JPPIPA 12(1) (2026)

Jurnal Penelitian Pendidikan IPA

http://jppipa.unram.ac.id/index.php/jppipa/index

The Effect of Self-Efficacy on Academic Achievement and Learning Engagement: A Systematic Literature Review

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Received: August 20, 2025
Revised: December 13, 2025
Accepted: January 15, 2026
Published: January 31, 2026

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DOI: 10.29303/jppipa.v12i1.12609

Abstract: Academic self-efficacy is a critical psychological construct consistently linked to student success. However, the extensive body of research is fragmented, necessitating a systematic synthesis to understand the key factors, outcomes, and underlying mechanisms associated with student's self-efficacy. The purpose of this systematic literature review is to synthesize and evaluate the current evidence on the effect of self-efficacy on academic achievement and learning engagement. Following the PRISMA guidelines, a comprehensive search was conducted across Science Direct database. The review synthesized findings from 25 articles, focusing on empirical studies that examined the antecedents and consequences of self-efficacy in relation to academic outcomes. The findings reveal that self-efficacy serves as a significant predictor of academic achievement and learning engagement. Results indicate that students with high self-efficacy demonstrate greater persistence, set more ambitious goals, and exhibit higher resilience in challenging subjects. The discussion highlights that this relationship is mediated by both social support and cognitive engagement strategies. In conclusion, developing self-efficacy is essential for optimizing educational outcomes.

Keywords: Academic achievement; Learning engagement; PRISMA; Self-efficacy; Systematic literature review

Introduction

Academic achievement represents performance outcomes that indicate the extent to which a person has accomplished specific goals that were the focus of activities in instructional environments, specifically in school, college, and university (Steinmayr et al., 2014). Academic achievement has long been a focal point of scholarly inquiry (Tao et al., 2022). Research evidence shows that students' behavior and academic achievement are directly influenced by the beliefs they have about themselves and about their academic potential (Pajares & Schunk, 2002).

Learning engagement refers to students' psychological state of activity that affords them to feel activated, exert effort, and be absorbed during learning activities (Wong & Liem, 2022). Learning engagement represents a multidimensional construct that integrates cognitive, emotional, and behavioral involvement, reflected through a student's persistence, concentration, and strategic approach to problem-solving during the instructional process (Miao et al., 2025). Previous research has indicated that there was a positive correlation of all facets of student engagement (overall, behavioral, emotional, and cognitive) with academic achievement (Lei et al., 2018). According to Luo, Chen, Yu, & Zhang (2023) learning engagement can significantly predict academic performance and, compared with academic self-efficacy, tends to be more directly and stably linked to academic achievement.

An individual's belief in their capabilities 'to organize and execute the courses of action required to produce given attainments', is termed self-efficacy (Bandura, 1997). Self-efficacy is considered one of the most crucial elements within motivational theory. Individuals tend to be more motivated to undertake a specific action when they perceive they have the capability to perform it successfully. Woolfolk (2023) explain that self-efficacy refers to an individual's knowledge of their own ability to complete a particular

How to Cite:
Primawati, R. I., Wiji, W., & Mulyani, S. (2026). The Effect of Self-Efficacy on Academic Achievement and Learning Engagement: A Systematic Literature Review. *Jurnal Penelitian Pendidikan IPA*, *12*(1), 1–11. https://doi.org/10.29303/jppipa.v12i1.12609

task without the need to compare it with the abilities of others. Bandura (1997) identified four sources of self-efficacy expectations: 1) mastery experiences, which involve achieving goals through direct action; 2) physiological and affective states, which are physical and physiological reactions that cause a person to feel alert, stressed, anxious, or tense; 3) vicarious experiences, which occur through observing a model (or oneself) successfully completing a task; and 4) social persuasion, which consists of messages from others and tends to influence self-efficacy differently based on the content of the feedback and the standing of the person providing it. Prospective students demonstrated high academic self-efficacy, reporting strong confidence in their ability to successfully perform essential tasks such as notetaking and concentration (Fokkens-Bruinsma et al., 2021). According to Bandura (2010) an individual with high self-efficacy is capable of managing unpleasant emotional states by inducing relaxation, redirecting attention to pleasant matters, self-soothing, and seeking support from those closest to them, thereby enabling them to cope with anxiety and sadness.

Self-efficacy is explicitly mentioned within the forethought phase. This phase involves the analysis of a learning task, setting goals, and creating a plan to achieve them, which includes planning strategy use and activating motivational beliefs such as self-efficacy regarding the likely outcomes of performing the task at hand (Graham, 2022). In the performance phase, students execute tasks while monitoring their engagement, followed by a self-reflection phase where evaluating outcomes shapes future self-efficacy and reinforces their agency in achieving academic success (Graham et al., 2020).

This is supported by research from Ferrell and Barbera (2015), which indicates that university students with high self-efficacy tend to exhibit better performance. This result aligns with prior research demonstrating that if the students have a strong sense of research self efficacy, they are more likely to invest more time and energy in study and research, and obtain higher academic achievement through sustained engagement and perseverance (Miao et al., 2025). This also aligns with the findings of Avargil (2019), who reported that an improvement in the understanding of chemistry corresponds with an increase in self-efficacy. Another study found that self-efficacy and academic resilience sequentially mediate the relationship between peer relationships and learning engagement (Shao & Kang, 2022). High self-efficacy encourages students to engage more actively in learning, utilize higher-order thinking strategies, and ultimately achieve a better conceptual understanding. Self-efficacy is a key factor influencing success in a learning environment, as it can serve as a motivation for students to learn and to solve the problems they are given (Van Gasse et al., 2020). A study by Shamdas (2023) also found that strong academic self-efficacy significantly drives achievement among pre-service teachers by fostering the confidence required to solve complex academic challenges.

