CTU Journal of Innovation and Sustainable Development
ISSN 2588-1418 | e-ISSN 2815-6412

DOI:10.22144/ctujoisd.2025.063

Ruling the wild waves: Construct of learning strategies in Physics among college students

Donabelle L. Apa[1], Glory Mae B. Macarine[1], Elona Jane D. Ramirez[1], and Ian S. Somosot[2*]

[1]Students, Institute of Teacher Education, Davao del Norte State College, Philippines

[2]Faculty, Institute of Teacher Education, Davao del Norte State College, Philippines

*Corresponding author (ian.somosot@dnsc.edu.ph)

Article info.

Received 24 Sep 2024
Revised 15 Jul 2025
Accepted 31 Jul 2025

Keywords

Exploratory factor analysis, learning strategies, physics, quantitative research design

ABSTRACT

Physics is known to be the most difficult branch among all other sciences. Understanding how students approach and engage with learning in physics can aid in determining effective strategies that result in better learning outcomes. Teachers can uncover best practices and assist struggling students in learning physics. The strategies in learning physics will ultimately improve the knowledge and performance of the struggling students. This quantitative study captures the construct of learning strategies in physics among college students. To achieve the purpose, an exploratory factor analysis was utilized, employing purposive sampling to collect qualitative data involving 6 participants to extract their learning strategies. From these statements, the researchers were able to generate a survey questionnaire that was used in the quantitative phase with the application of random sampling. When employing exploratory factor analysis, with a KMO of .851. The students' overall perception of these strategies was also measured as moderate. Hence, future researchers may consider the result of the study for further investigation utilizing confirmatory factor analysis, and structural equation modeling, and determine a model that best fits learning strategies in physics.

1. INTRODUCTION

In modern educational institutions, students are expected to exercise a greater degree of autonomy, take initiative, and exhibit understanding of the information being studied. Students must employ learning strategies that constitute the ability to initiate, direct, and regulate their own information search as well as the processing and storage of the information found for knowledge to grow effectively both within and outside of the classroom. However, difficulties are often an unavoidable but important part of the learning process (Lodge et al., 2018). Physics, to be specific, is known to be difficult for both high school and college students (Bug-os & Caro, 2019). On this subject, the failure rate is often high, and many studies found out that this is due to inefficient learning strategies (Oon & Subramaniam, 2011; Johnson, 2012; Reddy & Panacharoensawad, 2017; Sartika & Humaira, 2018; Badmus & Jita, 2022).

Physics is one of the natural sciences that is considered an important subject since this allows students to learn about nature. Further, physics also plays an important role in training the students to provide technological advances (Oral & Erkilic, 2022). However, students perceived that physics is also a difficult subject, particularly its content, which affects their learning of the subject (Ekici, 2016; Shirazi, 2017). But in general, physics is perceived as the most difficult of the three fields physics, chemistry, and biology. In a study conducted by Wangchuk et al. (2023), they reported that 59.60% of the students indicated that physics is a difficult subject and believed that this subject is challenging, tough, confusing, and puzzling. Moreover, the difficulty of the subject is associated with students, curriculum and the nature of the subject (Wangchuk et al., 2023). Students, including those in STEM degrees, say physics is more difficult than Biology (Wong et al., 2022) and slightly more difficult than Chemistry as it is much more math-oriented and includes more abstract ideas (Oon & Subramaniam, 2011).

Even in the global setting, these perceptions about physics are common. In fact, results of a study conducted in India by Reddy & Panacharoensawad (2017) to a population of Bachelor of Education students of Physics showed that poor mathematical skills and a lack of understanding the problem are the major obstacles in the domain of problem-solving skills in Physics. Statistically, the top three (3) factors found to have affected student learning are: the lack of ability in remembering related equations (57.4%), lack of practice on problem solving during the classes (55.1%), and lack of understanding the fundamental basics of the physics problem (50.8%). Additionally, in Indonesia another study revealed that in dealing with problem solving in physics, college students had difficulty in comprehending the problems and had a hard time planning a solution (Sartika & Humaira, 2018). This gives emphasis to the importance of comprehending concepts and knowing how to cohere them so students would be ingenious in solving Physics problems.

A study conducted by Corpuz (2017) at the University of Perpetual Help System Laguna, Philippines, showed that the students found most of the Physics topics to be difficult. The students cited that their difficulty in physics was caused by their poor background in mathematics and that they had inadequate time for studying. Listening attentively to the lectures, note-taking, and studying alone were the learning strategies often utilized by the students to overcome the difficulties encountered in physics. However, their academic performance in physics remained fair.

