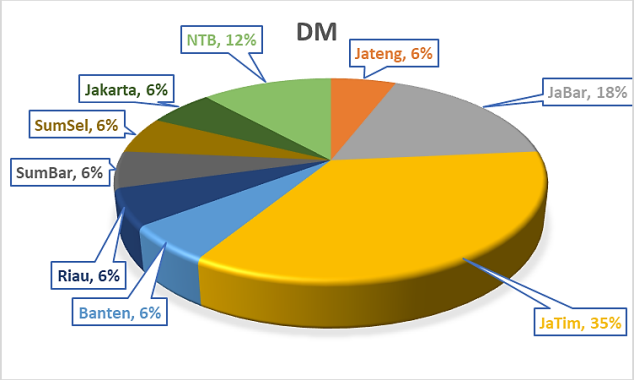

Figure 10. MD study data based on research location

Jakarta each have an exact contribution of 6%, indicating an imbalance in the distribution of research. The dominance of East and West Java reflects the influence of factors such as the availability of research facilities and more supportive education policies. This imbalance indicates the need for more attention to research development in other regions that have smaller contributions, to broaden the understanding of how mathematical dispositions influence MPSA in various educational contexts.

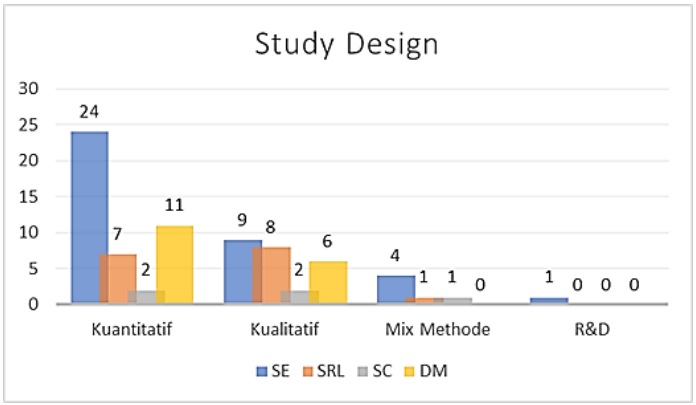

Figure 11. Data studies by study design

Based Figure 11, the total number of studies analyzed in this study was 76, consisting of 44 quantitative studies (58%), 25 qualitative studies (33%), 6 mixed method studies (8%), and 1 R&D study. In the quantitative design, SE was the main focus with 24 studies, followed by MD with 11 studies, SRL with 7 studies, and SC with 2 studies. In qualitative designs, SE received the most attention (9 studies), followed by SRL with 8 studies, MD with 6 studies, and SC with 2 studies. The use of mixed designs was dominated by SE (4 studies), followed by SRL and SC with 1 study each, while MD was not recorded in mixed research. R&D designs were very limited, with only 1 study focusing on SE, while SRL, SC, and MD were not recorded in this design.

The dominance of quantitative approaches suggests that most research focuses on more objective and systematic measurement of the relationship between affective aspects and mathematical problem-solving ability (SME). This approach facilitates the analysis of numerical data and allows for broader generalization of findings. However, a limitation of quantitative approaches is the lack of depth of understanding of the internal processes that occur within students as they interact with mathematics learning, which may be better explained through qualitative or blended approaches. Although qualitative and blended approaches recorded smaller contributions, both methods provided deeper insights into students' experiences, the learning strategies they applied and the contextual factors that influenced their MPSA. The lack of research with an R&D design suggests that more attention needs to be paid to the development of affective aspect-based tools or interventions to improve MPSA. Therefore, future research needs to further explore the use of mixed design and R&D to gain a more comprehensive and applicable understanding.

How can these findings inform holistic pedagogical strategies

Self-Efficacy (SE)

Most studies on Self-Efficacy (SE) show a positive influence on MPSA. In quantitative research, 19 studies showed a significant effect between SE and MPSA, while only 5 studies found no significant effect. In qualitative research, 8 studies found a positive relationship between high SE and high MPSA, suggesting that students who have greater confidence in their ability in mathematics tend to be more successful in solving mathematical problems. On the other hand, only 1 study showed that SE was not positively related to MPSA. In mixed-method research, 4 studies showed a positive relationship and influence between SE and MPSA, while no study showed the opposite result. This emphasizes the importance of developing students' SE in mathematics learning. SE is considered a dominant affective factor in influencing MPSA (Bales & Estomo, 2022). Pedagogical strategies that can be applied include providing positive feedback, creating an environment that supports experimentation with mathematical problems, and providing opportunities for successful experiences that can increase students' self-confidence.