Although many studies are carried out to explore factors affecting students' academic achievement, the evidence connecting self-efficacy with academic achievement and learning engagement is vast and fragmented. Studies are spread across various disciplines, educational levels (secondary and higher education), and specific learning contexts. This fragmentation makes it challenging for educators and researchers to gain a clear, consolidated understanding of the overall effect. While numerous individual studies exist, there is a need for a comprehensive synthesis that rigorously evaluates and integrates these findings.

Systematic literature review (SLR) is a systematic way of collecting, critically evaluating, integrating, and presenting findings from across multiple research studies on a research question or topic of interest. SLR provides a way to assess the quality level and magnitude of existing evidence on a question or topic of interest (Pati & Lorusso, 2018). This review will contribute to the existing knowledge by providing a clear, evidence-based overview of the relationship between self-efficacy, academic achievement, and learning engagement, specifically within the critical developmental stages of adolescence and young adulthood.

Therefore, the primary objective of this systematic literature review is to synthesize and evaluate the current evidence on the effect of self-efficacy on academic achievement and learning engagement. Specifically, this review aims to:

1. Identify and summarize the effects of self-efficacy on academic achievement.
2. Synthesize the findings regarding the relationship between self-efficacy and various dimensions of learning engagement.
3. Identify existing gaps in the literature to provide clear directions for future research.

To achieve these objectives, this review will be guided by the following research questions (RQs):

1. What do the results of research findings suggest about the relationship between self-efficacy and academic achievement?
2. How does self-efficacy influence students' learning engagement in the classroom?
3. What factors are shown to influence students' academic self-efficacy?
4. How is the relationship between academic self-efficacy and students' psychological well-being?
5. How does academic self-efficacy mediate the relationship between antecedent factors and student learning outcomes?

Method

This systematic literature review was conducted by following the reporting checklist of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (Liberati et al., 2009). The goal of the guideline is to make it easier to conduct a meticulously planned and documented systematic literature review in a way that supports review articles' integrity, consistency, and accountability. Additionally, the protocol for the study comprises selecting the data sources, search terms, and inclusion criteria.

We utilized Science Direct as web-based database. This database was chosen for its extensive collection of high-impact, efficiently find trusted, latest discoveries in sciencee, and relevant to the research topic. More specifically, all the papers published since 2020 until in the middle of June 2025 in subject areas: social sciences, psychology, computer science, and decision sciences. We only include research article and book chapter for article type. Review articles were excluded.

Studies were included in this review if they met the following inclusion criteria: (a) published in English; (b) were peer-reviewed journal articles; (c) involved high school or university students as the primary population; (d) examined either the factors that influence academic self-efficacy, or the relationship between self-efficacy and learning-related processes and outcomes (e.g., achievement, engagement, self-regulation); (e) For studies involving high school students, the research context was limited to science subjects (e.g., Chemistry, Biology, Physics) or STEM fields; and (f) were empirical studies. We also type in column find articles with these terms: ("academic self efficacy") AND ("high school" OR "university") AND (science OR chemistry) AND ("academic performance" OR "motivation") AND (factor OR strategy). The last search was run on 16th June 2025.

The title, abstract, keywords, authors' names and affiliations, journal name, and year of publication of the identified records were exported to an MS Excel spreadsheet. The study selection process was conducted in two distinct phases. In the first phase, titles and abstracts of the identified records were screened independently. Articles that clearly did not meet the inclusion criteria were excluded at this stage. Subsequently, in the second phase, a full-text eligibility assessment was performed on the remaining articles. The MS Excel spreadsheet was modified by adding the items for which data were sought for data management such as findings or summary of results.

The PRISMA flow diagram for the current study selection process is illustrated in Figure 1. The initial search yielded 285 records in the database systems. After initial screening, 88 articles were excluded as they were not high school or university students. The full texts of the remaining 37 article were carefully screened and 12 article were excluded, as they did not meet the eligibility criteria. Finally, 25 articles were found to meet all inclusion criteria and were included in the final synthesis.

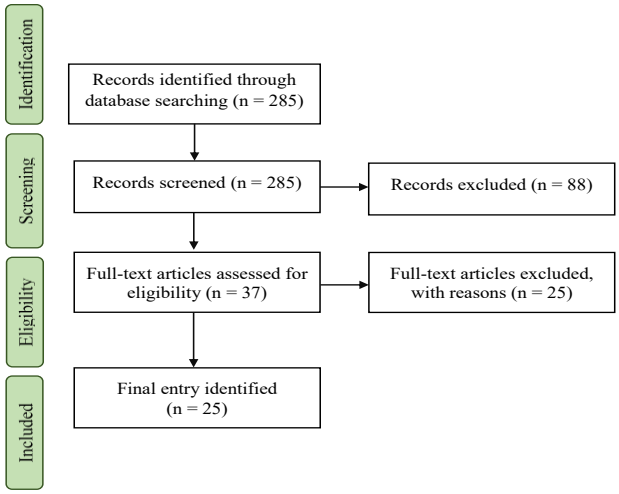

Figure 1. Flow chart of article selection process

Result and Discussion

Based on the searching technique, 25 articles were extracted and analyzed. All articles were categorized based on 5 main themes, which are effect of self efficacy in academic achievement (9 articles), self-efficacy in influence students' learning engagement (6 articles), factors that influence self-efficacy (8 articles), self-efficacy and students' psychological well-being (3 articles), and self-efficacy as mediator (4 articles). To answer the five objectives, all the findings were analyzed and synthesized. It should be noted that some articles contributed findings to more than one theme. Table 1 shows the summary of the included articles based on name of researcher, year of publication, research methods, and findings.