In Davao City, research conducted by Bajana et al. (2017) showed that education students from the University of Immaculate Conception claimed that questions in physics were too difficult to answer. Results also showed that the attitude of the lecturer towards the subject as perceived by the students greatly affects the behavior of the students inside the classroom. Students shared that even though questions are too difficult to solve, they are always comfortable in asking and answering questions in the class, showing that the physics lecturer is friendly. This is in line with the argument that difficulties do not only stem from students' capacity but from the teacher as well (Owolabi & Adedayo, 2012).

However, little work has been done on the integration of learning strategies into physics courses. Based on the review of the prior research, the researchers identified two major gaps in the prior research and literature: an empirical gap and a population gap. First, there is an empirical gap in prior research, marked by a lack of rigorous research. Some of these unexplored learning strategies in physics appear to be important and worthy of investigation in the context of Davao del Norte State College (DNSC) students with physics subjects in their curriculum. An empirical investigation of these issues is important because it can become a framework for intervention programs that would help learners cope with their struggles in physics. Furthermore, previous research has focused primarily on quantitative and qualitative research concerning the difficulties of students in learning Physics. To date, very little to no study has directly attempted to evaluate learning strategies empirically.

The researchers also found a population gap. Some of the sub-populations have been unexplored and under-researched. The construct of learning strategies appears to be important and worthy of investigation in the context of Davao del Norte State College. An investigation of this group is important because it can add to the growing body of knowledge in the areas of teaching and learning, and fisheries and applied sciences where students' learning strategies in physics subjects are explored which will be relevant to their courses and future profession. Furthermore, previous research has focused primarily on the population of high school students and college students with courses highly inclined to physics like engineering. However, to the best of the researchers' knowledge, there are no existing studies which specifically examined Bachelor of Secondary Education major in Sciences, Bachelor of Science in Marine Biology, Bachelor of Science in Food Technology, and Bachelor of Science in Fisheries and Aquatic

Sciences students. Thus, these set the urgency of the study.

1.1. Research questions

The study was conducted to determine the construct of learning strategies in physics among college students. Specifically, the study sought to answer the following questions: What are the demographic profiles of the students in terms of sex, year level, and course? What are the constructs of learning strategies in physics among college students? What is the perception of college students with regard to learning strategies in physics?

1.2. Hypothesis

The hypothesis was tested at 0.05 level of significance. There is no construct that shapes the learning strategies in physics among college students.

2. THEORETICAL FRAMEWORK

Asian researchers are working together to construct the interest-driven creator (IDC) theory, which they hope will articulate a comprehensive theory of learning design for Asia's future educational system. This theory hypothesizes that students, driven by interest, can be engaged in the creation of knowledge (generating ideas and artifacts). They will excel in learning performance, acquire 21st century skills, and develop creativity habits if they repeat this creation process in their everyday learning routines. Interest, creation, and habit are the three anchoring concepts in the IDC Theory. The IDC theory is relevant to the study conducted as it explores students' learning strategies in physics. According to Chan, et al. (2019) when learning becomes interesting for students, they focus their attention, invest time and energy, exert effort effortlessly, enjoy the process, and consequently, excel in learning performance. Despite that, creation is the actual learning process. This means that students will intend to create something worth sharing with their peers, feel a sense of achievement, and take pride in the creation. Habits, which focuses on the third and final anchored concept of IDC where learning habits are built through interest-driven creation activities undertaken as daily learning routines (Chan et al., 2019).

These three component concepts that together make up each anchored concept make up a concept loop. For instance, the creation loop consists of three component concepts—imitating, combining, and staging. Imitating is concerned with taking in (or inputting) an abundant amount of existing knowledge from the outside world to form one's background knowledge. Combining is the process of integrating ideas from the students' prior knowledge with information already encountered in the outside world to supply (or create) new ideas or objects frequently. Staging relates to frequently demonstrating the generated ideas or artifacts to the relevant communities and receiving feedback from these communities to improve the novelty and value of the demonstrated outcomes while gaining social recognition and nurturing positive social emotions (Chan et al., 2019).

