The correlation of student's motivation and self-concept: A case study in science learning

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Abstract
Although the relationship between student motivation, self-perception, and achievement in science education is well established, there is still a lack of focused studies on these aspects at the lower secondary level, particularly in private school settings where student demographics and learning environments may pose unique challenges. The purpose of this study is to: (1) assess lower secondary students' motivation and self-concept in scientific learning; and (2), using correlational analysis and qualitative feedback, determine ways to improve these aspects. Using a quantitative descriptive survey design, this study assessed 60 grade 7-9 students from a private lower secondary school. The Students' Motivation Toward Science Learning (SMTSL) and adapted Chemistry Self-Concept Inventory (CSCI) measured motivation and self-concept, respectively. Data analysis included mean scores for both variables and Spearman's rank correlation (accounting for Liker-scale ordinality and non-normal distributions). A moderate-high level of motivation (Active learning strategies [ALS]=4.0-4.1 highest, Performance Goal [PG]=2.8-3.1 lowest) and self-concept (Positive Perception of Science Self Concept [PSSC]=3.8-3.9 highest, Mathematic Self-Concept [MSC]=2.9-3.2 lowest) with moderate positive correlation ($r = 0.572$, $p < 0.001$) underscores that self-concept and motivation are interrelated, suggests interventions should simultaneously promote active learning (to enhance ALS) while addressing mathematical confidence (to improve MSC). These findings suggest that teachers can boost engagement through active learning and confidence-building strategies, while school and policymakers should design targeted interventions to support students with low scientific confidence and high-performance pressure.

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1. Introduction

Self-concept is a complex idea that greatly affects how well students perform academically and the courses they choose, especially in science. Self-concept refers to an individual's belief about their abilities in specific areas (Nielsen & Yezierski, 2015). Additionally, a student's frame of reference influences their self-concept. While self-concept tends to be more stable than self-efficacy, some research has explored interventions aimed at improving students' self-concept (Baiduri & Usmiyatun, 2023). Many researches have shown a strong link between academic self-concept and achievement. For example, a study with university students found that those with a higher academic self-concept tended to perform better, suggesting that students who have confidence in their abilities are more likely to succeed (Iyengar et al., 2021; T. Tahir et al., 2023). However, despite its importance, another study pointed out that many students struggle with low self-concept in science, which negatively impacts not only all academic success but also significantly impacts students' decisions about science courses, as those with a robust academic self-concept are more inclined to take on and excel in these subjects (Ubago-Jimenez et al., 2024; Widuroyekti et al., 2023). Moreover, self-concept affects not just individual performance; it also influences students' motivation and resilience when facing academic challenges, which can shape their long-term educational journeys (Abuzar & Purwandari, 2024; Ubaidillah et al., 2023). In conclusion, cultivating a good self-concept in students is critical for boosting their academic outcomes and directing their educational choices, particularly in STEM subjects.

Motivation, both intrinsic and extrinsic, is crucial for achieving optimal learning outcomes. There is a pressing need to address the mismatch between high motivation levels and low academic performance in science subjects. Studies have shown that high levels of learning motivation are significantly correlated with improved academic performance. For instance, research indicates that learning motivation positively impacts

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students' learning independence and outcomes, particularly in challenging subjects like science (Eriyanto et al., 2021; Indra et al., 2023). However, there exists a pressing need to address the mismatch between high motivation levels and low academic performance in these areas. Additionally, motivation, though crucial, does not always translate into better performance, as seen in cases where highly motivated students still underperform in science subjects (Ningsih et al., 2022; Widiani & Istiqomah, 2021). This discrepancy highlights the importance of not only fostering motivation but also understanding the underlying barriers that affect students' academic success in science subjects. Addressing these issues can lead to more effective educational strategies and improved student outcomes (Wang & Asniza, 2023; Wibowo et al., 2023).

Significant knowledge gaps still exist about the combined impact of motivation and self-concept in education, especially for lower secondary students, despite a wealth of study on these topics. First, while existing studies have examined self-concept and motivation separately, the limited integrated approach that considers both self-concept and motivation as interconnected factors that can shape science learning outcomes at the lower secondary level (Ubago-Jimenez et al., 2024; Wang & Yu, 2023). Second, there is limited insight into why high motivation sometimes fails to translate into better performance, suggesting unexamined moderating factors (Ningsih et al., 2022; Wang & Asniza, 2023). Third, most interventions target either self-concept or motivation, neglecting integrated approaches that could synergize their benefits (Iyengar et al., 2021). Fourth, the developmental stage of early adolescence – a pivotal period for science identity formation – is underrepresented in current literature (Widuroyekti et al., 2023). Finally, existing studies predominantly focus on Western contexts, leaving a gap in culturally relevant strategies for diverse educational setting (Tahir et al., 2023). Addressing these gaps could refine interventions and policies to better support science learners.