Table 1. Profile of included articles

Author (Year)	Research Methods	Purpose	Findings
Shaikh, Alsharief, Amin, Noordin, & Shaikh (2023)	Quantitative Survey	The purpose of the study is to examine university students' academic performance.	The factors that tend to have bearing on self-efficacy are teacher feedback, collaborative learning and perceived digital environment. Among all the determinants for university

Author (Year)	Research Methods	Purpose	Findings
			students' design self-efficacy, the most significant factor is collaborative learning.
Huang, Bernacki, Kim, Hong (2022)	Quantitave Correlation	The purpose of this study was to employ variable centered and person centered approaches to examine the role that self-efficacy and metacognitive monitoring behaviors in learning achievement	Self-efficacy and metacognitive monitoring behavior each predicted performance, and that their interaction revealed greater benefits of metacognitive monitoring behavior for those with lower levels of self-efficacy.
Trautner and Schwinger (2022)	Quantitative Survey	To investigate whether the relationship between incremental theories about motivation and the use of regulation strategies is mediated by self-efficacy for motivation regulation	Extrinsic motivation for studying were related to stronger self-efficacy beliefs for motivation regulation. Learners who believe that extrinsic motivation for studying is malleable had significantly more confidence in their own abilities to motivate themselves to study
Hitches, Woodcock, Ehrich (2022)	Quantitative Survey	This study examined the stress and academic self-efficacy levels of university students	Students who had higher self-efficacy in academic related tasks, reported lower levels of stress in relation to these tasks.
Cheng, Xie, Collier (2023)	Quantitave Correlation	The purpose of this study was to examine the relations between academic delay, motivational beliefs, and academic achievement in an online science course.	The relation between with person academic delay and academic achievement was significantly moderated by academic self-efficacy. When academic self-efficacy was at or below the mean level, the relation between within-person academic delay and academic achievement was significantly negative.
Dai (2024)	Quantitative Survey	Explore the influence mechanism of mindful agency	Mindful agency enhances students' self-efficacy in facing the challenges of online learning. This heightened self-confidence encourages them to be more actively engaged, which in turn leads to them achieving their learning goals more frequently.
Robinson, Lee, Friedman, Christiaans, McKeague, Pavelka, Sirjoosingh (2022)	Mixed Method	Examined trajectories of expectancy for success and attainment value in introductory chemistry courses	Self-efficacy is a dynamic construct that can be effectively supported through specific teaching practices. Instructors who are warm, approachable, and who design assessments as learning tools, as well as emphasize the importance of effort, can significantly help students maintain or even enhance their self-efficacy in the learning process within a chemistry classroom.
Mou (2024)	Mixed Method Explanatory Sequential Design	This study investigated design students' self-efficacy and motivation	Students with higher levels of creative self-efficacy are more inclined to engage in creative tasks and demonstrate perseverance when confronted with challenges
Tasgin and Dilek (2023)	Quantitave Correlation	Examines whether critical thinking dispositions significantly mediate self-efficacy and problem solving skills	High self-efficacy improves critical thinking competence and facilitates individuals to be more successful and motivate
Sun, Liu, Oei, Zhen, Ding, & Jiang (2020)	Quantitave Correlation	The study investigated the association of perceived parental warmth with math engagement	When parents are warm and loving to their children (relatedness), they are more likely to provide concreate support and encourage children's efforts in learning as well (competence). Thus, the satisfaction of children's need for competence promotes academic self-efficacy in challenging subjects such as math.
Abaszadeh, Amani, and Pordanjani (2024)	Quantitave Correlation	Investigate the relationship between motivational cognitive variables and academic self-efficacy	Motivational-cognitive variables (intelligence beliefs, task value, and achievement goals) have a positive and significant relationship with students' academic self-efficacy.