3. CONCEPTUAL FRAMEWORK

The study was conceptualized with the extent of uncovering the constructs of learning strategies in Physics among the students in Davao del Norte State College. The following were the predetermined variables in this study. According to Oxford Reference, predetermined variables are variables whose current and lagged values, but not necessarily future values, are uncorrelated with the current disturbance. More generally, it is a variable whose value is determined prior to the current period. Predetermined variables are often used as instrumental variables to tackle the endogeneity problem. Thus, these variables become the basis of our literature.

On the one hand, exploratory factor analysis was used to get these variables. EFA is based on the premise that observable variables, referred to as measured variables, can be reduced to a smaller number of latent variables, referred to as constructs that share a common variation (Ghani et.al., 2022). Thus, it determines the number of factors that influence measured variables and determines which measured variables are more tightly associated.

4. MATERIALS AND METHOD

The study employed a quantitative research design utilizing exploratory factor analysis (EFA) investigating the learning strategies of students towards their physics subjects. In this study, since learning strategies could have many variables, exploratory factor analysis was used to determine the construct of learning strategies in Physics among students of Davao del Norte State College, whether the constructs are significantly different when assessed through the demographic profiles, and which observable variables appear to best measure in each component.

The participants were 150 students who were selected using random sampling techniques. These respondents were students who had taken Physics subjects in the previous semester. Pallant (2020) stated that 150 respondents were adequate for EFA if the KMO value was greater than 0.7. The respondents answered the researcher-made questionnaire. The instruments underwent validity and reliability testing with Cronbach's Alpha score of 0.940 which means that the questionnaire had a strong reliability score. The data were tested and analyzed using frequency, EFA, and mean.

5. RESULTS AND DISCUSSION

Demographic information refers to the data on the characteristics or features that define an individual or population. According to Connelly (2013), in order to help researchers define the sample of people or organizations in their studies and improve their understanding of the population that they are investigating, obtaining demographic data is both crucial and beneficial. These data are reported in narrative or table format.

In this study, the respondents' demographic profiles were obtained, specifically, sex, year level, program, and senior high school strand. Based on the results gathered from one hundred fifty (150) respondents who participated in the study, most of the respondents were female (63.30%) and 36.70% were male. When grouped according to their programs, 30% came from BSED Sciences, 26.70% from BS in Marine Biology, 22% from BS in Fisheries and Aquatic Sciences, and 21.30% from BS in Food Technology. Regarding the year level, 28% were first-year students, 28.70% were second-year students, 20.70% were third-year students, and 22.70% were fourth-year students. When grouped with their senior high school strand, 30.70% were Technical Vocational and Livelihood students, 28.70% were General Academic Strand students, and 14% were Science, Technology, Engineering, and Mathematics students.

5.1. Exploratory factor analysis

The 45-item questionnaire was used to conduct an exploratory factor analysis (EFA) on the data collected in this quantitative phase. To evaluate the factorability of the correlation matrix and the likely number of factors, the factors were rotated. The hypothesis stating that no significant construct shapes physics understanding among college students was tested at the 0.05 level of significance and subsequently rejected. According to Pallant (2011) for the data to be considered for EFA, the correlation matrix should be *r= 0.30 or greater*, the Bartlett's test of Sphericity should be significant at *p=0.05,* and the Kaiser-Meyer-Olkin should be *0.60 or above*. These assumptions were satisfied as presented in Table 1. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy initially showed a KMO index of 0.851, which was higher than the minimum value of 0.60 (Tabachnick & Fidell, 2013). This demonstrates that sample adequacy was observed during the study, permitting factor analysis. In addition, the partial correlations of the items were established as a result of the significant result of Bartlett's test of sphericity. The results of these tests (Barlette's test = 0.000) indicate that factor analysis is appropriate. Moreover, with the initial eigenvalues higher than 1, which were used to identify the likely number of constructs to be extracted, 5 constructs explaining 49.92 percent of variance were extracted based on the outcome of the initial solution. Constructs with eigenvalues greater than 1 are considered vital, according to Tabachnick and Fidell (2013).