Self-Regulated Learning (SRL)

In research on SRL, findings show a strong relationship with MPSA. In quantitative research, 6 studies showed a significant effect of SRL on MPSA, while 1 study found no significant effect. In qualitative research, 6 studies showed that students who have high

levels of SRL tend to have better MPSA, but 2 studies showed no positive relationship. 1 study used mixed methods, and it showed a positive relationship between SRL and MPSA. No study showed negative results. This confirms that SRL is very important in mathematics learning, which emphasizes the importance of teaching students how to manage their learning independently, set goals, monitor their progress, and correct ineffective strategies (Boon, 2024). In line with the opinion of Yaseen et al., (2023) which states that SRL improves learning strategies, motivation, and learning outcomes. Pedagogical strategies that can be implemented include the use of techniques such as a more purposeful learning approach (setting clear goals, self-reflection, and providing opportunities for students to evaluate their own learning process), as well as the application of scaffolding or metacognitive strategies (Doo et al., 2020).

Self-Concept (SC)

For SC, findings suggest that SC has a more limited influence on MPSA. In the quantitative research, no study showed a significant effect of SC on MPSA, and 2 studies showed that SC had no significant effect. This indicates that SC tends to play less of a direct role than other affective aspects, such as SE or SRL, in line with Julius (2022) study which showed that there was no significant relationship between SC and MPSA. On the qualitative side, 2 studies showed that high SC was associated with better MPSA, indicating that students' beliefs about their abilities in mathematics can influence the way they approach mathematical problems. In mixed-methods research, one study showed a positive relationship between SC and MPSA, while no study showed negative results. Although the findings are limited, this suggests that students' self-concept of their mathematical abilities can improve their performance in problem solving. Therefore, in pedagogical strategies, it is important to create a supportive environment where students feel valued and encouraged to develop their positive self-concept in learning mathematics. However, SC is still important because it affects students' confidence in their identity as mathematical learners, which in turn can have an impact on problem-solving performance. This is reinforced by the research of Fadillah et al. (2018) and Kadir et al. (2020) who stated that SC is essential not only for academic achievement, but also for effective problem solving in educational contexts and everyday life.

Mathematical Disposition (MD)

Research related to Mathematical Disposition (MD) shows that students' mathematical disposition has a significant influence on MPSA. In quantitative research, 5 studies showed a significant effect between MD and MPSA, while 1 study showed no significant effect. In qualitative research, 9 studies showed that high mathematical disposition was associated with better MPSA, while 2 studies showed results that did not support this relationship. Mixed-methods research did not show any results related to MD. These findings suggest that mathematical disposition, which includes students' attitude, interest and motivation towards mathematics, is crucial in supporting their ability to solve problems. This reinforces the importance of learning based on developing positive attitudes towards mathematics to improve the success of MPSA (Fadilah & Hakim, 2022). Therefore, in the context of pedagogical strategies, it is important to focus mathematics teaching on building positive dispositions towards the subject, for example by connecting mathematics to real-world situations and providing challenges that encourage critical

thinking as well as creating a classroom atmosphere that supports students' active engagement.

From these findings, it is clear that SE and MD have a stronger and more consistent influence on students' MPSA. Therefore, holistic pedagogical strategies need to prioritize the development of these two aspects in mathematics learning, taking into account the importance of SRL and SC. An approach based on increasing SE, developing SRL, and building a positive SC will help students feel more confident, more engaged, and more ready to face challenges in learning mathematics. For this reason, teachers must create a supportive environment, provide positive feedback, and provide opportunities for reflection and self-management of the learning process.

▪ CONCLUSION

This study found that affective aspects such as self-efficacy (SE), self-regulated learning (SRL), self-concept (SC), and mathematical disposition (MD) have a significant influence on students' mathematical problem solving ability (MPSA). From the analysis, SE shows the strongest correlation with MPSA, followed by MD. Variability in SC indicates context-dependent influences, while SRL becomes increasingly important with an increase in the level of education, especially at the high school/vocational high school/Islamic high school level. These findings emphasize the importance of integrating affective aspects into mathematics teaching, which can improve students' ability to solve mathematical problems and strengthen their self-concept as confident and independent learners. In addition, this study provides a map of research distribution based on education level, region, and publication trends that can be a reference in designing more effective educational interventions.

The impact of this study on education is that mathematics teaching should place more emphasis on the development of affective aspects such as SE, SRL, and MD, which have been proven to play an important role in improving students' problem-solving abilities. Holistic interventions that cover these four aspects must be applied to support students' cognitive and affective development. However, this study also has limitations, including the lack of critical assessment tools and no statistical testing. Further research can be done by focusing on each research approach, such as a qualitative approach conducting a meta-synthesis study, and a quantitative approach conducting a meta-analysis study.

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