Author (Year)	Research Methods	Purpose	Findings
Azila-Gbettor, Mensah, Abiemo (2022)	Quantitative Survey	Examined the effect of self-efficacy on academic programme satisfaction through the meaningfulness of studies	Students who are confident in their ability and maintain a positive attitude are more satisfied with the academic programme they enrolled in. Students' feelings of self-efficacy play a role in fostering a higher perception of studies as important and valuable
Wang, Cao, Gong, Wang, Li, Ai (2022)	Quantitative Survey	Examine the mediating roles of self-efficacy and academic emotions in the relationship between interaction and learning engagement	Interaction affects self-efficacy, self-efficacy in turn affects emotions, and these emotions are what ultimately influence learning engagement
Tang, Fan, Zou, George, Arbona, & Olvera (2021)	Quantitative Survey	Examine the linking roles of students' self-efficacy and achievement emotions	Higher self-efficacy encourages students to have greater persistence in learning, even when facing difficulties
Han, Usher, and Brown (2021)	Quantitative Survey	Explore relationship between self-efficacy and academic achievement	Increased self-efficacy can lead to better academic achievement.
Ba, Ming, and Zhang (2025)	Quantitative Survey	Investigates how growth mindset interventions, including internal and external subscales, affect academic performance	Although growth mindsets do not directly affect academic performance, their impact is mediated by self-efficacy and effort regulation, emphasizing the significance of psychological elements in academic achievement.
Hanham, Lee, and Teo (2021)	Quantitative Survey	To capture relationships with the students' perceptions of their academic capabilities and academic performance	Academic self-efficacy is positively related to academic achievement. The more students feel capable of understanding, analyzing, breaking down, and applying the concepts being taught, the more likely they are to get higher grades on assignments
Martin, Ginns, and Collie (2023)	Quantitative Survey	Fluid reasoning (resource) in university students' self-efficacy (motivation)	Self-efficacy significantly predicted higher engagement (participation, aspirations, enjoyment) and lower disengagement
Kryshko, Fleischer, Grunschel, Leutner (2022)	Quantitative Survey	To examine the relationship between self-efficacy for motivational regulation and satisfaction with academic studies	A positive relationship between self-efficacy for motivational regulation and satisfaction with academic studies
Zhao, Zeng, Deng (2024)	Quantitave Correlation	Explored the interconnection between career and academic progress	A positive correlation was observed between students' career development trajectory and their academic engagement; those demonstrating progress showed enhanced academic motivation and self-efficacy, whereas those with a decline exhibited a parallel decrease
Zeng, He, LiLiang, Zhang, Yi, & Quan (2022)	Quantitative Survey	Examined the role of career adaptability and academic self-efficacy	High academic self-efficacy leads students to be more successful in their academic performance and career development, which in turn enhances their satisfaction in life.
Heo, Bonk, and Doo (2022)	Quantitative Survey	Examined the structural relationships among self-efficacy, resource management, and learning engagement	Learners who believe in their own capabilities (high self-efficacy) are more assured that they can master tasks and problems. For the depressed group, self-efficacy did not appear to have a direct impact on their learning engagement, instead self-efficacy indirectly influenced learning engagement through resource management
Trautner and Schwinger (2020)	Quantitative Survey	Explored the concept of self-efficacy for motivation regulation	An individual's self-efficacy for motivation regulation is linked to a greater willingness to exert academic effort, especially when facing difficulties. Moreover, self-efficacy promotes a more frequent application of motivation regulation strategies, which subsequently contributes to an increase in effort expenditure

Author (Year)	Research Methods	Purpose	Findings
Xiaoying, Baharom, & Razak (2024)	Quantitative Survey	Developed a mediation model consisting of behavioral cultural intelligence, academic self-efficacy, and academic adaptation	High self-efficacy empowers students to reframe academic challenges as growth opportunities, enabling them to fully engage, overcome obstacles, and actively seek greater involvement through class discussions and project leadership
Datu and Yuen (2020)	Quantitave Correlation	Examine the associations of connectedness with academic self-efficacy and career development	Gratitude significantly mediates the relationship between connectedness to parents and peers and all domains of academic self-efficacy. This means that positive relationships with parents and peers enhance gratitude, which subsequently boosts students' confidence in their academic abilities.

RQ1: What do the results of research findings suggest about the relationship between self-efficacy and academic achievement?

A study by Robinson et al. (2022) identified four distinct groups of students based on their patterns of change in self-efficacy and attainment value over one semester. These groups were designated as increasingly confident chemists, high and stable confident chemists, moderately confident chemists, and confident non-chemists. Initial analyses revealed that students' final grades had the strongest positive correlation with their self-efficacy at three different time points during the semester. This suggests that the higher the students' self-efficacy, the higher their final grades. Students classified in the high and stable confident chemists group achieved the highest final grades compared to all other groups. This group was defined as students with high and stable levels of self-efficacy and attainment value throughout the semester. For example, Trautner & Schwinger (2020) found that self-efficacy enhances a student's effort expenditure, and this higher effort is what subsequently leads to better grades. According to Huang et al. (2022) self-efficacy plays a complex and crucial role in science learning. Its role is not only as a direct predictor of achievement, but it also dynamically interacts with students' learning behaviors, therefore self-efficacy is accurate in predicting final exam scores. However, Cheng et al. (2023) study have found the academic procrastination and academic achievement are significantly influenced by self-efficacy; that is, how an individual's postponement of tasks over time affects their performance is highly dependent on their confidence in their academic abilities.

Research conducted by Han, Usher, and Brown (2021) indicates that only self-efficacy related to quantitative abilities (mathematics and science), not humanities, can predict first-year Grade Point Average (GPA). Both the students' initial level of quantitative self-efficacy upon entering college and the growth rate of this confidence during the first year significantly predict their academic achievement. This demonstrates that students' beliefs are partly responsible for their academic outcomes. Student's perceived ability to comprehend, analyze, deconstruct, and applying concepts taught in their unit of study, the more likely they were to score a higher grade for their assignments. Consequently, the more capable students feel in these cognitive skills, the more likely they will produce high-quality written assignments (Hanham et al., 2021).

