Learning Strategies and Attitudes as Predictors of Problem-Solving Abilities of STEM Students in General Physics

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ABSTRACT

Problem-solving abilities are essential for students studying Science, Technology, Engineering, and Mathematics (STEM). However, some students have difficulty problem-solving due to their learning styles and attitudes. Thus, this quantitative study aimed to assess the effects of learning strategies and attitudes toward problem-solving skills in General Physics of Grade 12 STEM students in public senior high schools in Davao City. This study used a non-experimental quantitative method using descriptive-correlational. Moreover, the respondents of this study were chosen through simple random sampling of one hundred (100) senior high school STEM students from public senior high schools in Cluster 1 and 2, Division of Davao City. Modified and adapted survey questionnaires by Queen's University, Kuwarikunda (2020), and Heppner (1998), using a 5-point Likert scale, were employed for data collection. Analysis involved mean, two-way ANOVA, and path analysis. Results indicated a significant and positive relationship between the use of learning strategies and problem-solving skills among Grade 12 STEM students across all examined indicators, thus rejecting the null hypothesis. The findings also indicated a significant positive relationship between the attitude towards physics and the ability to solve problems among Grade 12 STEM learners in all the indicators examined. Several recommendations can be put forth for future research such as comparative examination, mixed-methods approach, and intervention studies.

Keywords: problem-solving, learning strategies, attitudes, Physics, STEM

INTRODUCTION

Problem-solving abilities are essential for students studying Science, Technology, Engineering, and Mathematics (STEM). General Physics, in particular, acts as a cornerstone course that requires sophisticated problem-solving abilities. The successful use of learning methodologies, as well as the development of positive attitudes toward problem-solving, are critical aspects that can considerably influence STEM students' success in grasping the complexity of General Physics. However, some students experience difficulties in problem-solving due to their learning strategies and attitudes.

Certain students have difficulty solving problems because their learning methodologies and the attitudes they bring to the classroom are not aligned (Cardino & Ortega-Dela Cruz, 2020). The dominance of rote memorization as a learning approach, particularly in early STEM education, is one noteworthy problem (Maddox, 2023). Rather than gaining a deeper comprehension of the underlying principles, some students could place a significant emphasis on memorization of formulas and procedures. This method may impair their capacity for problem-solving in general physics, where the application of concepts and critical thinking are crucial. To tackle this issue, there needs to be a change in emphasis towards developing conceptual knowledge and more efficient teaching methods that encourage critical thinking and problem-solving abilities (Nold, 2017).

In addition, for some students in Indonesia, having a negative attitude about solving problems can be a major obstacle to succeeding in general physics (Astalini, Darmaji, Pathoni, Kurniawan, Jufrida, Kurniawan, & Perdana, 2019). A rigid mindset, a fear of failing, or a low sense of self-efficacy are some examples of factors that can make someone reluctant to take on difficult problem-solving tasks. Targeted interventions that emphasize perseverance in the face of adversity, confidence building for pupils, and the development of a growth mindset are necessary to overcome these negative attitudes (Yeager, Hanselman, & Walton, 2019).

Meanwhile, the underrepresentation of several demographic groups, including women and minorities, in STEM disciplines can be attributed to the difficulties posed by a variety of learning strategies and attitudes (Wrigley-Asante, Ackah, & Frimpong, 2023).

Furthermore, in Lasam, Philippines, differences in learning strategies and attitudes can be attributed to the student's cultural origins, prior educational experiences, and socioeconomic considerations (Magulod, 2019). It is possible that students from different cultural backgrounds and different educational experiences did not interact with similar resources in the classroom. Therefore, such inequalities in the acquisition of fundamental abilities and learning techniques, lead to challenges that disadvantage some students when they encounter obstacles, in STEM fields like General Physics (UNESCO, 2022).

The existing relationship among learning strategies, attitudes, and problem-solving abilities is intricate and interconnected, playing a crucial role in shaping the academic success of students, particularly in STEM disciplines like General Physics. Learning strategies, encompassing cognitive and metacognitive approaches, act as the mechanisms through which students acquire, process, and apply knowledge (Conley, 2014). A positive attitude fosters a proactive and resilient approach to problem-solving challenges, enhancing the efficacy of chosen learning strategies (Brandt, 2020). Conversely, negative attitudes may hinder the utilization of effective strategies and impede the development of problem-solving skills (Mazana, Montero, & Casmir, 2019). The interaction of these elements emphasizes the importance of a holistic educational approach that takes into account both the cognitive and affective dimensions of learning, recognizing the reciprocal influence of learning strategies and attitudes on the development of robust problem-solving abilities in STEM students studying General Physics.

While various researchers have investigated problem-solving skills among STEM students, there is still a vacuum in knowing how certain learning strategies and mindsets contribute to General Physics performance. This study will seek to address that need by investigating the connections between learning strategies, attitudes, and problem-solving abilities in the particular environment of General Physics courses for STEM students.

Statement of the Problem

This study determines the effect of learning strategies and attitudes of problem-solving abilities in General Physics among STEM students. Specifically, it answers the following questions:

1. What is the level of learning strategies of Grade 12 STEM students in terms of:

    1.1 Time management;

    1.2 Goal-setting;

    1.3 Use of resources;

    1.4 Exam Preparation; and

    1.5 Exam Writing?

2. What is the level of Physics attitude of Grade 12 STEM students in terms of:

2.1 Self-efficacy;

2.2 Self- determination;

2.3 Intrinsic motivation;

2.4 Career motivation; and

2.5 Goal motivation?

3. What is the level of problem-solving abilities of Grade 12 STEM students in terms of:

3.1 Problem-solving confidence;

3.2 Approach-avoidance style; and

3.3 Personal control?

4. Is there a significant relationship between learning strategies and problem-solving abilities among Grade 12 STEM students?

5. Is there a significant relationship between physics attitude and problem-solving abilities among Grade 12 STEM students?

LITERATURE REVIEW

Learning Strategies

Learning strategies, as defined by Muelas & Navarro (2015), are a collection of methods that students employ to gain knowledge and understanding. These methods include taking notes, organizing information, summarizing, and coding. Learning techniques and styles are not the same thing. Whereas learning strategies relate to students' approaches to learning in particular contexts and activities, learning styles are used to characterize the information processing patterns linked to students' personalities (Xiaojing, 2016).

In addition, effective learning strategies are methods and tactics that students employ to acquire, store, retain, recall, and apply knowledge. According to cognitive learning theories, students are the main participants in the educational process and play a more active role than just passively absorbing knowledge. As a result, to properly absorb and assimilate information, students not only receive knowledge and information but also engage in mental activities (Shi, 2017). To meet their learning objectives, students can choose from a variety of sources, guide their learning process, and manage their emotions and inclinations (Diaz, Zapata, Diaz, Arroyo, & Fuentes, 2019)

While Vega-Hernandez, Patino-Alonso, Cabello, Galindo-Villard, and Fernandez-Berrocal (2017) identified three main categories of learning strategies: cognitive and learning control strategies, learning support strategies, and study habits, Muelas and Navarro (2015) classified strategies into four main categories in addition to identifying specific strategies (i.e. information acquisition strategies, information coding strategies, information retrieval strategies, and processing support strategies).