The novelty of this research lies in its focus on simultaneously investigating the correlation of student's motivation and their science self-concept in the context of science learning. By addressing this unexplored intersection, the study aims to contribute to the existing body of knowledge and inform the development of targeted strategies for enhancing student motivation and self-concept, ultimately improving science education outcomes at the lower secondary level. This study takes a distinctive approach by focusing on lower secondary students, a group at a crucial stage in their educational journey where foundational attitudes and skills in science are developed. By examining the interaction between motivation and self-concept, the research highlights the dynamic relationship of these important factors during a formative time when students start to shape their academic identities and future goals. This study aims to: (1) Examine the levels of motivation and self-concept in science among lower secondary students, (2) analyze the correlation between motivation and self-concept in science learning, (3) provide insights for targeted interventions that enhance both factors to improve science education outcomes. Thus, in this study, the following research questions are put forth: "How are the students' motivation and self-concept in science learning among junior high school students?", and "How is the correlation between students' motivation and self-concept in science learning among junior high school students?".

2. Method

To visually summarize the research process, Figure 1 illustrates the workflow. The diagram outlines key stages, including (1) selection variables and instruments, (2) instruments validation to the experts, (3) data collection (e.g. surveys on motivation and self-concept), (4) analysis methods (qualitative and quantitative analysis), (5) expected outcomes. The diagram highlights how qualitative and quantitative phases are integrated, beginning with instrument selection and ending with joint analysis of findings.

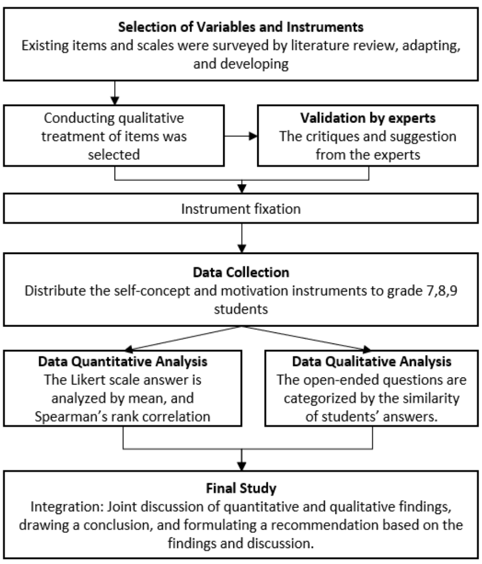

Figure 1. Research workflow

As shown in Figure 1, the workflow emphasizes iterative validation (expert feedback) and mixed-method analysis, ensuring robust conclusions. This structured approach aligns with the research's aim of exploring motivation and self-concept in science learning.

2.1. Research Design

This study utilizes a quantitative descriptive approach within a survey research design. A survey design provides a quantitative or numeric description of a population's trends, attitudes, or opinions by studying a sample, allowing researchers to generalize or draw inferences (Holmes, 2023). This study uses a quantitative descriptive approach as its research technique. In accordance with the research design, surveys were used to gather data in order to give a thorough picture of the motivation and self-concept of students today. This case study design allows for an in-depth exploration of how these constructs interact within a specific educational context, contributing valuable knowledge to educational practices aimed at enhancing student engagement and performance in science learning (Jatisunda et al., 2024). Finding patterns, trends, and correlations in the dataset is made easier by the quantitative descriptive approach, which allows survey results to be analyzed systematically.

2.2. Participants

This research investigating students' quality of motivation and self-concept in science learning. By conducted a cross-sectional study within one of private lower secondary school in Karawang, focusing among 60 seventh-, eighth-, and ninth-graders. A non-probability sampling technique will be employed, specifically using convenience sampling, which allows for the selection of participants who are readily available and accessible to the researcher (Berndt, 2020). This approach is particularly suitable given the context of the study, as it enables efficient data collection while ensuring that the sample reflects the characteristics of the target population. Table 1. Participant's demographic summarizes participants demographics, including grade distribution (7, 8, 9 graders) and gender ratios. This ensures the sample reflects the target population's diversity, reducing selection bias.

Table 1. Participant's demographic

Grade	Gender	Subtotal	
		n	%
7	Female	8	13
	Male	11	18
	Total	19	32
8	Female	11	18
	Male	12	20
	Total	23	38
9	Female	10	17
	Male	8	13
	Total	18	30
Total	Female	29	48
	Male	31	52
Total		60	100

Table 1 reveals a balanced distribution of participants across grades (32% Grade 7, 38% Grade 8, and 30% Grade 9) and a near equal gender split (48% female, 52% male). The slight overrepresentation of eight-graders and male students aligns with convenience sampling constraints but does not significantly deviate from the school's demographic profile. This distribution mitigates potential selection bias by encompassing all target subgroups, ensuring findings generalize to the broader student population in similar contexts.