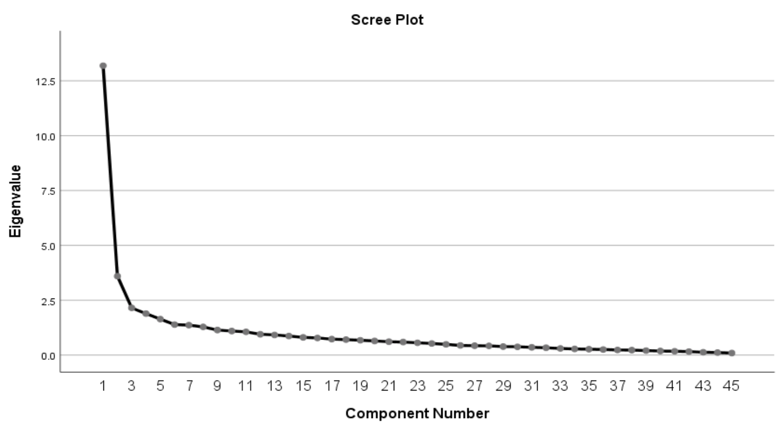

Figure 1. Scree plot of eigenvalues and factors

The varimax rotation was utilized as one of the orthogonal rotations in the third run of the EFA to minimize build complexity with maximized variance of factor loadings (Tabachnick & Fidell, 2013). The five constructs have been determined. Construct 1 accounted for 29.307% of item variance, while Construct 2 accounted for 7.992%, Construct 3 accounted for 4.777%, Construct 4 accounted for 4.197%, and Construct 5 accounted for 3.643% of item variance. The study also presented the scree plot of Eigenvalues and Factors as shown in Figure 1. The scree plot shows the principal component (x-axis) and the eigenvalue (y-axis). This will be utilized to examine the curve shape and locate the point at which it abruptly shifts. In the presented illustration (Figure 1), the screen plot revealed a clear break after the second component. This curve's point denotes the maximum number of components to keep (Ledesma et al., 2015). Consequently, the significant number of factors to be extracted for factor analysis is the number of factors before the curve flattens.

Table 1. Factor loadings of the learning strategies of learning physics among college students

Items	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Q21. Collaborating with classmates for brainstorming and understanding Physics.	0.680				
Q23. Seeking clarification from instructors when conflicting information is found.	0.593				
Q25. Directly asking teachers for clarification instead of relying on classmates.	0.676				
Q32. Actively listening to instructors during discussions.	0.617				
Q34. Teaching classmates to reinforce understanding and familiarity with Physics.	0.699				
Q5. Actively engaging with concepts through understanding, note-taking, and writing.		0.648			
Q15. Employing mnemonics for memorizing Physics terms and formulas.		0.536			
Q28. Documenting personal understanding of Physics concepts for future reference.		0.581			
Q29. Taking notes during instructor-led calculations or video explanations.		0.647			
Q31. Transcribing word-by-word explanations during lectures.		0.514			
Q33. Memorizing formulas from various topics to facilitate problem-solving.		0.596			
Q35. Conducting self-assessment through question creation and quizzes.		0.703			
Q44. Reviewing junior high school Physics topics as a foundation for current coursework.		0.601			
Q17. Using paper cut-outs as flashcards for efficient memorization.			0.655		
Q20. Persistence and practice when faced with challenging concepts and problems.			0.594		
Q24. Attempting problems set before concluding their difficulty.			0.645		
Q41. Adjusting and experimenting with different learning strategies if ineffective.			0.558		
Q7. Requesting practice problems from instructors.				0.525	
Q11. Reading problem-solving instructions before attempting assignments.				0.658	
Q18. Deriving formulas by understanding variables and their relationships.				0.518	
Q26. Breaking down lessons into smaller, manageable concepts.				0.598	

Items	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Q30. Prioritizing understanding of fundamental concepts before problem-solving.				0.562	
Q39. Reviewing and organizing notes after class to reinforce learning.				0.665	
Q3. Seeking supplementary materials and resources to enhance conceptual understanding.					0.530
Q6. Finding examples and formulas online to assist in problem-solving.					0.577
Q9. Engaging multiple senses (eyes, ears, hands) while learning Physics.					0.541
Q10. Establishing a consistent learning routine and dedicating time daily.					0.646
Q12. Utilizing internet resources to supplement learning beyond provided materials.					0.763
Q13. Creating a peaceful learning environment to minimize distractions.					0.531
Q19. Attempting to solve problems independently during board work sessions.					0.691
Q38. Ensuring attendance in Physics class to avoid missing important discussions.					0.626
Q42. Engaging in focused early morning study sessions prior to tests or quizzes.					0.541
Q43. Recognizing the optimal times for independent learning versus collaborative learning.					0.736

Rotation method: Varimax with Kaiser Normalization

KMO of Sampling Adequacy: 0.851

Barlette's Test of Sphericity: 0.000

Cronbach's Alpha: 0.940

As presented in Table 1, the first construct has five items; three items have a very good factor loading, and these items are Item Q21, "Collaborating with classmates for brainstorming and understanding Physics", with a factor loading of 0.680; Item Q25 "Directly asking teachers for clarification instead of relying on classmates", with a factor loading of 0.676; and Item Q34, "Teaching classmates to reinforce understanding and familiarity with Physics", with a factor loading of 0.699. Moreover, two of the items, Q23 and Q32, have a factor loading interpretation of good with a factor loading of 0.593 and 0.617.