In the context of this study, learning strategies refer to the following indicators set by Queens University:

Time management. Time management in the academic context has been a subject of extensive research, highlighting its critical role in student success. Existing literature underscores the positive correlation

between effective time management skills and academic performance (Nigussie, 2019).

Flaherty (2019) emphasized the necessity for students to learn adaptive time management techniques. In their examination of the impact of smartphone use on students' time management, Lee and Choi (2020) acknowledged the possible distractions associated with these gadgets. The body of current research emphasizes how dynamic time management is in modern surroundings and stresses the need to modify tactics to successfully traverse the opportunities and obstacles that change as modern technologies and educational settings do.

Goal-setting. Research like the meta-analysis by Locke and Latham (2019) confirms the beneficial effects of goal-setting on motivation and performance. The need to establish precise and demanding objectives for improved performance is shown by this study. Additionally, a study conducted recently by Harkin et al. (2020) examined the psychological factors that underlie successful goal-setting, highlighting the significance of commitment and self-efficacy. The body of research shows how important it is to have flexible, customized goal-setting strategies that take context and individual characteristics into account. The field of study on goal-setting is always changing, which highlights the theories and applications of goal-setting's lasting significance. These developments offer insightful information to individuals, educators, and organizations who want to use goal-setting to achieve better results and performance.

Use of Resources. Research on the effects of multimedia resources, including interactive simulations and video lectures, on student knowledge and engagement is carried out by groups like Wang et al. (2020). These results imply that a more dynamic and all-encompassing learning environment can be fostered by carefully integrating multimedia resources to accommodate various learning preferences. Furthermore, Hew and Cho's (2019) research explores the use of open educational resources (OER) in higher education contexts. The study emphasizes how open educational resources (OER) can help create inclusive learning environments by making them more affordable and accessible. To reduce differences in resource access among varied student groups, the findings highlight the significance of taking into account the socioeconomic aspects that affect students' access to educational resources and argue for the incorporation of open and freely available materials.

These studies collectively emphasize the need for interventions and educational strategies that foster effective time management practices among students, ultimately contributing to their holistic development and academic success.

Exam Preparation. A growing body of research on test preparation as a learning technique from 2019 and later explores the diverse ways in which students prepare for exams in different learning environments. The effect of learning strategies that are self-regulated on exam performance is examined in research by Richardson et al. (2019). The study highlights the significance of students actively participating in their exam preparation by using techniques like self-monitoring, goal-setting, and time management. The results indicate that developing self-regulated learning techniques enhances students' capacity to adequately prepare for tests, which in turn leads to better academic outcomes.

Additionally, research by Smith and Kim (2020) explores the function of technology in test-taking strategies. Their study looks into how digital resources, such as websites and learning applications, might be used as instruments for independent learning and getting ready for tests. The results show that incorporating technology into exam preparation can improve students' access to a variety of educational resources, offer interactive study tools, and promote group learning. This latest study emphasizes how exam preparation tactics are dynamic and recognizes the value of both innovative technological tools and classic self- regulated learning approaches in maximizing students' assessment readiness in modern educational settings.

Exam Writing. Phillips and Ochs (2020) study the influence of teaching students with clear exam-writing skills to improve their performance and overall learning experience. According to the findings, giving

students specific advice on organizing exam responses, managing time, and comprehending assessment criteria improves their ability to express knowledge and display critical thinking during exams. Furthermore, research like Dabbagh and Moore's (2021) explores the incorporation of technology in exam writing. Their study looks into how digital tools like collaborative platforms and instant feedback mechanisms might help students improve their writing skills in preparation for exams. According to the findings, incorporating technology into the exam-writing process not only allows for more interactive and engaging learning experiences but also allows for formative assessment and self-reflection, ultimately contributing to the development of effective exam-writing strategies.

Attitudes

A person's attitude plays a significant role in defining their interest, focus, and response to related disciplines (Jhangiani, 2022). Take students' attitudes about science, for instance. The science standards in Colombia are designed to help students acquire the knowledge, abilities, and mindset necessary to investigate the world around them and find solutions (Hernánez-Suarez, 2019). The dispositions, tendencies, or inclinations to react to all the factors (actions, persons, situations, or ideas) involved in learning science were chosen as this study's definition of attitudes toward science (Mao, Cai, He, Chen, & Fan, 2021). It is necessary to select instruments supported by rigorous research because, unlike Likert-scale items, attitude measurement instruments have encountered challenges at the conceptual (validity) and methodological (reliability) levels due to the definition of the various science-related attitudinal objects that can be measured (León-Mantero, Casas-Rosal, Pedrosa-Jesús, & Maz-Machado, 2020). In this study, attitudes refer to the following indicators: self-efficacy, self-determination, intrinsic motivation, career motivation, and goal motivation.

Problem-solving Abilities

Being able to solve problems is crucial for day-to-day living. Thus, it is important to foster in students a curiosity and a thirst for knowledge to aid in the development of their problem-solving and autonomous thought processes (Wang, 2021). These skills are necessary to address issues throughout life and build confidence, along with optimistic attitudes and an active attitude. In the context of globalization, creative capacity is essential for creating competitive advantages to meet educational goals. As a result, critical thinking, creative thinking, and problem-solving skills are crucial fundamental abilities required of future global citizens.

Problem-solving confidence. Identifying the elements that are known to have been asked and the sufficiency of the required elements is the first indication of mathematical problem-solving skills (Widjajanti & Wahyudin, 2015). Formulating a mathematical problem and developing a mathematical model is the second and line of using strategies to solve the problem. Explaining or interpreting the results to the problem of origin is the fourth indicator. Finally, one could use a variety of science techniques. Recent studies have looked into affective components, such as confidence or self-assurance, which is thought to help pupils solve mathematical problems more effectively, in addition to the extensive research on cognitive elements.

Approach-Avoidance Style. The results of Gernigon et al. (2017) indicate that patterns of approach and avoidance arise from the interaction of information units related to particular social-cognitive characteristics. These factors include the perceived threat to oneself if the objective is not achieved, the competence expectations related to goal achievement, and the expected rewards to oneself from reaching the goal. One way to adapt to new surroundings is to increase or decrease the distance between positive and negative stimuli (Shadli et al., 2016). People, events, objects, and ideas are examples of things that require differentiation to be avoided (Rougier et al., 2020).

The approach style of problem-solving showed the strongest link with academic achievement in high school

students, outperforming other psychosocial variables such as confidence, control, and avoidance (Zainali zadeh & Ahvan, 2015). One's method of coping with novel problems (stressors) is reflected in theirproblem-solving approach.

Personal Control. The capacity to restrain one's impulses, thoughts, feelings, and behaviors to align them with one's values and higher priorities is known as self-control (Inzlicht et al., 2016). When working on reasoning issues in mathematics, self-control is necessary to keep a consistent focus on essential information while shielding information processing from distractions such as unrelated thoughts (Hagger & Chatzisarantis, 2017).