2.3. Instruments

To measure students' motivation, the Students' Motivation Toward Science Learning (SMTSL) (Tuan et al., 2005) instrument will be utilized, while the Chemistry Self-Concept Inventory (CSCI) (Nielsen & Yezierski, 2015) will be adapted to assess students' self-concept in science. Both instruments have been translated into Indonesian to ensure cultural relevance and comprehension among participants. Notably, for the CSCI, references to chemistry will be modified to encompass general science concepts, aligning with the lower secondary level which use the integrated science, not separated into physics, chemistry, and biology. Additionally, this study uses all factors of self-concept such as mathematics self-concept, science self-concept, academic enjoyment self-concept, academic capability self-concept, positive problem-solving self-concept, and negative problem-solving self-concept. For more in-depth data collection, this research uses 4 open-ended questions, such as "what makes you motivated to study science?", "what makes you unmotivated to study science?", "What makes you understand the concept of science well?", and "What makes you unable to understand the concept of science well?".

2.4. Data Analysis

Data analysis will focus on measuring the average of the student's motivation and self-concept score gained. The interpretation ranges for motivation and self-concept average score are defined in Table 2. Another analysis that conducted in this research was analyze correlation between motivation and self-concept using Spearman's correlation coefficient, which is because the data was not normally distributed (Hermanto & Harliana, 2024).

Table 2. Data interpretation of results

Mean scores	Level of interpretation
4.51 – 5.00	Very high
3.51 – 4.50	High
2.51 – 3.50	Moderate
1.51 – 2.50	Low
1.00 – 1.50	Very low

Table 2 defines the Likert-scale interpretation ranges for motivation and self-concept scores (e.g., 1.0-1.50='Very Low', 2.51-3.5= 'Moderate', 3.51-4.50= 'High'). These thresholds provide a framework for categorizing student responses, enabling systematic comparison of trends across grade levels and identifying areas needing intervention. Additionally, descriptive statistics will be utilized to summarize participants' scores on both instruments, providing insights into overall trends in motivation and self-concept among the students. The data collected through these instruments will be analyzed using IBM SPSS Statistics 25 statistical software to perform basic analysis. The Spearman's correlation degree between the variables as shown as Table 3.

Table 3. The category of Spearman's correlation

Mean scores	Level of interpretation
$\rho = 0$	No correlation
$0 < \lvert\rho\rvert \leq 0.19$	Very weak
$0.20 < \lvert\rho\rvert \leq 0.39$	Weak
$0.40 < \lvert\rho\rvert \leq 0.59$	Moderate
$0.60 < \lvert\rho\rvert \leq 0.79$	Strong
$0.80 < \lvert\rho\rvert \leq 1.00$	Very strong
1.00	Monotonic correlation

Table 3 reports Spearman's correlation coefficients between motivation and self-concept. A significant positive correlation (e.g., $\rho > 0.5$, $\rho < 0.05$) would support the hypothesis that higher self-concept predicts stronger motivation.

3. Results and Discussion

The purpose of this study is to profile students' motivation and self-concepts toward science learning in lower secondary level by utilized two questionnaires from (Nielsen & Yezierski, 2015; Tuan et al., 2005), and the correlation between motivation and self-concept among lower secondary by using the Spearman's rho correlation analysis.

3.1. Profiling student's motivation and science self-concept toward science learning in lower secondary

Student motivation from the Students' Motivation Toward Science Learning (SMTSL) instrument consist of six factors include self-efficacy (SE), active learning strategies (ALS), science learning value (SLV), performance goal (PG), achievement goal (AG), and learning environment stimulation (LES). The Figure 2 show the results of student's motivation average in each factor and separated based on their grade, which are ninth-, eighth-, and seventh-graders.

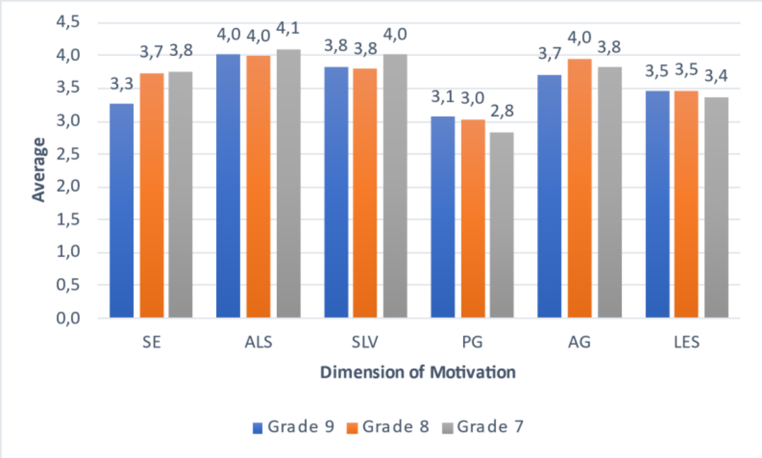

Figure 2. Student's Motivation Average

Figure 2 compares the average motivation scores across key dimensions (e.g., self-efficacy [SE], active learning strategies [ALS], science learning value [SLV], performance goal [PG], achievement goal [AG], and learning environment stimulation [LES]) among seventh- (grey), eighth- (orange), and ninth- (blue) grade students. The graph reveals that Grades 7 and 8 tend to report higher motivation across several dimensions compared to Grade 9. This trend may reflect changes in learning attitudes, external pressures, or academic challenges faced as students' progress. In Self-efficacy and science learning value decline slightly in higher grades, indicating a need for interventions to sustain student confidence and perceived importance of science. Performance goals increase with grade level, suggesting a shift toward extrinsic motivations, such as grades and recognition. Consistent scores in active learning strategies highlight the effectiveness of hands-on and collaborative approaches in science education.