Osei and Appiah-Twumasi (2021) defined the cooperative learning strategy as an instructional learning strategy in which students are divided into groups with diverse ability levels who will work together on a common task, supporting and encouraging one another to improve student learning experiences. According to Willis (2021) the interactive and interdependent components provide emotional and interpersonal experiences that strengthen judgment, critical thinking, and flexibility of perspective, creative problem-solving, innovation, and goal-directed behavior. Furthermore, in the study of Adolphus et al. (2013) when students work together to solve physics problems, they become more motivated. Students who were taught utilizing a collaborative learning strategy had significantly better problem-solving skills than those who were taught using the traditional approach.

The second construct has a total of eight items. Only three items such as Q5, "Actively engaging with concepts through understanding, note-taking, and writing" with a factor score of 0.648; Item Q29, "Taking notes during instructor-led calculations or video explanations" with a factor score of 0.647; and Item Q35, "Conducting self-assessment through question creation and quizzes" with a factor score of 0.703 are classified to have a very good factor score. Meanwhile, Item Q28, "Documenting personal understanding of Physics concepts for future reference" with a factor loading of 0.581; Item Q33, "Memorizing formulas from various topics to facilitate problem-solving" with a factor loading of 0.596; and Item Q44, "Reviewing junior high school Physics topics as a foundation for current coursework" with a factor loading of 0.601 are classified to have a good factor score. On the other hand, items such as Q15, "Employing mnemonics for memorizing Physics terms and formulas" with a factor loading of 0.536 and Item Q31, "Transcribing word-by-word explanations during lectures" with a factor loading of 0.514 are classified to have a fair factor score.

As defined, elaboration is a learning strategy that organizes the learning from general to specific and also provides a summary for a review of the subject content (Priawasana et al., 2020). Furthermore, elaboration is also a cognitive learning strategy that involves the enhancement of information that gives clarifications on the relationship between information to be learned and related information (Hamilton, 2012). Moreover, according to Tay (2013) elaboration strategies, such as interpreting, summarizing, memorizing, making analogies, and effective notetaking, help students store new knowledge in their long-term memory by making internal links between things to be learned.

For the third construct it has four items in total, wherein two items namely Q17, "Using paper cut-outs as flashcards for efficient memorization" with a factor loading of 0.655 and Q24, "Attempting problem sets before concluding their difficulty" with a factor loading of 0.645 are classified to have a very good factor score. In contrast, item such as Q20, "Persistence and practice when faced with challenging concepts and problems" with a factor loading of 0.594 and Q41, "Adjusting and experimenting with different learning strategies if ineffective" with a factor loading of 0.558 are interpreted to have a good factor value.

In relation to the third construct, revising knowledge strategy helps students examine their deeper understanding of critical content composed of multiple discrete cognitive processes that includes (1) reviewing prior knowledge; (2) identifying and correcting mistakes, misconceptions, or misunderstanding; (3) identifying gaps in knowledge; (4) amending prior knowledge; and (5) explaining the underlying reasons for specific knowledge revisions (Schmidt et al., 2015). It is important to note that students need to take regular breaks to make revising knowledge strategies become more effective, efficient, and manageable. Furthermore, it is also important for the students to check their progress while doing "revising strategy" for them to help find the ideas and concepts that are lacking (Wangdi & Zangmo, 2021). Thus, to gain a better understanding of the subject concepts, the student should make revision notes. It allows them to translate concepts into their own words, making them easier to understand, and that having more revision notes is associated with higher achievements (Luo et al., 2016) and also improves class participation (Wangdi & Zangmo, 2021).