Effective learning strategies can help students solve problems more effectively, according to Su et al. (2017), who said that teachers who implement them help their students successfully navigate life's hurdles. Students are more motivated to learn when there is a deeper relationship between them and their teachers. Calvo et al. (2018) observed the elements influencing preschoolers' problem-solving skills through art-related activities. The understanding of problem objectives, the growth of perception skills, personal experience, peer interaction, and the resource support offered by teachers' instructional methodologies were some of these elements. Finding problem-related data is a crucial step in the problem-solving process, which includes gathering data, evaluating data, lowering data coverage, or connecting pertinent data (LaForce et al., 2017; Wu et al., 2020).

Learning strategies that direct discussion of current events can help teachers develop their students' problem-finding and problem-solving abilities (Lu, et al, 2017). Students realized that innovation could encompass new development and modification based on current situations rather than the unique production of "something from nothing" (Wu et al., 2020). Meanwhile, teachers, social and cultural context, and prior foreign language acquisition experience all showed highly significant relationships with students' attitudes toward education learning strategies, which they believe to be the most important aspect of their creative learning (Achilleos et al., 2019).

RESEARCH METHODOLOGY

Research Design

This study adopted a descriptive correlation analysis technique using a quantitative research design the researcher looks at the link between two or more variables in an uncontrolled, natural environment. An extensive examination of the relationship among learning strategies, attitudes, and problem-solving ability in General Physics was provided via descriptive correlation. One potential avenue for research was to examine the potential predictor role of learning strategies and attitude towards physics in problem-solving abilities. In summary, using quantitative analysis in connection with descriptive correlation improves our understanding of the connections between these variables, enabling a more thorough and useful interpretation of their interconnections in the context of learning and problem-solving scenarios in General Physics.

Respondents

The study used simple random sampling. One hundred (100) senior high school STEM students from senior high schools in Cluster 1 and 2this institution were the study's sample, which was done in public senior high schools in Cluster 1 and Cluster 2, Division of Davao City, Region XI. This number was sufficient for examining the concerns and obstacles that have been identified. According to Frankael and Wallen (2009), as mentioned by Akman (2023), a correlational study's minimum acceptable sample size is at least 30. Additionally, they state that data from samples smaller than 30 may not reflect the degree of correlation.

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Instruments of the Study

The researcher adapted the Learning Strategies Development Survey instrument by Queen's University to gather the data for the independent variable, learning strategies. It has five indicators: Time management; Goal-setting; Use of resources; Exam Preparation; and Exam Writing. In evaluating the level of learning strategies of STEM students, the respondents used the following scale in rating the questionnaire: 5 as a lot or always; 4 as fairly; 3 as sometimes; 2 as not often, and 1 as rarely or never.

Range of Means	Description	Interpretation
4.20-5.00	Strongly agree	This means that the learning strategies of Grade 12 STEM students are always manifested.
3.40-4.19	Agree	This means that the learning strategies of Grade 12 STEM students are often manifested.
2.60-3.39	Moderately agree	This means that the learning strategies of Grade 12 STEM students are sometimes manifested.
1.80-2.59	disagree	This means that the learning strategies of Grade 12 STEM students are not often manifested.
1.00-1.79	Strongly disagree	This means that the learning strategies of Grade 12 STEM students are never manifested.

To gather the data for another independent variable, attitudes, the researcher adapted the Science Attitude Questionnaire – Physics Version developed by Kuwarikunda (2020). It has five indicators namely: self-efficacy, self-determination, intrinsic motivation, career motivation, and goal motivation. In evaluating the attitudes of STEM students, the respondents used the following scale in rating the questionnaire: 5 as strongly agree; 4 as agree; 3 as moderately agree; 2 as disagree and 1 as strongly disagree.

Range of Means	Description	Interpretation
4.20-5.00	Strongly agree	This means that the students' positive attitudes are always manifested.
3.40-4.19	agree	This means that the students' positive attitudes are often manifested.
2.60-3.39	Moderately agree	This means that the students' positive attitudes are sometimes manifested.
1.80-2.59	disagree	This means that the students' positive attitudes are rarely manifested.
1.00-1.79	Strongly disagree	This means that the students' positive attitudes are never manifested.

To gather the data for the dependent variable, problem-solving abilities, the researcher utilized the Problem-Solving Inventory (PSI) (Heppner, 1988) which has three indicators: problem-solving, approach-avoidance style, and personal control. In evaluating the problem-solving abilities of STEM students, the respondents

used the following scale in rating the questionnaire: 5 as strongly agree; 4 as agree; 3 as moderately agree; 2 as disagree, and 1 as strongly disagree.

Range of Means	Description	Interpretation
4.20-5.00	Strongly agree	This means that the problem-solving abilities of the students are always manifested.
3.40-4.19	agree	This means that the problem-solving abilities of the students are often manifested.
2.60-3.39	Moderately agree	This means that the problem-solving abilities of the students are sometimes manifested.
1.80-2.59	disagree	This means that the problem-solving abilities of the students are rarely manifested.
1.00-1.79	Strongly disagree	This means that the problem-solving abilities of the students are never manifested.

Procedure

The researcher underwent the following steps and procedures in gathering the data for this study:

Asking for Permission to Conduct the Study. The researcher wrote a letter requesting permission to conduct the study to the Division Office of Davao City via the Schools Division Superintendent (SDS). The researcher then asked for the principal of the school's permission first.

Administration and Retrieval of Questionnaires. With the approval and full support of the SDS and school principal, the researcher thoroughly explained how to answer the given questionnaires to the STEM teachers. During the actual administration of the survey questionnaires, the researcher translated each question from the indicators in their dialect to ensure that the respondents understood each question well and that their answers were accurate. All STEM students in the school were requested to answer the instrument. After the respondents had completely and honestly answered and provided all the necessary data needed in the questionnaire, the researcher retrieved all the answered questionnaires.

Gathering and Tabulation of Data. The data was collated and tabulated after successfully administrating and retrieving the survey questionnaires. Then, appropriate statistical tools were employed to get the data required for interpretation and further analysis.

Data Analysis

The gathered data was examined using the following statistical tools:

Mean. This was used to answer the first two objectives of the study. More specifically, it was used to describe the level of learning strategies, attitudes, and problem-solving abilities in General Physics of STEM students**.**

Two-way Analysis of Variance (Two-Way ANOVA). This statistical tool was used to determine the significance of the relationship between learning strategies, attitudes, and problem-solving abilities of STEM students in answer to the sub-problem.

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RESULTS & DISCUSSION

The discussions are presented based on the sequence of the statement of the study questions.

Level of Learning Strategies of Grade 12 STEM Learners

Table 1.1: Level of Learning Strategies of Grade 12 STEM Learners in terms of Time management

Time Management	Weighted Mean	Interpretation
I find it easy to stick to a study schedule.	3.56	Agree
When I decide to study, I can start and keep going.	3.74	Agree
I spread out my study time, to avoid cramming.	3.36	Moderately Agree
I have enough time in my week to study.	3.49	Agree
I spend more time on difficult courses.	3.82	Agree
My on-line time is under control: it doesn't interfere with other things.	3.41	Agree
Overall	**3.56**	**Agree**

The learners agree that they find it easy to stick to a study schedule (weighted mean: 3.56). This implies that they display discipline and commitment in following their planned study routines. They also agree that when they decide to study, they can start and keep going (weighted mean: 3.74). This indicates a high level of motivation and perseverance in their study habits. The learners moderately agree that they spread out their study time to avoid cramming (weighted mean: 3.36). This suggests that while they make some effort to prevent last-minute studying, there is room for improvement in managing their study time more effectively.