Another study found that both growth internal and external mindsets have a considerable effect on self-efficacy, which positively impacts academic achievement, these findings emphasize the importance of developing self-efficacy as a crucial strategy to enhance academic achievement, as it moderates the relationship between mindset and performance (Ba et al., 2025). Students' sense of self-efficacy can encourage them to perceive their studies as important and valuable, making self-efficacy a useful initial factor for predicting the extent to which students find their studies meaningful (Azila-Gbettor et al., 2022). Research conducted by Zeng et al. (2022) shows that greater career adaptability are positively related to higher academic self-efficacy. Career adaptability acts as a vital bridge connecting a student's personal hope and future goals to their academic self-efficacy. High academic self-efficacy then becomes the foundation for achieving academic and professional success, which is directly linked to an enhanced sense of overall life satisfaction.

RQ2: How does self-efficacy influence students' learning engagement in the classroom?

Students with higher self-efficacy show increased participation, greater aspirations, and higher levels of enjoyment in their studies (Martin et al., 2023). When learners have a high level of self-efficacy, they can be more confident and self-assured that the learning tasks and problems can be adequately mastered. Self-efficacy also indirectly enhances learning engagement through resource management abilities such as managing time, environment, and effort (Heo et al., 2022). Having a strong sense of academic self-efficacy fundamentally changes how students perceive difficulties, transforming them from intimidating barriers into

valuable chances for personal and academic growth. This shift in mindset is especially crucial for international junior college students in the unique educational and cultural context of Guangxi, where they must navigate both high academic standards and cultural complexities. When these students are confident in their ability to manage academic challenges, they are more inclined to tackle demanding work, exert effort, and persist through obstacles. They don't view academic responsibilities as insurmountable obstacles but rather as opportunities for growth and learning (Xiaoying et al., 2024). Another study found that students with higher levels of creative self-efficacy are more inclined to engage in creative tasks and demonstrate perseverance, even when encountering difficulties. Although some of students struggled with visual representation, they persisted in seeking an appropriate solution and persist in completing the project (Mou, 2024).

Interaction with content and peers enhances self-efficacy, which in turn is a crucial factor in promoting greater learning engagement. This increase in self-efficacy, gained through experience and feedback from interaction, subsequently drives higher levels of student engagement (Wang et al., 2022). For example, Dai (2024)

found that increasing self-efficacy in e-learning could encourage students to engage more actively in their studies because students with a high sense of self-efficacy are more inclined to participate actively, exert greater effort, and develop their own learning strategies. As a result, there would be more opportunities for students to achieve their learning objectives, and the accomplishment of learning goals would encourage students to have a positive evaluation.

RQ3: What factors are shown to influence students' academic self-efficacy?)

Self-efficacy is influenced by internal factors, namely motivational-cognitive variables, and external factors, which encompass the environment. Motivational-cognitive variables such as intelligence beliefs, task value, and achievement goals have been proven to have a positive and significant relationship with academic self-efficacy. Students who believe that intelligence can be developed (incremental intelligence) tend to have higher academic self-efficacy. Environmental factors significantly mediate the relationship between motivational-cognitive variables and academic self-efficacy. Teacher-student interaction, mother-child interaction, and parents' educational expectations all play significant mediating roles (Abaszadeh et al., 2024).

When parents show warmth and affection towards their children, they are more inclined to offer practical support and foster their children's learning efforts (competence). Consequently, fulfilling a child's need for competence boosts their academic self-efficacy in difficult subjects (Sun et al., 2020). There is a positive association between connectedness to parents and subsequent gratitude. This gratitude, in turn, enhances self-efficacy in academic and career domains. For instance, when parents successfully achieve career goals, children may be inspired to pursue their own interests. Connectedness with peers also increases various dimensions of academic self-efficacy, such as investment in learning and time management, through the mediating role of gratitude. A surprising finding was the non-significant relationship between connectedness to teachers and schools with gratitude and self-efficacy outcomes. This is possibly because students may feel pressured by academic demands from teachers (Datu & Yuen, 2020). However, another study has found students' belief that extrinsic motivation is malleable is related to stronger self-efficacy for their own motivation regulation. This belief, in turn, indirectly encourages them to use motivation regulation strategies more frequently and exert greater effort in their studies. This relationship is specific to beliefs about extrinsic, not intrinsic, motivation , although the pattern becomes more nuanced when analyzed at the level of individual strategies (Trautner & Schwinger, 2022).

In addition, findings have shown that self-efficacy is influenced by several factors. For example, verbal feedback from more expert/knowledgeable others can contribute to learners' perceptions of mastery. Online mentoring services provide these benefits through instructional feedback to students. This feedback can be categorized as "verbal persuasion," which is one of the key sources for the formation of self-efficacy (Hanham et al., 2021). Another study found the factors that tend to have bearing on self-efficacy are teacher feedback, collaborative learning and perceived digital environment, but the most significant factor is collaborative learning. The more frequently students collaborate in groups to solve problems, complete projects, or achieve common goals, the higher their design self-efficacy becomes (Shaikh et al., 2023). The status of career development serves as a significant moderator in the relationship between career action and academic self-efficacy, students demonstrating an upward trajectory in career development displayed higher levels of academic motivation and academic self-efficacy (Zhao et al., 2024).