The results indicate that Grade 7 and Grade 8 students scored higher on self-efficacy (3.7 and 3.8) and high-categorized compared to Grade 9 students, who reported a lower average score of 3.3 which moderate-categorized. This pattern suggests that younger students may have greater confidence in their ability to succeed in science learning tasks. However, the decline in self-efficacy for Grade 9 could reflect increased academic challenges or pressures as they progress to higher grades. Such a phenomenon is supported by Bandura's social cognitive theory, which posits that Self-efficacy plays a crucial role in shaping motivation and learning outcomes (Pečiuliauskienė, 2020). As students advance in their education, they frequently face more intricate scientific concepts and heightened expectations from their teachers, which can result in feelings of inadequacy or anxiety regarding their abilities (Nugraha et al., 2020). Additionally, the transition to Grade 9 often brings about significant changes in curriculum requirements and assessment methods, which may lead to a decline in self-efficacy (Rahmadani et al., 2023). This decline highlights the importance of targeted interventions to support students during this pivotal transition. Strategies such as mentorship programs or improved instructional support could enhance self-efficacy among Grade 9 students, ultimately boosting their motivation and performance in science learning (Sneed et al., 2020). Furthermore, creating a classroom environment that promotes growth mindset principles may help students perceive challenges as opportunities for learning instead of obstacles, potentially reducing the drop in self-efficacy as they navigate their academic journey (Rahmadani et al., 2023).

All three grade levels reported in similar scores for active learning strategies, which high-categorized, with averages of 4.0 for Grades 8 and 9 and a slightly higher 4.1 for Grade 7. It means that students across grades are actively engaged in using strategies like experimentation, note-taking, and group discussions to enhance their science learning. The consistently high scores imply that active learning is a common practice among lower secondary students, irrespective of grade level. The findings align with existing literature that emphasizes the importance of active learning strategies in promoting student engagement and academic achievement in science education (Martinez & Gomez, 2025; Nuangchalerm & Kanphukiew, 2024). Active learning is characterized by student participation in the learning process through collaborative activities that foster critical thinking and application of knowledge (Qurratu'ain et al., 2024). Research has shown that when students engage in active learning, they are more likely to retain information and develop a deeper understanding of scientific concepts (Zakariyya et al., 2021). For instance, a study found that implementing active learning strategies led to significant improvements in students' academic performance and problem-solving skills in science (Nugraha et al., 2020). This suggests that the high scores reported by students across all grades may reflect their effective use of these strategies to navigate complex scientific content. Educators play a crucial role in fostering this environment by incorporating diverse active learning techniques such as group discussions, hands-on experiments, and peer teaching (Zakariyya et al., 2021). These methods not only enhance student participation but also help build a supportive community where students feel empowered to explore scientific concepts collaboratively. However, it is essential to consider that while the overall engagement is high, individual differences in motivation and self-efficacy may still exist among students. As they progress through grades, factors such as increased academic pressure and curriculum complexity could affect their willingness to engage actively. Therefore, continuous support from educators is vital to maintain high levels of engagement through tailored instructional strategies that cater to the varying needs of students (Rahmadani et al., 2023).

The average scores for science learning value were high-categorized across all grades, with Grade 7 scoring 4.0, and Grades 8 and 9 both reporting 3.8. This recognition is crucial, as it can foster a positive attitude towards learning and motivate students to engage more deeply with scientific concepts (Supriadi et al., 2022). However, a slight decrease in the SLV scores for higher grades may suggest that older students experience a decline in perceived value, possibly due to external pressures such as exams or a shift in interest towards other subjects.This shift could be influenced by various factors, including external pressures associated with examinations, increased academic workload, or a growing interest in other subjects that may seem more immediately relevant or rewarding (Nugraha et al., 2020). Research indicates that as students' progress through their educational journey, they often face heightened expectations and challenges that can detract from their intrinsic motivation to learn specific subjects (Petridis et al., 2024). For instance, Grade 9 students might experience stress related to standardized testing or the need to make choices about future educational paths, which could lead them to prioritize subjects perceived as more critical for their immediate academic success (Rahmadani et al., 2023). This phenomenon aligns with the concept of "value erosion," where the perceived importance of a subject diminishes over time due to external pressures and shifting interests. Moreover, the consistent high scores among younger students indicate that fostering a strong foundational understanding of the value of science is vital at early educational stages. Engaging students through inquiry-based learning and hands-on experiments can help sustain their interest and appreciation for science as they advance through grades (Amin et al., 2022).