In terms of having enough time in their week to study, the learners agree (weighted mean: 3.49). This showcases their belief that their schedules provide ample time for academic activities. The learners strongly agree that they spend more time on difficult courses (weighted mean: 3.82). This reveals their prioritization of challenging subjects and their recognition of the importance of investing additional time in these areas. Regarding online time management, the learners agree that their online activities are under control and do not interfere with other tasks (weighted mean: 3.41). This suggests that they maintain a balanced approach to managing their online engagement, ensuring that it does not hinder their overall productivity. Overall, the Grade 12 STEM learners demonstrate a positive attitude towards time management in their learning strategies.

The study conducted by Duckworth et al. (2020) examined the time management techniques employed by high school students. Researchers discovered that students tend to dedicate additional time to demanding or complex courses to guarantee understanding and proficiency in the subject matter. Grade 12 learners may prioritize challenging courses in their time management methods to satisfy academic obligations.

Table 1.2: Level of Learning Strategies of Grade 12 STEM Learners in terms of Goal Setting

Goal Setting	Weighted Mean	Interpretation
I set high standards for myself in school	3.9	Agree

I persist when the work is boring or challenging.	3.71	Agree
I am up to date with assignments.	3.92	Agree
I am satisfied with my grades.	3.98	Agree
My course work relates to my future plans.	4.22	Strongly Agree
Overall	**3.95**	**Agree**

The level of learning strategies of Grade 12 STEM Learners reveals a positive inclination towards goal setting among the students. The learners agree that they set high standards for themselves in school, with a weighted mean of 3.9. This demonstrates their willingness to challenge themselves academically and strive for excellence in their studies. They also exhibit agreement in persisting through boring or challenging work, as indicated by a weighted mean of 3.71. This suggests that the learners possess the determination and resilience necessary to overcome obstacles and remain committed to their academic pursuits.

Further, the learners demonstrate a strong sense of responsibility and organization regarding assignments, with a weighted mean of 3.92 for being up to date with their tasks. This implies that they prioritize staying on top of their assignments and fulfilling their obligations promptly. The learners also expressed satisfaction with their grades, as indicated by a weighted mean of 3.98. This suggests that they perceive their academic achievements as meeting personal expectations, reflecting a sense of accomplishment and contentment.

Hattie and Timperley (2019) observed that students who established precise and ambitious goals for their academic performance were more inclined to be content with their grades. Similarly, Locke and Latham (2019) examined the fundamental concepts of goal-setting theory and its implementation in the field of education of Grade 12 students to establish they may experience more contentment with their grades upon accomplishing or surpassing those objectives.

Table 1.3: Level of Learning Strategies of Grade 12 STEM Learners in terms of Use of Resources

Use of Resources	Weighted Mean	Interpretation
I am able and willing to ask for help when I need it.	4.17	Agree
I use “people-resources” available, when needed.	3.89	Agree
I use text, internet, or library resources when needed.	4.36	Strongly Agree
I feel confident about my note-taking methods.	3.8	Agree
I attend review sessions when offered.	3.72	Agree
Overall	**3.99**	**Agree**

The results obtained from the level of learning strategies of Grade 12 STEM learners indicate that the students generally have a positive attitude towards asking for help when they need it. The statement “I am able and willing to ask for help when I need it” received a relatively high weighted mean of 4.17, indicating agreement among the students. This suggests that they are open to seeking assistance and recognize the importance of collaboration in their learning process.

Furthermore, the students also demonstrate a willingness to utilize various resources available to them. The statements “I use ‘people-resources’ available when needed” and “I use text, internet, or library resources when needed” received weighted means of 3.89 and 4.36, respectively, both indicating agreement. This

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implies that the students actively seek support from both human and external resources, highlighting their resourcefulness in acquiring knowledge.

Furthermore, a study conducted by Wang and Wu (2019) examined the information-seeking tendencies of secondary school pupils. The researchers discovered that Grade 12 students depend on a diverse range of materials, such as textbooks, internet databases, and library resources, to finish assignments and get ready for tests. Students exhibited the capacity to differentiate and determine the appropriate utilization of various sources, taking into account the specific requirements of the work and their personal learning preferences.

In addition, Gross et al. (2021) revealed that Grade 12 students who utilized library resources, including databases, research guides, and librarian support, expressed greater satisfaction with their learning experiences and regarded library resources as valuable tools in their academic endeavors. Overall, the students' positive attitude towards seeking help and utilizing resources demonstrates their proactive approach to learning. However, there is room for improvement regarding confidence in note-taking methods and active participation in review sessions.

Table 1.4: Level of Learning Strategies of Grade 12 STEM Learners in terms of Exam Preparation

Exam Preparation	Weighted Mean	Interpretation
I separate my initial "learning" from my "studying".	3.74	Agree
I know what to study for an exam.	3.89	Agree
I feel confident in my study methods.	3.6	Agree
I answer practice questions to study.	3.8	Agree
I study in a group, or with a friend.	3.36	Moderately Agree
I adjust my study methods for different courses.	3.66	Agree
Overall	**3.68**	**Agree**

The results of the level of learning strategies of Grade 12 STEM learners in terms of exam preparation indicate that the students generally exhibit agreement and a positive approach to their study habits. The statement "*I separate my initial 'learning' from my 'studying*" received a weighted mean of 3.74, indicating agreement among the students. This suggests that they recognize the importance of differentiating between acquiring new knowledge and revising and consolidating that knowledge through studying.

Furthermore, the students indicated agreement with the statement "I know what to study for an exam" with a weighted mean of 3.89. This implies that they possess a clear understanding of the exam content and can prioritize their study materials effectively. Additionally, the statement "*I answer practice questions to study*" received a weighted mean of 3.8, further indicating agreement. This suggests that the students actively engage in practice exercises to enhance their understanding and application of course concepts.

However, the students expressed slightly lower levels of confidence in their study methods, as seen in the statement "*I feel confident in my study methods"* with a weighted mean of 3.6. While this still reflects agreement, it suggests a potential need for further exploration and development of effective study strategies. Similarly, although agreement was reached on other statements such as studying in a group or with a friend and adjusting study methods for different courses, the weighted means of 3.36 and 3.66 respectively indicate a moderately agreeable response, indicating that there may be room for improvement in these areas.

The investigation by Karpicke and Butler (2020) revealed that successful students, including those in the twelfth grade, engage in self-regulated learning practices, such as organizing study materials, setting

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specific study objectives, and monitoring their comprehension of exam content, according to the findings. During exam preparation, these strategies assist students in determining what to study and concentrating on essential concepts.

A study conducted by Dunlosky et al. (2021) also established that b grade 12 students identified and prioritized what to study for exams and frequently employed effective study strategies, such as self-testing, distributed practice, and elaborative interrogation, according to the study. Overall, the students demonstrate a generally positive outlook towards exam preparation, separating their learning and studying and having a clear understanding of what to focus on for their exams. However, there may be a need for additional support in enhancing their confidence in study methods and encouraging more active engagement in group study.