This study of general and organic chemistry students identified several factors influencing self-efficacy: instructor warmth and approachability, assessment styles, an emphasis on effort and learning strategies, the availability of support resources, and the real-world relevance of the material. Assessments like practice problems and exams were perceived as opportunities to monitor and improve understanding,

rather than as mere demonstrations of competence. Similarly, the utilization of support resources such as tutorials, tutors, and teaching assistants was framed as a desire to learn, not an indication of inability. By learning the importance of effort and strategy, students understand that hard work yields results, fostering the belief that "I can do this". Connecting course content to real life is important for promoting attainment value for chemistry, whereas instructors' warmth and approachability may be particularly important for supporting students' expectancy for success (Robinson et al., 2022).

RQ4: How is the relationship between academic self-efficacy and students' psychological well-being?

Academic self-efficacy and stress respectively predict a student's success at university, which is measured through their academic achievement and their satisfaction with life. Students who had higher self-efficacy in academic-related tasks, reported lower levels of stress in relation to these tasks. When students are confident in their capabilities, they may consider stressors or demands as challenges, instead of threats, decreasing the stress experienced in response (Hitches et al., 2022). Research in two studies with STEM undergraduates, one being cross-sectional and the other involving two measurement points found that consistently showed a positive correlation between self-efficacy for motivational regulation and satisfaction with both study content and the ability to cope with academic stress (Kryshko et al., 2022). The influence of time and study environment management on learning engagement was found to be significantly larger for the depressed group compared to the non-depressed group. Therefore, these findings indicate a need for instructors to provide targeted support to students with moderate-to-higher depression, focusing on improving their management of time and study environments to boost learning engagement (Heo et al., 2022).

RQ5: How does academic self-efficacy mediate the relationship between antecedent factors and student learning outcomes?

Student's self-efficacy is a significant predictor of their problem-solving abilities. This is attributed to the tendency of highly self-efficacious individuals to persistently and decisively tackle problems until they achieve success. Such individuals are also more likely to engage in critical thinking, which boosts their motivation and competence. The connection between self-efficacy and problem-solving skills is significantly mediated by the student's disposition for critical thinking (Tasgin & Dilek, 2023).

There are significant mediation exists between learning climate, self-efficacy and learning persistence. Students who experience greater autonomy support from their teachers report higher levels of self-efficacy, which subsequently predicts greater persistence in their learning. Furthermore, when the learning environment is perceived as more supportive, students not only gain more confidence but also experience less anxiety and more enjoyment. This pathway, where a supportive climate fosters confidence that then reduces anxiety, is another mechanism that ultimately encourages students to persist in their learning (Tang et al., 2021).

Academic self-efficacy significantly mediates the relationship between behavioral cultural intelligence and academic adaptation. When international junior college students effectively navigate diverse cultural settings, it enhances their confidence in their own academic abilities. This newfound confidence is what then makes it easier for them to adapt academically. This process occurs because culturally intelligent behaviors lead to successful mastery experiences, like excelling in group projects, and positive social persuasion, such as receiving praise from peers and faculty, both of which strengthen a student's academic self-efficacy (Xiaoying et al., 2024).

Learner-learner and learner-content interactions are linked to learning engagement, with a focus on the mediating roles of self-efficacy and academic emotions. The findings indicate that self-efficacy is a direct mediator. Moreover, the results support a serial mediation model where both self-efficacy and the emotions of enjoyment and boredom sequentially connect online interactions to learning engagement. When students engaged in interaction with peers and content, they can express and share ideas with others and gain a deeper construct of what they are learning, thus enhancing confidence in completing learning tasks (Wang et al., 2022).

Conclusion

Self-efficacy is a critical psychological construct fundamentally linked to educational success, particularly in demanding fields such as STEM. By influencing goal-setting, effort, and resilience, self-efficacy enables students to attain higher grades and navigate academic setbacks effectively. Moreover, as a primary driver of learning engagement, self-efficacy empowers students to participate actively in the instructional process. Therefore, developing self-efficacy is a critical factor in enhancing educational outcomes, as it facilitates the motivation and engagement required for academic achievement.

Acknowledgments

The researcher would like to thank all parties who have supported the research of this article, especially Prof. Dr. Wiji,

M.Si and Dr. Sri Mulyani who have provided support, input, facilities and opportunities in completing this article.

Author Contributions
Conceptualization, methodology, formal analysis, investigation, writing—review and editing, R.I.P, W.W, and S.M.; software, resources, data curation, writing—original draft preparation, R.I.P. All authors have read and agreed to the published version of the manuscript.

Funding
Researchers independently funded this research

Conflicts of Interest
The authors declare no conflict of interest

References

Abaszadeh, H., Amani, M., & Pordanjani, T. R. (2024). The relationship between motivational-cognitive variables, academic self-efficacy of students mediated by parent's educational expectations, parent-child interaction, and teacher-student interaction. *Learning and Motivation*, *86*. https://doi.org/10.1016/j.lmot.2024.101983

Avargil, S. (2019). Learning Chemistry: Self-Efficacy, Chemical Understanding, and Graphing Skills. *Journal of Science Education and Technology*, *28*(4), 285–298. https://doi.org/10.1007/s10956-018-9765-x

Azila-Gbettor, E. M., Mensah, C., & Abiemo, M. K. (2022). Self-efficacy and academic programme satisfaction: mediating effect of meaningfulness of study. *International Journal of Educational Management*, *36*(3), 261–276. https://doi.org/10.1108/IJEM-09-2021-0353

Bandura, A. (1997). Self-efficacy: The exercise of control. In *Self-efficacy: The exercise of control.* W H Freeman/Times Books/ Henry Holt & Co.