In the performance goals dimension, all grades show the moderate interpretation. Grade 9 students reported an average of 3.1, followed by Grade 8 at 3.0, and Grade 7 at a significantly lower score of 2.8. This trend indicates that older students are more focused on achieving good grades or outperforming peers compared to younger students. Older students are more likely to adopt performance-approach goals, aiming to outperform peers, which aligns with findings that high-stakes environments foster such goals (Tahir et al., 2025). Motivation and achievement are more closely connected in higher grades, indicating that as students grow older, their academic motivation tends to increase (Petridis et al., 2024). While in the cognitive effect, pursuing performance-approach goals can create cognitive distractions, which may hinder working memory and overall performance (Limna et al., 2022). The increase in performance goals for higher grades may reflect the growing competitiveness and academic expectations as students advance in their education. Although focusing on performance goals can lead to academic success, it can also result in heightened anxiety and a fear of failure, especially in high-pressure situations. This complexity implies that while performance goals can boost achievement, they might also undermine intrinsic motivation and overall well-being (Maor et al., 2023; Wang & Yu, 2023).

Achievement goals were rated highest by Grade 8 students (4.0), followed closely by Grade 7 (3.8) and Grade 9 (3.7), in high-categorized. These results explain that students in Grade 8 are particularly driven to achieve success and mastery in science learning. The development stage and educational environment may be as a factor that drives the high achievement. At this age, students often experience a surge in self-efficacy and are more receptive to learning challenges, while engaging curricula and supportive teaching practices may enhance motivation, as suggested by research indicating that students' self-efficacy significantly correlates with their achievement in science (Nugraha et al., 2020; Tahir et al., 2023). The slight decline for Grade 9 could be attributed to academic fatigue or competing priorities as they approach higher education transitions. As students transition into higher grades, they may face increased academic pressure and fatigue, which can diminish their motivation levels (Petridis et al., 2024). Another, approaching higher education transitions often leads students to prioritize other subjects or extracurricular activities over science, impacting their perceived importance of achievement goals (Pawils et al., 2023).

For learning environment stimulation, Grade 8 students scored highest with 3.5, while both Grade 7 and Grade 9 students reported averages of 3.4. These results is moderate categorized and highlight the role of classroom environments, teaching strategies, and peer interactions in fostering student motivation (Mafarja et al., 2022). Students' perceptions of their learning environments significantly influence their motivation. For instance, shared perceptions of a supportive classroom positively correlate with student satisfaction and achievement. Effective teaching methods, such as interactive activities and discussions, are crucial in creating stimulating environments (Martinez & Gomez, 2025). The similarity across grades suggests that students perceive their learning environments to be moderately stimulating but may benefit from further improvements (Nuangchalerm & Kanphukiew, 2024).

Student science self-concept from the adopted Chemistry Self-Concept Inventory (CSCI) instrument consist of six factors include mathematics self-concept (MSC), science self-concept (SSC), academic enjoyment self-concept (AESC), academic capability self-concept (ACSC), positive problem-solving self-concept (PPSSC), and negative problem-solving self-concept (NPSSC). The Figure 3 displays the average scores across six dimensions of science self-concept and stratified by grade level with different color, which are blue for ninth-graders, orange for eighth-graders, and grey for seventh-graders. The results reveal variations in self-concept profiles among adolescents at different educational stages.

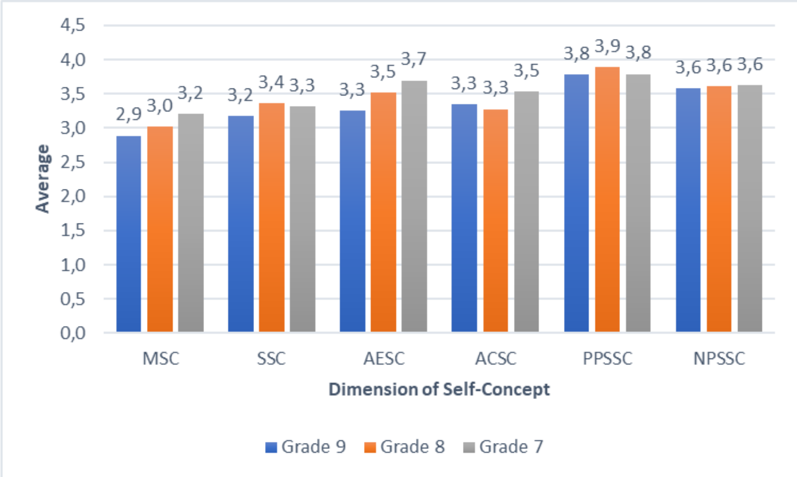

Figure 3. Student's self-concept average

As illustrated in Figure 3, overall, the data demonstrates that while there is slight variation in certain dimensions such as MSC and AESC, PPSSC consistently emerges as the strongest factor, suggesting that students perceive themselves positively in their ability to solve problems. A positive self-concept in problem-solving can enhance students' motivation and engagement in academic tasks, leading to better performance outcomes (Rachmawati, 2022). The stability of PPSSC scores across grades suggests that this confidence is a critical factor in students' academic self-perception (Julius, 2022; Wang, 2023). Additionally, the scores for most self-concept factors remain stable across the grade levels, with only minor fluctuations. For MSC, the average scores are slightly lower for ninth-graders (2.9) compared to eighth-graders (3.0) and seventh-graders (3.2), and moderate categorized for all results. This is suggesting a small decline in mathematical self-concept as students advance in grade levels. This aligns with existing literature which suggests that as students face more challenging content, their self-perception in subjects like mathematics can diminish, often due to increased academic pressure or negative experiences (Rachmawati, 2022). This trend is supported by studies showing that as students' progress through school, they often face increased challenges in mathematics, which can negatively impact their self-concept (Wang, 2023). The decrease may also reflect a shift in social comparison standards as adolescents become more aware of their peers' abilities (Crone & van Drunen, 2024).