Table 1.5: Level of Learning Strategies of Grade 12 STEM Learners in terms of Exam Writing

Exam Writing	Weighted Mean	Interpretation
I finish my exams in the allotted time	4	Agree
I answer the exam questions I know best, first	4.11	Agree
I map out an essay answer before writing.	3.69	Agree
I take enough time to understand what the problem asks.	4.12	Agree
I predicted exam questions well	3.27	Moderately Agree
I studied enough for the exam.	3.59	Agree
Overall	**3.8**	**Agree**

Based on the results, it can be interpreted that Grade 12 STEM learners generally exhibit positive learning strategies when it comes to exam writing. The learners strongly agreed they could finish their exams within the allocated time (weighted mean: 4), indicating good time management skills during exams. They also agree that they prioritize answering the exam questions they are most confident in, suggesting a strategic approach to maximize their performance.

Furthermore, the learners generally agree that they take enough time to understand (weighted mean: 4.12) what the problem asks, indicating a sufficient level of comprehension before attempting to solve the problems. They also moderately agree that they can predict exam questions well, implying that they possess some level of foresight when it comes to anticipating exam content. In terms of studying, the learners agree that they have put in enough effort to prepare for the exams. This suggests that they recognize the importance of adequate preparation and are proactive in studying for their exams.

The study conducted by Weinstein and Acee (2019) established that high-achieving students allocate an adequate amount of time (weighted mean: 4) to comprehend the demands of each examination prompt before constructing their answers (weighted mean: 3.69). This technique entails meticulously reading and scrutinizing the question to guarantee comprehension and precision in their responses.

In a similar vein, Smith and Samuels (2020) in their study found that successful test takers, dedicate time at the start of the exam to thoroughly read each question, identify important terms and instructions, and understand the extent of the problem before attempting to provide an answer.

Overall, the Grade 12 STEM learners display positive learning strategies in terms of exam writing, showcasing good time management, prioritization of questions, comprehension skills, and study habits.

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Level of Physics Attitude of Grade 12 STEM Learners

Table 2.1: Level of Physics Attitude of Grade 12 STEM Learners in terms of Self-efficacy

Self-Efficacy	Weighted Mean	Interpretation
I am confident I will do well on the physics test.	3.39	Moderately Agree
I am confident I will do well in physics experiments.	3.54	Agree
I believe I can master physics knowledge and skills	3.21	Moderately Agree
I believe I can get marks between 75% and 100% in physicstests and exams.	3.71	Agree
I am sure I can understand physics.	3.63	Agree
Overall	**3.5**	**Agree**

The results obtained from the level of Physics attitude of Grade 12 STEM learners in terms of self-efficacy indicate that the learners generally possess moderate to agreeable levels of confidence and belief in their abilities related to physics. The statement "*I am confident I will do well on the physics test*" received a weighted mean of 3.39, indicating a moderate level of agreement. This suggests that while the learners generally have some level of confidence, there may still be room for improvement in their self-efficacy regarding test performance in physics.

Similarly, the learners agree that they are confident in doing well in physics experiments, as indicated by a weighted mean of 3.54. This implies that they possess a positive attitude towards practical applications of physics concepts and have a reasonable level of confidence in their ability to perform well in experimental settings. The learners also moderately agree with the statement "*I believe I can master physics knowledge and skills"* with a weighted mean of 3.21. This suggests that while they have some belief in their ability to master physics, there may be some doubts or uncertainties about their competence in this subject.

However, the learners express stronger agreement with the statements "*I believe I can get marks between 75% and 100% in physics tests and exams*" and *"I am sure I can understand physics*" with weighted means of 3.71 and 3.63 respectively. This indicates a higher level of confidence and belief in their ability to excel in physics assessments and comprehend the subject matter.

The study conducted by Tas et al. (2020) revealed a positive correlation between students' favorable attitudes toward physics and their self-assurance in achieving high performance on tests and exams. These kids exhibited a greater propensity to establish ambitious objectives for themselves.

Besides, Potvin and Hasni (2021) results revealed a correlation between students who possessed favorable attitudes towards physics and their belief in their ability to attain high scores in tests and exams. Their optimistic outlook on the subject bolstered their drive and determination to achieve academic excellence.

Table 2.2: Level of Physics Attitude of Grade 12 STEM Learners in terms of Self-determination

Self-determination	Weighted Mean	Interpretation
I put enough effort into learning physics.	3.94	Agree
I use different strategies to learn physics.	3.85	Agree

I spend lots of time learning physics.	3.5	Agree
I prepare well for physics tests and exams.	3.62	Agree
I study hard to learn physics.	3.79	Agree
Overall	**3.74**	**Agree**

The results obtained from the level of Physics attitude of Grade 12 STEM learners in terms of self-determination indicate a positive and agreeable attitude towards learning physics. The learners demonstrate a strong belief in putting sufficient effort into their physics studies, as indicated by the weighted mean of 3.94. This suggests that they actively engage in their learning, displaying a proactive approach to acquiring knowledge in physics.

Furthermore, the learners express their willingness to employ different strategies to enhance their understanding of physics, as indicated by the weighted mean of 3.85. This demonstrates their adaptability and inclination to explore various approaches to master the subject. The learners' commitment and dedication are evident in their responses, as they also indicate spending a significant amount of time learning physics (weighted mean = 3.50) and preparing well for tests and exams (weighted mean = 3.62). The high weighted mean of 3.79 for studying hard-to-learn physics reinforces their determination and perseverance in acquiring a deep understanding of the subject.

Deci and Ryan (2019) study indicate that students are more inclined to exert effort toward learning when they experience a sense of autonomy, competence, and relatedness within their learning environment. Within the realm of physics education, students who view the process of learning physics as personally significant and in line with their interests are more inclined to invest effort and actively participate in learning activities.

In a study conducted by Hulleman et al. (2020), the researchers investigated the influence of motivation and effort on high school physics courses. The researchers discovered a favourable correlation between students' intrinsic motivation, which refers to their interest and delight in physics, and their level of effort and tenacity in learning the subject. When students possess intrinsic motivation, they are more inclined to dedicate time and effort toward comprehending physics topics and resolving issues.

In addition, a study by Wermers et al. (2021) found that student's perception of their competence and self-efficacy in physics strongly influenced their level of effort and involvement in learning activities. Increased self-assurance in students' physics skills leads to a greater willingness to dedicate effort toward understanding the topic.

Overall, these results suggest that Grade 12 STEM learners' commitment to putting effort, employing diverse strategies, dedicating time, and preparing for assessments indicates their strong motivation and a high likelihood of continued engagement and success in the field of physics.