Construct 4 has a total of six items. Item Q11, "Reading problem-solving instructions before attempting assignments" with a factor score of 0.658 and Q39, "Reviewing and organizing notes after class to reinforce learning" with a factor score of 0.665 are items that classified to have a very good factor value. Moreover, Q26, "Breaking down lessons into smaller, manageable concepts" with a factor score of 0.598 and Q30, "Prioritizing understanding of fundamental concepts before problem-solving" with a factor score of 0.562 are described to have a good factor value. Meanwhile, only item Q7, "Requesting practice problems from instructors" with a factor score of 0.525 and Q18, "Deriving formulas by understanding variables and their relationships" with a factor score of 0.518 are interpreted to have a fair factor value.

In connection, students with various personalities, skills, and requirements can generally benefit from utilizing organizational strategies. This method is crucial for all students since it facilitates the organization of dense subject matter by segmenting the learning material into sensible sequences. (Wegner et al., 2013). This sequence includes the organization of experiences in which students may try guided discoveries to give them the opportunity to construct understanding, which is important to produce deeper learning. Moreover, this also increases the chance for the students to remember content. Using this guided discovery strategy serves as a stimulus for planning, learning, thinking, reflecting, investigating, predicting, reporting, and questioning, which are important factors for the students to become more creative, resourceful, innovative, interactive and construct new ideas. These are important skills that science students need to develop (Akinbobola, 2015).

A total of ten items under this last construct, two items have an excellent factor loading, and these items are Q12, "Utilizing internet resources to supplement learning beyond provided materials" with a factor score of 0.763 and Q43, "Recognizing the optimal times for independent learning versus collaborative learning" with a factor score of 0.736. Furthermore, there are two items interpreted to have a very good factor value namely item Q10, "Establishing a consistent learning routine and dedicating time daily" with a factor score of 0.646 and Q19, "Attempting to solve problems independently during board work sessions" with a factor score of 0.691. Meanwhile, item Q6, "Finding examples and formulas online to assist in problem-solving" with a factor score of 0.577 is only classified as having a good factor value. On the other hand, there are four items described as having fair factor values, such as Q3, Q9, Q13, and Q42 with a factor of 0.530, 0.541, 0.531, and 0.541 respectively.

According to Nwangwa and Amadi (2018) students have a sense of ownership and control of their learning, which allows them to learn on their own actions and direct, regulate and assess their learning. When students are learning independently, they can set their goals, make their choices, and make decisions on how to meet their learning needs. In learning physics, they have control over their own pace of learning and can assess their learning goals to determine meaningful learning. In relation to the results of the study, it is confirmed that students find their own ways to learn physics. Student learning strategies include utilizing valid internet resources, finding time to learn independently, establishing study routines, solving board problems on their own, and finding sample problems online to assist in problem-solving.

Furthermore, in assessing the internal consistency of the questionnaire of construct, Cronbach's alpha was computed. Cronbach's alpha reliability coefficient for all constructs reached 0.940 in which, according to Hair et al. (2017) indicates that a reliability higher than 0.90 is regarded as excellent; thus, construct reliability was confirmed.

5.2. Level of college student perception towards learning strategies in Physics

Higher education is a way of acquiring knowledge, skills, and competencies through a continual process of learning by doing (Anggaryani et al., 2023). Moreover, teachers also need to create different teaching methods and practices to make sure that the students are equipped with STEM knowledge, skills, and capabilities in learning (Ismail et al., 2022). In this study, researchers were able to identify different learning strategies in learning physics. Table 2 presents the constructs of learning strategies in Physics among college students. It has an overall mean of 3.29 with a standard deviation of .597. This means that the students' learning strategies in physics are sometimes manifested.

Additionally, it was also shown that the overall description under the Control Strategy construct had high results, having the highest mean among other identified constructs. The mean score of students' perception of the Control Strategy as they learn Physics is 3.60 with a standard deviation of .582. This means that students' control strategy is often manifested. Having high control strategies will drive students to stay active and to achieve positive learning and achievement outcomes. Moreover, it is also helpful for the students who are struggling academically to have control strategies since it will also help improve performance outcomes (Keyserlingk et al., 2022). Control strategies describe students' willingness to manage their own learning by consciously monitoring their progress with respect to personal goals, motivation, and self-belief (Schweder, 2019).