In SSC, scores remain fairly consistent in moderate across all three grades, with averages around 3.2–3.4, indicating a stable perception of science-related self-concept. Consistent positive reinforcement and engagement in science can contribute to a stable self-concept in this domain (Jatmiko et al., 2023). The AESC factor reveals some variation, with seventh-graders scoring the highest (3.7) in high level, followed by eighth-graders (3.5) and ninth-graders (3.3) which in moderate level. This means that academic enjoyment decreases slightly in higher grades. The students' enjoyment of academic subjects decreases, potentially due to increased academic pressure and workload (Han et al., 2023). In ACSC, all three grade levels score similarly in moderate level, maintaining a consistent average of approximately 3.3–3.5. Conversely, the NPSSC scores remain stable at 3.6 for all grade levels, showing consistency in students' perceptions of negative problem-solving self-concept. This stability suggests that while students may struggle with problem-solving challenges, their negative self-perceptions do not worsen over time. It reflects a consistent awareness among students about their difficulties without an exacerbation of negative feelings towards their capabilities (Julius, 2022).

3.2. Students' response towards open-ended question

Students are given four open-ended questions in this study. The replies from the students are then grouped according to how similar they are. Each of the open-ended questions has a different number of categories. Based on their categories, the author of this analysis of student replies identifies and describes each response.

3.2.1. Q1: What makes you motivated to study science?

The analysis of students' response to these questions was classified into eight distinct categories, including practical implementation of experiments, the curiosity, the teaching-learning method, specific topic of science, external supports, learning enjoyment, future goals, and good science score. A total of 59 students responded to these eight categories. Category I: The reason behind their motivation in science learning is the existing of experiments. With the total of respondents 15.25%, the students answer that the existing of the experiment, or seeing the science experiment from the video is fun and can test the new things. Category II: The total of 20.34% of students were answer their curiosity push them to learn science. Many facts, phenomena can be explained by science is the most answer from students. Category III: The teaching learning method motivates students only 3.39% Category IV: The 11.86% of students answer that specific topic in science is motivated them to learn science. Category V: The 5.08% of the total answer is external supports such as parents and also friends may enhance their motivation in learning science. Category VI: The enjoyment in learning science is 18.64% from the total answer. Many of students only states just "fun" in this question. Thus, it relates to how they enjoy during science learning. Category VII: The similar percentage for future goals is 18.64%. The students relate their motivation in learning science to their future goal, and the usefulness of science with their lives now and into the future Category VIII: The 6.78% answer is the students want to get a good score when learning science in the school.

3.2.2. Q2: What makes you unmotivated to study science?

Four different groups were identified from the study of the students' answers to these questions: challenging calculations or materials, dislike for particular scientific fields, learning style, and also environmental influences and personal sentiments. These four categories received responses from 55 students in total. Category I: The category that has most answer is the challenging calculations or materials also the utilization of scientific name. This challenging, makes student the most unmotivated during learning science with the percentage is 67.27%. Category II: The dislike for particular scientific fields, such as biology with the memorizing material activities, and memorizing the formulas has 9.09% answer of students. Category III: The learning style that provided in the classroom / classroom environment has 9.09% answer of students that may be the reason of unmotivated. Such as teachers who explain too quickly, or the test that suddenly held. Category IV: The environmental influences and personal sentiments have 14.55% answer of students. Such as friend who are nosy so that they hinder the learning process of students, feeling when students get bad score in the science test, and when they meet difficulty to understand the materials in many times.

3.2.3. Q3: What makes you understand the concept of science well?

Based on the students' responses to the following questions, five distinct categories were determined: the teacher's explanation, simple content, learning strategies, practicum availability, and individual aptitude/confidence. A total of 58 students responded to these five categories. Category I: The good explanation from teacher during learning is 51.67%. Category II: 10.00% of students answer that they can understand the science concept well when the simple content in science. Category III: The learning strategies in the class may help students understanding during learning science concept in the 6.67%. Category IV: The practicum availability may enhance their understanding of science content in 10.00%. Category V: The last category of students answers when they can understand science concept well is in 21.67% with the individual aptitude or their confidence. They belief that they can learning science concepts.