Bandura, A. (2010). Self-efficacy. The Corsini encyclopedia of psychology. Hoboken. *New Jersey: John Wiley & Sons*, *4*, 1534–1536.

Ba, Y., Ming, W., & Zhang, H. (2025). Unlocking academic success: How growth mindset interventions enhance student performance through self-belief and effort regulation. *Acta Psychologica*, *256*. https://doi.org/10.1016/j.actpsy.2025.104977

Cheng, S., Xie, K., & Collier, J. (2023). Motivational beliefs moderate the relation between academic delay and academic achievement in online learning environments. *Computers and Education*, *195*. https://doi.org/10.1016/j.compedu.2023.104724

Dai, X. (2024). A study on mindful agency's influence on college students' engagement with online teaching: The mediating roles of e-learning self-efficacy and self-regulation. *Acta Psychologica*, *243*. https://doi.org/10.1016/j.actpsy.2024.104146

Datu, J. A. D., & Yuen, M. (2020). Students' connectedness is linked to higher gratitude and self-efficacy outcomes. *Children and Youth Services Review*, *116*. https://doi.org/10.1016/j.childyouth.2020.105210

Ferrell, B., & Barbera, J. (2015). Analysis of students' self-efficacy, interest, and effort beliefs in general chemistry. *Chemistry Education Research and Practice*, *16*(2), 318–337. https://doi.org/10.1039/c4rp00152d

Fokkens-Bruinsma, M., Vermue, C., Deinum, J. F., & van Rooij, E. (2021). First-year academic achievement: the role of academic self-efficacy, self-regulated learning and beyond classroom engagement. *Assessment and Evaluation in Higher Education*, *46*(7), 1115–1126. https://doi.org/10.1080/02602938.2020.1845606

Graham, S. (2022). Self-efficacy and language learning–what it is and what it isn't. *Language Learning Journal*, *50*(2), 186–207. https://doi.org/10.1080/09571736.2022.2045679

Graham, S., Woore, R., Porter, A., Courtney, L., & Savory, C. (2020). Navigating the Challenges of L2 Reading: Self-Efficacy, Self-Regulatory Reading Strategies, and Learner Profiles. *Modern Language Journal*, *104*(4), 693–714. https://doi.org/10.1111/modl.12670

Hanham, J., Lee, C. B., & Teo, T. (2021). The influence of technology acceptance, academic self-efficacy, and gender on academic achievement through online tutoring. *Computers and Education*, *172*. https://doi.org/10.1016/j.compedu.2021.104252

Han, J., Usher, E. L., & Brown, C. S. (2021). Trajectories in quantitative and humanities self-efficacy during the first year of college. *Learning and Individual Differences*, *91*. https://doi.org/10.1016/j.lindif.2021.102054

Heo, H., Bonk, C. J., & Doo, M. Y. (2022). Influences of depression, self-efficacy, and resource management on learning engagement in blended learning during COVID-19. *Internet and Higher Education*, *54*. https://doi.org/10.1016/j.iheduc.2022.100856

Hitches, E., Woodcock, S., & Ehrich, J. (2022). Building self-efficacy without letting stress knock it down: Stress and academic self-efficacy of university students. *International Journal of Educational Research Open*, *3*. https://doi.org/10.1016/j.ijedro.2022.100124

Huang, X., Bernacki, M. L., Kim, D., & Hong, W. (2022). Examining the role of self-efficacy and online metacognitive monitoring behaviors in

undergraduate life science education. *Learning and Instruction*, *80*. https://doi.org/10.1016/j.learninstruc.2021.101577

Kryshko, O., Fleischer, J., Grunschel, C., & Leutner, D. (2022). Self-efficacy for motivational regulation and satisfaction with academic studies in STEM undergraduates: The mediating role of study motivation. *Learning and Individual Differences*, *93*. https://doi.org/10.1016/j.lindif.2021.102096

Lei, H., Cui, Y., & Zhou, W. (2018). Relationships between student engagement and academic achievement: A meta-analysis. *Social Behavior and Personality*, *46*(3), 517–528. https://doi.org/10.2224/sbp.7054

Liberati, A., Altman, D. G., Tetzlaff, J., Mulrow, C., Gøtzsche, P. C., Ioannidis, J. P. A., Clarke, M., Devereaux, P. J., Kleijnen, J., & Moher, D. (2009). The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate healthcare interventions: explanation and elaboration. *BMJ (Clinical Research Ed.)*, *339*. https://doi.org/10.1136/bmj.b2700

Luo, Q., Chen, L., Yu, D., & Zhang, K. (2023). The Mediating Role of Learning Engagement Between Self-Efficacy and Academic Achievement Among Chinese College Students. *Psychology Research and Behavior Management*, *16*, 1533–1543. https://doi.org/10.2147/PRBM.S401145

Martin, A. J., Ginns, P., & Collie, R. J. (2023). University students in COVID-19 lockdown: The role of adaptability and fluid reasoning in supporting their academic motivation and engagement. *Learning and Instruction*, *83*. https://doi.org/10.1016/j.learninstruc.2022.101712

Miao, H., Guo, R., & Li, M. (2025). The influence of research self-efficacy and learning engagement on Ed.D students' academic achievement. *Frontiers in Psychology*, *16*. https://doi.org/10.3389/fpsyg.2025.1562354

Mou, T. Y. (2024). The practice of visual storytelling in STEM: Influence of creative thinking training on design students' creative self-efficacy and motivation. *Thinking Skills and Creativity*, *51*. https://doi.org/10.1016/j.tsc.2023.101459

Pajares, F., & Schunk, D. H. (2002). *Self and Self-Belief in Psychology and Education: A Historical Perspective*.