Table 2.3: Level of Physics Attitude of Grade 12 STEM Learners in terms of Intrinsic Motivation

Intrinsic Motivation	Weighted Mean	Interpretation
The physics I learn is relevant to my life.	3.68	Agree
Learning physics is interesting.	3.9	Agree
Learning physics makes my life more meaningful.	3.47	Agree

I am curious about discoveries in physics.	3.9	Agree
I enjoy learning physics.	3.67	Agree
Overall	**3.72**	**Agree**

The results obtained from the Level of Physics Attitude of Grade 12 STEM Learners in terms of intrinsic motivation suggest that the learners exhibit a positive and agreeable attitude towards physics education. They perceive the physics they learn as relevant to their lives, as indicated by the weighted mean of 3.68. This implies that they recognize the practical applications and significance of physics in various aspects of their daily lives, fostering a sense of relevance and importance.

Furthermore, the learners find learning physics interesting and enjoyable, as demonstrated by the weighted mean of 3.9 and 3.67, respectively. This indicates a strong intrinsic motivation, as they experience pleasure and engage in the subject willingly. The fact that learning physics makes their lives more meaningful (weighted mean = 3.47) suggests that they find personal value and purpose in their physics education. Moreover, their curiosity about discoveries in physics, as indicated by the high weighted mean of 3.9, demonstrates a genuine interest in exploring and staying updated with the latest advancements and breakthroughs in the field. Overall, these results indicate that Grade 12 STEM learners are intrinsically motivated in their pursuit of physics education. Their perception of relevance, interest, enjoyment, and curiosity reflects a deep and genuine passion for the subject, fostering a positive learning environment.

In supporting these findings, a study by Harackiewicz et al. (2019) revealed that students who have intrinsic motivation to study physics exhibited a greater level of curiosity toward scientific discoveries and progress in the discipline. These pupils exhibited a heightened inclination to investigate novel thoughts and ideas, motivated by their inherent inquisitiveness.

In a similar vein, a study by Lazarides et al. (2020) revealed a positive correlation between the amount of intrinsic motivation in physics among high school students and their inclination to demonstrate curiosity toward scientific phenomena and discoveries. These students proactively pursued opportunities to expand their knowledge of physics-related subjects and actively participated in scientific investigation.

Table 2.4: Level of Physics Attitude of Grade 12 STEM Learners in terms of Career Motivation

Career Motivation	Weighted Mean	Interpretation
Learning physics will help me get a good job	3.49	Agree
Knowing physics will give me a job advantage.	3.64	Agree
Understanding physics will benefit my career.	3.61	Agree
I will use physics problem-solving skills in my career	3.56	Agree
My career or job will involve physics.	3.4	Moderately Agree
Overall	**3.54**	**Agree**

The results obtained from the Level of Physics Attitude of Grade 12 STEM Learners in terms of career motivation indicate that the learners perceive physics education as valuable and beneficial for their future careers. They agree that learning physics will help them secure a good job, as indicated by the weighted mean of 3.49. This suggests that the learners recognize the practical applications of physics in various professional fields and understand that a strong foundation in physics can enhance their employability

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prospects.

Furthermore, the learners agree that knowing physics will give them a job advantage (weighted mean = 3.64) and understanding physics will benefit their careers (weighted mean = 3.61). These responses imply that the learners recognize the value of physics knowledge as a competitive advantage in the job market. In addition, the learners agree that they will use physics problem-solving skills in their careers (weighted mean = 3.56). This highlights their awareness that the analytical and critical thinking skills acquired through studying physics are transferable and applicable in a wide range of professional contexts.

The study by Aschbacher et al. (2020) suggested that students recognized STEM topics, particularly physics, as advantageous for future professional prospects.

Similarly, Tai et al. (2021) study on perspectives of high school students regarding the significance of physics education revealed that students who acknowledged the significance of physics in diverse fields, such as engineering, medicine, and technology, had higher levels of motivation to engage in these topics.

Therefore, Wang and Degol (2020) discovered that students who were driven by job ambitions in STEM subjects, specifically in physics-related professions, exhibited elevated levels of interest and perseverance in their academic pursuits.

Overall, these results suggest that Grade 12 STEM learners perceive physics education as instrumental in their future careers.

Table 2.5: Level of Physics Attitude of Grade 12 STEM Learners in terms of Goal Motivation

Goal Motivation	Weighted Mean	Interpretation
I like to do better than other students on physics test	3.32	Moderately Agree
Getting a good science grade is important to me	4.05	Agree
It is important that I get marks between 75% and 100% in physics tests/exams	4.23	Strongly Agree
I think about the grade I will get in physics.	4.19	Agree
Scoring high on physics tests and laboratory work matter to me a lot.	4.13	Agree
Overall	**3.98**	**Agree**

The results obtained from the level of Physics attitude of Grade 12 STEM learners in terms of goal motivation reveal that the learners place a significant emphasis on academic achievement and performance in physics. They moderately agree that they like to do better than other students on physics tests, with a weighted mean of 3.32. This suggests that while competition may not be the primary motivator, the learners still value performing well in comparison to their peers.

Additionally, the learners strongly agree that getting a good science grade is important to them, as evidenced by the weighted mean of 4.05. This indicates that the learners highly prioritize academic success in science subjects, particularly in physics. They recognize the significance of achieving good grades in physics as an indicator of their overall academic performance and future opportunities.

Moreover, the learners strongly agree that it is important for them to obtain marks between 75% and 100% in physics tests/exams (weighted mean = 4.23). This suggests that the learners have set high standards for themselves in terms of their desired level of achievement in physics. Furthermore, the learners agree that

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they frequently think about the grade they will receive in physics (weighted mean = 4.19). This indicates that they are mindful of their academic performance and constantly evaluate their progress and potential outcomes.

In supporting these findings, Potvin and Hasni (2020) in their study indicated that students' goal orientation, namely their pursuit of mastery goals had a substantial impact on their attitudes towards physics. Students who pursued mastery goals exhibited more favorable views toward physics.

Besides, Aschbacher et al. (2021), in their studies found out that students driven by mastery goals, such as curiosity and the aspiration for comprehension, displayed more favorable attitudes towards physics in contrast to those driven by performance goals.

Overall, these results indicate that Grade 12 STEM learners place great importance on achieving good science grades, strive for excellence in physics tests/exams, and frequently think about their academic performance.

Level of Problem-Solving Abilities of Grade 12 STEM Learners

Table 3.1: Level of Problem-Solving Abilities of Grade 12 STEM Learners in terms of Problem-solving Confidence

Problem-Solving Confidence	Weighted Mean	Interpretation
I am able to think up creative and effective alternatives to solve a physics problem.	3.57	Agree
I have the ability to solve physics problems even though initially no solution is immediately apparent.	3.35	Moderately Agree
I make solutions to physics problems and I am happy with them later.	3.56	Agree
After making a decision, the outcome I expected usually matches the actual outcome.	3.54	Agree
I trust my ability to solve new and difficult physics problems.	3.47	Agree
When making a decision, I weigh the consequences of each alternative and compare them against each other.	3.68	Agree
I try to predict the overall result of carrying out a particular course of action.	3.59	Agree
Many physics problems I face are too easy for me to solve.	2.95	Moderately Agree
Many physics problems I face are too easy for me to solve.	3.82	Agree
When I make plans to solve a physics problem, I am almost certain that I can make them work.	3.55	Agree
Given enough time and effort, I believe I can solve physics problems that confront me.	3.85	Agree
When faced with a novel situation, I have confidence that I can handle physics problems that may arise.	3.41	Agree
When confronted with a physics problem, I am sure that I can handle the situation.	3.37	Moderately Agree

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When confronted with a physics problem, I consistently examine my feelings to find out what is going on in a problem situation.	3.57	Agree
Overall	**3.52**	**Agree**

The results obtained from the level of problem-solving abilities of Grade 12 STEM Learners in terms of problem-solving confidence indicate that the learners possess a moderate to high level of confidence in their problem-solving abilities in the context of physics.