3.2.4. Q4: What makes you unable to understand the concept of science well?

Four different groups were identified from the students' answers to the following questions: teacher explanation, external interference, individual aptitude/confidence, and difficult science formulae or materials. These four categories received responses from 60 students in all. Category I: The bad explanations from teacher during the lesson may not help students to understand concepts of science well. This is the most students answer with the total percentage is 56.90%. Category II: The external interference such as friends' activity that nosy, or the learning environment may affect the inability of understanding the science concept well, with total answer is 20.69%. Category III: 18.97% answer percentage of the lower confidence or student's individual aptitude may affect the inability to understand the concept of science well. Category IV: The last category has 3.45% percentage answer with the difficult in science formulae or materials.

3.3. The correlation between motivation and self-concept among lower secondary students

The correlation between motivation and self-concept among lower secondary is presented by Table 4 with the Spearman's rho correlation results examining the relationship between students' motivation and self-concept in science learning. The analysis reveals a statistically significant association between these two constructs, as detailed below.

Table 4. The correlation results

	Variables	Correlation (r)	Sig. (p)	Explanation
Spearman's rho	Correlation between motivation and self-concept	0.572	0.000	Positive correlation

As shown in Table 4, the results of the Spearman's rho correlation analysis show a positive and significant correlation between motivation and self-concept (r = 0.572, p = 0.000). This indicates that as students' self-concept improves, their motivation tends to increase as well. The correlation coefficient (r = 0.572) reflects a moderate to strong relationship, suggesting that self-concept significantly influences student motivation. The p-value (p = 0.000) confirms that this relationship is statistically significant, indicating that the observed correlation is unlikely to be due to chance.

Motivation serves as a cornerstone for academic success. It is a non-cognitive factor that significantly influences student engagement and overall performance. Research, such as that conducted by (Riadi et al., 2024), has demonstrated a strong link between higher levels of motivation and improved academic outcomes. Notably, achievement motivation, the drive to pursue and attain academic goals, is intricately connected to self-concept. Students with a positive self-view, believing in their own abilities and competence, are more likely to be intrinsically motivated to learn and strive for excellence (Han et al., 2023). This positive feedback loop reinforces both motivation and self-concept, creating a virtuous cycle that fosters academic growth and success.

In relation to the Science Self-Concept Inventory (SSCI), this positive correlation underscores the need to foster a strong self-concept across various dimensions, including mathematics self-concept (MSC), science self-concept (SSC), and problem-solving self-concept (PPSSC and NPSSC). Focusing on these areas could help boost students' motivation, especially in science subjects like science. Self-concept, an individual's perception of their own abilities and worth, plays a pivotal role in shaping academic outcomes (Azizah et al., 2022; Pečiuliauskienė, 2020). Research, such as that by (Wang & Yu, 2023), has shown that a strong self-concept enhances motivation, driving students to exert greater effort and persist through challenges in their academic pursuits. Furthermore, studies like those conducted by (Petridis et al., 2024) indicate that a positive self-concept fosters a more enjoyable and invigorating learning experience, further reinforcing intrinsic motivation and leading to greater academic success. The interplay between motivation and self-concept suggests that fostering a supportive learning environment can enhance both, leading to improved academic performance (Azizah et al., 2022). Conversely, while motivation and self-concept are positively correlated, factors such as external pressures and negative experiences can adversely affect both, leading to decreased motivation and a poor self-concept. This highlights the need for holistic educational strategies that address these challenges. The correlation motivation indicator and self-concept in show in Table 5.

Table 5. The correlation motivation indicator and self-concept

Dimensions of motivation	Self-Concept		Explanation
	Correlation	Sig.	
Self-efficacy	0.483	0.000	Moderate and significant
Active learning strategy	0.448	0.000	Moderate and significant
Science learning value	0.366	0.004	Weak and significant
Performance goal	0.026	0.843	Very weak, not significant
Achievement goal	0.382	0.003	Weak and significant
Learning environment simulation	0.385	0.002	Weak and significant

According to the Table 5, it provides insights into the relationship between various dimensions of motivation and self-concept among lower secondary students in science learning. The analysis reveals that self-efficacy and active learning strategies show the strongest relationships with self-concept, both at a moderate and significant level. These findings underscore the importance of building students' confidence and promoting active engagement in science learning. In contrast, dimensions such as performance goals show no meaningful relationship with self-concept, indicating that extrinsic motivations alone are insufficient to shape students' perceptions of their abilities.

The correlation between self-efficacy and self-concept is moderate and significant (r = 0.483, p = 0.000). This finding suggests that students with higher confidence in their abilities to perform science tasks also tend to have a stronger self-concept in science learning. This in line with the results of the research that higher self-efficacy correlates with a stronger academic self-concept, suggesting that students who believe in their capabilities are more likely to succeed in science learning environments (Jatmiko et al., 2023). It's in line with another research that shows the positive self-concept and high self-efficacy are crucial for academic success, particularly in subjects like biology and mathematics (Baiduri & Usmiyatun, 2023). Another research found that students with higher self-efficacy tend to have a more positive self-concept regarding their abilities in science, which subsequently affects their learning attitudes and achievements. This underscores the critical role of fostering both self-efficacy and self-concept to improve student engagement and performance in science education (Baiduri & Usmiyatun, 2023). Thus, self-efficacy plays a crucial role in shaping students' perceptions of their capabilities, influencing both their learning outcomes and attitudes toward science. This aligns with Bandura's social cognitive theory, which emphasizes the importance of self-efficacy in academic performance and motivation (Wang & Yu, 2023).