Pati, D., & Lorusso, L. N. (2018). How to Write a Systematic Review of the Literature. *Health Environments Research and Design Journal*, *11*(1), 15–30. https://doi.org/10.1177/1937586717747384

Robinson, K. A., Lee, S. Y., Friedman, S., Christiaans, E., McKeague, M., Pavelka, L., & Sirjoosingh, P. (2022). "You know what, I can do this": Heterogeneous joint trajectories of expectancy for success and attainment value in chemistry. *Contemporary Educational Psychology*, *69*. https://doi.org/10.1016/j.cedpsych.2022.102055

Shaikh, I. M., Alsharief, A., Amin, H., Noordin, K., & Shaikh, J. (2023). Inspiring academic confidence in university students: perceived digital experience as a source of self-efficacy. *On the Horizon*, *31*(2), 110–122. https://doi.org/10.1108/OTH-05-2022-0028

Shamdas, G. (2023). Motivation, Self-Efficiency, and Academic Achievement Private Teacher Professional Education Students in Differentiated Learning Courses. *Journal of Education Research and Evaluation*, *7*(4), 729–738. https://doi.org/10.23887/jere.v7i4.62814

Shao, Y., & Kang, S. (2022). The association between peer relationship and learning engagement among adolescents: The chain mediating roles of self-efficacy and academic resilience. *Frontiers in Psychology*, *13*. https://doi.org/10.3389/fpsyg.2022.938756

Steinmayr, R., Meiǹer, A., Weideinger, A. F., & Wirthwein, L. (2014). *Academic achievement*. Oxford University Press Oxford, UK.

Sun, Y., Liu, R. De, Oei, T. P., Zhen, R., Ding, Y., & Jiang, R. (2020). Perceived parental warmth and adolescents' math engagement in China: The mediating roles of need satisfaction and math self-efficacy. *Learning and Individual Differences*, *78*. https://doi.org/10.1016/j.lindif.2020.101837

Tang, D., Fan, W., Zou, Y., George, R. A., Arbona, C., & Olvera, N. E. (2021). Self-efficacy and achievement emotions as mediators between learning climate and learning persistence in college calculus: A sequential mediation analysis. *Learning and Individual Differences*, *92*. https://doi.org/10.1016/j.lindif.2021.102094

Tao, Y., Meng, Y., Gao, Z., & Yang, X. (2022). Perceived teacher support, student engagement, and academic achievement: a meta-analysis. *Educational Psychology*, *42*(4), 401–420. https://doi.org/10.1080/01443410.2022.2033168

Tasgin, A., & Dilek, C. (2023). The mediating role of critical thinking dispositions between secondary school student's self-efficacy and problem-solving skills. *Thinking Skills and Creativity*, *50*. https://doi.org/10.1016/j.tsc.2023.101400

Trautner, M., & Schwinger, M. (2020). Integrating the concepts self-efficacy and motivation regulation: How do self-efficacy beliefs for motivation regulation influence self-regulatory success? *Learning and Individual Differences*, *80*. https://doi.org/10.1016/j.lindif.2020.101890

Trautner, M., & Schwinger, M. (2022). How are incremental theories about studying motivation related to effective motivation regulation? *Learning and Individual Differences*, *100*. https://doi.org/10.1016/j.lindif.2022.102232

Van Gasse, R., Vanlommel, K., Vanhoof, J., & Van Petegem, P. (2020). Teacher interactions in taking action upon pupil learning outcome data: A matter of attitude and self-efficacy? *Teaching and Teacher Education*, *89*. https://doi.org/10.1016/j.tate.2019.102989

Wang, Y., Cao, Y., Gong, S., Wang, Z., Li, N., & Ai, L. (2022). Interaction and learning engagement in online learning: The mediating roles of online learning self-efficacy and academic emotions. *Learning and Individual Differences*, *94*. https://doi.org/10.1016/j.lindif.2022.102128

Wong, Z. Y., & Liem, G. A. D. (2022). Student Engagement: Current State of the Construct, Conceptual Refinement, and Future Research Directions. In *Educational Psychology Review* (Vol. 34, Issue 1, pp. 107–138). Springer. https://doi.org/10.1007/s10648-021-09628-3

Woolfolk, A. (2023). *Educational Pscychology Fifteenth Edition*. Pearson Education, Inc.

Xiaoying, H., Baharom, S., & Razak, N. A. (2024). Behavioral cultural intelligence's role in academic adaptation: mediation by academic self-efficacy using PLS-SEM. *Thinking Skills and Creativity*, *53*. https://doi.org/10.1016/j.tsc.2024.101623

Zeng, Q., He, Y., Li, J., Liang, Z., Zhang, M., Yi, D., & Quan, J. (2022). Hope, future work self and life satisfaction among vocational high school students in China: The roles of career adaptability and academic self-efficacy. *Personality and Individual Differences*, *199*. https://doi.org/10.1016/j.paid.2022.111822

Zhao, Y., Zeng, H., & Deng, X. (2024). Chinese high school students' career development: Associations with academic self-efficacy and motivation. *Journal of Applied Developmental Psychology*, *91*. https://doi.org/10.1016/j.appdev.2023.101629