The learners agree that they can think up creative and effective alternatives to solve physics problems (weighted mean = 3.57). This suggests that they have confidence in their ability to generate innovative solutions when faced with challenging physics problems. Additionally, they agree that they can solve physics problems even when an immediate solution is not apparent (weighted mean = 3.35). This indicates their confidence in their problem-solving skills and their belief that they can overcome initial difficulties to find a solution.

Furthermore, the learners agree that they make solutions to physics problems and are happy with them later (weighted mean = 3.56). This suggests they have a positive attitude towards problem-solving outcomes and are satisfied with their ability to offer solutions. They also agree that their expected outcomes usually match the actual outcomes after making a decision (weighted mean = 3.54), indicating a level of accuracy and confidence in their decision-making process. Additionally, the learners agree that they trust their ability to solve new and difficult physics problems (weighted mean = 3.47) and that they consistently weigh the consequences of different alternatives when making decisions (weighted mean = 3.68). These results indicate that the learners possess confidence in their problem-solving abilities and have a systematic approach to decision-making.

Conversely, Brown and Jones (2021) in their study discovered that whereas many Grade 12 students expressed considerable levels of self-assurance in problem-solving, their real problem-solving skills did not consistently correspond with their confidence. Certain students displayed excessive self-assurance, resulting in mistakes during problem-solving and a disparity between their levels of confidence and their actual performance.

A study by Lee et al. (2019) found that the confidence of Grade 12 students in problem-solving was affected by multiple factors, such as previous experiences, self-efficacy beliefs, and the perceived complexity of the assignment. Several students expressed a lack of confidence in their problem-solving skills, although having sufficient ability in this area. Conversely, several students displayed high levels of confidence, even when they encountered difficulties in effectively addressing problems.

Overall, the results suggest that Grade 12 STEM learners exhibit a relatively high level of problem-solving confidence in the context of physics. They had confidence in their ability to generate creative solutions, overcome initial obstacles, and make effective decisions.

Table 3.2: Level of Problem-Solving Abilities of Grade 12 STEM Learners in terms of Approach-Avoidance Style

Approach-Avoidance Style	Weighted Mean	Interpretation
After I have attempted to solve a physics problem, I take time and compare the actual outcome to what I thought should have happened.	3.87	Agree
When I am confronted with a physics problem, I devise a plan and develop a strategy to collect information so I can define exactly what the problem is.	3.73	Agree

When I am confused by a physics problem, one of the first things I do is survey the situation and consider all the relevant pieces of information.	3.79	Agree
When I have a physics problem, I think up as many possible ways to handle it as I can until I can come up with more ideas.	3.8	Agree
I take time to consider deciding on a solution to a physics problem.	3.87	Agree
When confronted with a physics problem, I examine what sort of external things my environment may be contributing to the problem.	3.46	Agree
Most of the time, I work with my problems decisively.	3.53	Agree
Overall	**3.72**	**Agree**

The results indicate that Grade 12 STEM learners generally have a positive approach-avoidance style when it comes to problem-solving in physics. This is evident from the high weighted mean scores obtained for all the statements, indicating agreement with the given statements.

The findings reflected that learners' approach to physics problem-solving (weighted mean = 3.87, Agree). The demonstrated strategic approach by devising plans to collect information and define the problem (weighted mean = 3.73, Agree). Moreover, when faced with confusion, the learner's survey considered the relevant information, indicating a systematic and analytical approach (weighted mean = 3.79, Agree). They also showed a willingness to generate multiple solutions through many possible ways physics problems (weighted mean = 3.8, Agree).

Additionally, the learners take their time to consider and decide on a solution, indicating a thoughtful and deliberate approach to problem-solving (weighted mean = 3.87, Agree). Furthermore, they demonstrate recognition of external factors by examining how the environment may contribute to the physics problem (weighted mean = 3.46, Agree).

Although the weighted mean scores for working decisively (weighted mean = 3.53, Agree) were slightly lower compared to the other statements, the overall results suggest that Grade 12 STEM learners possess a positive approach-avoidance style when approaching physics problem-solving, demonstrating characteristics such as reflection, strategic thinking, systematic analysis, creative solution generation, thoughtful decision-making, and awareness of environmental influences.

In contrast, a study by Lee and Jones (2020) revealed that Grade 12 students who frequently engaged in avoidance behaviors, such as procrastination and evading tough work, demonstrated diminished problem-solving skills. These pupils had difficulties in addressing problems and were less inclined to efficiently tackle intricate problems.

In addition, Brown et al. (2021) in their study found that certain Grade 12 students showed approach-oriented inclinations and proficient problem-solving skills, whereas others showed avoidance-oriented behaviors that impeded their problem-solving ability. Avoidance habits and problem-solving skills were adversely affected by factors such as fear of failure and lack of confidence.

Table 3.3: Level of Problem-Solving Abilities of Grade 12 STEM Learners in terms of Personal Control

Personal Control	Weighted Mean	Interpretation
I have a systematic method for comparing alternatives and making decisions.	3.71	Agree

When my first efforts to solve a problem fail, I am certain about my ability to handle the situation.	3.65	Agree
I pause for a while and take time to deal with my problems.	3.98	Agree
I make judgments and later accept what will be the result of it.	3.88	Agree
When confronted with a physics problem, I stop and think about it before deciding on the next step.	3.81	Agree
Sometimes I get so charged up emotionally that I am able to consider many ways of dealing with physics problems.	3.64	Agree
Overall	**3.78**	**Agree**

The Grade 12 STEM learners demonstrate a strong sense of personal control concerning their problem-solving abilities. They possess a systematic method for comparing alternatives and making decisions (weighted mean = 3.71), indicating that they approach problem-solving tasks in a structured and deliberate manner.

Furthermore, the learner's express confidence in their ability to handle difficult situations even when their initial attempts to solve a problem fail (weighted mean = 3.65). They also pause and take time to deal with their problems (weighted mean = 3.98), indicating a thoughtful and reflective approach to problem-solving. Moreover, the learners tend to make judgments and later accept the results (weighted mean = 3.88), suggesting a level of adaptability and acceptance of outcomes. They also engage in critical thinking, pausing and considering their options when confronted with a physics problem (weighted mean = 3.81), indicating a mindful and deliberate approach to decision-making. Additionally, the learners report getting emotionally charged, which stimulates their ability to consider multiple ways of dealing with physics problems (weighted mean = 3.64), highlighting their resourcefulness and creative problem-solving abilities.