The correlation between active learning strategies and self-concept is also moderate and significant (r = 0.448, p = 0.000). This result indicates that students who actively engage in science learning, such as through hands-on activities, note-taking, and problem-solving, tend to have a more positive self-concept. Active learning strategies provide opportunities for students to interact with the subject matter and achieve success, which enhances their confidence and self-concept (Nuangchalerm & Kanphukiew, 2024; Zakariyya et al., 2021). A weak but significant correlation was observed between science learning value and self-concept (r = 0.366, p = 0.004). According to these results, students acknowledge the value of studying science, but its influence on their perception of themselves is not very great. Students may value science as relevant to their future or societal progress, but this value does not always translate into strong self-perception of their abilities in science learning (Korkmaz et al., 2020). While students may understand the societal importance of science, their self-concept is often shaped by their experiences in the classroom (Graichen et al., 2024). The science self-concept can be influenced by multiple factors beyond just interest or perceived importance, such as students' backgrounds, experiences, and interactions within educational contexts contribute to their self-concept in science, suggesting that recognizing the value of science does not directly correlate with a strong belief in one's scientific abilities (Schroeders & Jansen, 2022).

The correlation between performance goals and self-concept is very weak and not significant (r = 0.026, p = 0.843). This result highlights that focusing on outperforming peers or achieving high grades does not significantly contribute to students' self-concept. This research implies that although external motivating factors such as competitiveness might impact behavior, they do not always have a beneficial impact on students' self-concept of themselves in science or other academic fields. Instead, fostering intrinsic motivation through supportive learning environments may be more beneficial for developing a positive self-view among learners (Hajriah, 2020).

A weak but significant correlation was found between achievement goals and self-concept (r = 0.382, p = 0.003). This suggests that students driven by a desire to master science content and improve their skills tend to have a slightly stronger self-concept. Although the correlation is not strong, it reflects the positive role of intrinsic motivation in fostering a sense of competence and self-belief among students (Narangoda et al., 2021). It's contradictive with the (Pečiuliauskienė, 2020) that shows the higher levels of intrinsic motivation are associated with greater self-confidence and a more robust self-concept among students, supporting the idea that intrinsic motivations play a critical role in developing a sense of competence. However, while the correlations are not strong, there is a notable link between intrinsic motivation and self-concept, suggesting that students who are intrinsically motivated tend to have a better perception of their abilities and skills (Chen et al., 2024).

The correlation between learning environment stimulation and self-concept is weak but significant (r = 0.385, p = 0.002). This result suggests that a stimulating and supportive learning environment, including effective teaching strategies and engaging classroom interactions, contributes to students' self-concept. A positive environment reinforces students' abilities and encourages them to view themselves as capable learners in science (Herianto & Wilujeng, 2021; Mahayani et al., 2021).

4. Conclusion

This study offers a detailed look at students' motivation and self-concept regarding science learning in lower secondary education, uncovering subtle trends across different grades. While Grades 7 and 8 students demonstrated higher motivation and self-efficacy, Grade 9 showed declines in intrinsic motivation and perceived value of science, alongside a shift toward extrinsic drivers like academic pressure. Notably, self-concept remained stable overall, though minor dips in mathematical self-concept and academic enjoyment signaled challenges in advanced grades. Qualitative insights identified curiosity, hands-on learning, and future goals as key motivators, while difficult content and unsupportive environments emerged as barriers. These findings underscore the need for interventions that foster engaging, instructionally supportive classrooms to sustain motivation and self-concept during critical transitions.

Another result is a strong and positive link between motivation and self-concept (r = 0.572, p = 0.000), suggesting that as students' self-concept improves, their motivation increases as well. The moderate-to-strong correlation emphasizes how crucial self-concept is in influencing students' motivation, especially in science learning. Notably, factors like self-efficacy (r = 0.483, p = 0.000) and active learning strategies (r = 0.448, p = 0.000) show the highest correlations with self-concept, highlighting the need to build students' confidence and engagement through interactive and empowering educational experiences. Extrinsic factors (e.g., performance goals) showed weak or non-significant ties, emphasizing the primacy of intrinsic motivation and confidence-building practices. This reciprocal relationship aligns with existing literature, suggesting that targeted strategies—such as growth mindset training, participatory learning, and self-efficacy programs—can create a virtuous cycle of engagement and achievement in science education (Objective 3). Future studies could utilize advanced analytical methods, such as structural equation modelling, to investigate the relationship between intrinsic and extrinsic motivation and their overall impact on students' academic performance. On the other side, the active learning and confidence-building strategies in learning activities, also school and policymakers should design targeted interventions to support students with low scientific confidence and high-performance pressure.

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