The study by Yang and Chang (2021) indicated that students who demonstrated a sense of personal control were more inclined to pause and allocate time to effectively address their concerns. The students exhibited adaptive coping mechanisms, such as seeking social support, practicing relaxation techniques, and employing problem-solving skills, to effectively address their problems and effectively manage stress. Suggested that pupils who perceived themselves as having autonomy over their lives had more resilience when confronted with challenges. These students demonstrated the ability to temporarily halt their activities and dedicate time to evaluating their challenges,

Overall, these results indicate that Grade 12 STEM learners have a strong sense of personal control and exhibit effective problem-solving strategies. They approach problem-solving tasks systematically, maintain confidence even in the face of failure, and make well-considered judgments.

Relationship Between Learning Strategies and Problem-Solving Abilities

Table 4: Relationship Between Learning Strategies and Problem-Solving Abilities among Grade 12 STEM learners

Learning Strategies	**Problem-Solving Abilities**			
	r	**p-value**	**Decision**	**Interpretation**
Time management	0.552	0.000	Reject Ho	Significant
Goal Setting	0.643	0.000	Reject Ho	Significant

Use of resources	0.668	0.000	Reject Ho	Significant
Exam Preparation	0.786	0.000	Reject Ho	Significant
Exam Writing	0.804	0.000	Reject Ho	Significant

The results indicate a strong positive correlation between learning strategies and problem-solving abilities among Grade 12 STEM learners in all categories studied.

For time management, there is a moderate positive correlation (r=0.552, p=0.000), suggesting that learners who effectively manage their time tend to have better problem-solving abilities. Similarly, in the category of goal setting, there is a strong positive correlation (r=0.643, p=0.000), indicating that learners who set clear goals are more likely to excel in problem-solving tasks. The use of resources also shows a strong positive correlation (r=0.668, p=0.000), implying that learners who actively seek and utilize resources have higher problem-solving abilities.

In the category of exam preparation, there is a strong positive correlation (r=0.786, p=0.000), suggesting that learners who thoroughly prepare for exams perform better in problem-solving tasks. Lastly, in the category of exam writing, a strong positive correlation (r=0.804, p=0.000) indicates that learners who possess strong exam writing skills also excel in problem-solving.

Furthermore, Jones and Brown (2021) established that Grade 12 students who employed active learning tactics, such as practice testing, spaced repetition, and elaborative interrogation, had enhanced problem-solving skills. These students demonstrated a higher level of proficiency in applying acquired knowledge to unfamiliar situations and adjusting their approaches according to the requirements of the task.

On the contrary, Lee et al. (2020) in their similar discovered that certain learning procedures were linked to enhanced problem-solving abilities, whereas others did not yield significant results. For instance, although practice testing and elaboration proved to be successful, highlighting and summary tactics did not result in enhancements in problem-solving skills.

Overall, these results highlight the importance of learning strategies such as time management, goal setting, use of resources, exam preparation, and exam writing in fostering strong problem-solving abilities among Grade 12 STEM learners.

Relationship Between Physics Attitude and Problem-Solving Abilities

Table 5: Relationship Between Physics Attitude and Problem-Solving Abilities among Grade 12 STEM learners

Physics Attitude	**Problem-Solving Abilities**			
	r	**p-value**	**Decision**	**Interpretation**
Self-efficacy	0.765	0.000	Reject Ho	Significant
Self-determination	0.713	0.000	Reject Ho	Significant
Intrinsic motivation	0.648	0.000	Reject Ho	Significant
Career motivation	0.558	0.000	Reject Ho	Significant
Goal motivation	0.665	0.000	Reject Ho	Significant

The results indicate a strong positive correlation between physics attitude and problem-solving abilities among Grade 12 STEM learners in all categories studied. For self-efficacy, there is a strong positive

correlation (r=0.765, p=0.000), suggesting that learners who have confidence in their physics abilities also exhibit better problem-solving skills. Similarly, in the category of self-determination, there is a strong positive correlation (r=0.713, p=0.000), indicating that learners who are self-motivated and driven in their physics studies are more likely to excel in problem-solving tasks.

The intrinsic motivation shows a strong positive correlation (r=0.648, p=0.000), implying that learners who have an inherent interest and enjoyment in physics are more likely to have strong problem-solving abilities. In the category of career motivation, there is a moderate positive correlation (r=0.558, p=0.000), suggesting that learners who are motivated by future career prospects in the field of physics tend to have better problem-solving skills. Lastly, in the category of goal motivation, a strong positive correlation (r=0.665, p=0.000) indicates that learners who are motivated by specific goals related to physics also excel in problem-solving.

The study by Lee and Jones (2020) revealed a good correlation between students' favorable attitudes towards physics, including interest, curiosity, and confidence, and their proficiency in solving physics issues. Their optimistic outlook on the subject inspired them to tackle problem-solving activities with eagerness and resolve, leading to enhanced problem-solving skills.

In contrast, a study conducted by Brown et al. (2021) discovered that there was a favorable correlation between a positive attitude toward physics and problem-solving skills. However, this link did not hold for all students uniformly.

Overall, these results highlight the importance of positive attitudes towards physics, including self-efficacy, self-determination, intrinsic motivation, career motivation, and goal motivation, in fostering strong problem-solving abilities among Grade 12 STEM learners.

CONCLUSION

The following conclusions are derived from the summary of the results.

The measurement of Physics attitudes consists of five indicators: elf-efficacy, self-determination, intrinsic motivation, career motivation, and goal motivation. Based on the available results, it can be inferred that all indicators under this variable have achieved the designated level of "agree," indicating that Grade 12 STEM students frequently demonstrate Physics attitudes.

The study conducted those problem-solving abilities based on problem-solving confidence, approach-avoidance strategy, and personal control reached the "agree" level, indicating that Grade 12 STEM students frequently demonstrate problem-solving abilities.

The study also concluded that the correlation between learning strategies and problem-solving abilities. presented a significant relationship between the level of learning strategies and problem-solving abilities among Grade 12 STEM students.

Finally, the study also indicated that there existed a correlation between the attitude toward Physics and the ability among Grade 12 STEM students to solve problems.

RECOMMENDATIONS

Several recommendations can be put forth for future research concerning the impact of problem-solving abilities of Grade 12 STEM students and the influence of learning strategies and physics attitude:

Intervention studies. These involve the implementation of programs designed to cultivate positive physics attitudes and improve learning strategies among STEM students in grade 12. Assess the efficacy of these interventions in enhancing academic achievement and problem-solving skills.

A comparative examination: Analyze the impact of various physics attitudes and learning strategies on the problem-solving skills of distinct cohorts of Grade 12 STEM students. Examine potential discrepancies that may arise from variables including gender, socioeconomic status, and previous academic performance.

Mixed-methods strategy: By integrating qualitative and quantitative methods, one can acquire a holistic comprehension of the correlation that exists between problem-solving capabilities, physics attitude, and learning strategies. Triangulating data gathered through interviews, surveys, assessments, and observations can yield more profound insights into the experiences and perceptions of students.

Teacher Training and Professional Development. This study aims to investigate the impact of professional development and teacher training initiatives on the development of positive physics attitudes and the promotion of effective learning strategies among STEM students in grade 12. Examine the impact of instructor practices and attitudes on student problem-solving outcomes.

This information generated could be utilized to guide initiatives in teacher training, curriculum development, and educational practices that are all focused on improving STEM education for students.

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