Table 2. Level of learning strategies in Physics as perceived by the students

Learning Strategies in Physics	Mean	SD	Descriptive Equivalent
Factor 1: Cooperation Strategy	3.39	.760	Moderate
Factor 2: Elaboration Strategy	3.17	.732	Moderate
Factor 3: Revision Strategy	3.16	.684	Moderate
Factor 4: Organizational Strategy	3.23	.708	Moderate
Factor 5: Control Strategy	3.60	.582	High
Overall	**3.29**	**.597**	**Moderate**

Additionally, learners who perform self-regulation are those who are active and aware of their educational development. It is more likely for them to persevere and to achieve better results when they are faced with challenging academic settings (Zusho, 2017; Wang & Guan, 2020). Thus, when students are not actively conscious of their learning progress, it leaves students doubting their ability to succeed, making them hesitant to engage in learning or take appropriate academic growth risks (American Psychological Association, 2023). The result implies that students were not very conscious and consistent in learning physics as they have not established a well-defined learning routine. Students may lack motivation in making progress or development, especially when they encounter difficult concepts.

It was also presented in Table 2 that the overall description under the Cooperation Strategy construct had moderate results. The mean score of how students perceived the Cooperation Strategy as they learn Physics is 3.39 with a standard deviation of .760. This means that students' cooperation strategy is sometimes manifested. Cooperation Strategy has been found effective in a broad range of subjects because it is often recognized as learner centered where students work together, having emerged in opposition to the more traditional methods (Moges, 2019). According to Johnson et al. (2013), it can enhance both students' own and each other's learning. Which is why, in the lack or absence of cooperation strategies, students might find themselves struggling because they will be responsible for all their tasks and learning. When learning physics is done through cooperation, students will use a variety of learning activities in which will improve the learning experiences and improve teamwork, evaluation of students' learning, and appropriate group functioning (Appiah-Twumasi et al., 2020). Thus, the result implies that the lack of brainstorming, hesitance to ask questions and help from a knowledgeable other were some of the reasons why students struggled in understanding physics. Students might have been asking their peers, who were also having their own difficulties, which led to more misconceptions and confusion.

In Table 2, it was shown that the overall description under the Organizational Strategy construct had moderate results. The mean score of students' perception of the Organizational Strategy as they learn Physics is 3.23 with a standard deviation of .708. This means that students' organizational strategies are sometimes manifested. By using organizational strategies, deep learning occurs, especially when combined with an elaboration strategy. Using these strategies will help in analyzing and synthesizing information in ways that build a mental model linked to prior knowledge in memory. Deep learning includes organization of approaches including interaction with the knowledge content, relating ideas to previous knowledge and experiences, discovering and using organizing principles to integrate ideas, connecting evidence to the conclusions, and assessing empirical arguments (Guido, 2013). On the other hand, students who are unable to create manageable pieces of content will be more likely to be overloaded with information. The result implies that students have difficulties in understanding complex physics concepts because they were unable to use effective scaffolding techniques to absorb the lessons better. Also, the lack of practice in following and understanding the step-by-step process of problem solving hinders the students from solving accurately solved problems set by themselves, which is important in quizzes and exams where they must rely on their own scientific abilities.

Meanwhile, based on Table 2, it was shown that the overall description under the Elaboration Strategy construct had moderate results. The mean score of how students perceived the Elaboration Strategy as they learn Physics is 3.17 with a standard deviation of .732. This means that students' elaboration strategy is sometimes manifested. Elaboration strategies promote both understanding and memory of new information since students establish connections between new knowledge and the existing body of knowledge. These techniques encourage understanding-based learning (Wegner, et al., 2013). It involves making information more integrated and organized within existing knowledge structures. By connecting and integrating the to-be-learned information with other concepts in memory, this increased organization presumably facilitates the reconstruction of past learning at the time of retrieval (Weinstein et al., 2018). However, when students lack essential prior knowledge, learning is typically incomplete and fragmented. Students will have trouble understanding how one thought links to another, distinguishing between main ideas and details, and creating a coherent summary of the learning material. Additionally, student misconceptions of the subject matter are common, but it can interfere with new learning. Some misconceptions are minor glitches that students work out on their own; others can be tenacious, resistant to instruction, and lead to serious misinterpretations of new material (Vosniadou, 2013; Bensley & Lilienfeld, 2017). Thus, the result implies that students face challenges in learning physics because they lack an elaboration strategy, which essentially connects prior knowledge to new knowledge. Students were ineffective in establishing their schema as they struggled in scaffolding learning. They specifically lack notetaking, memorizing, and reviewing techniques, which would have helped them understand physics in a step-by-step manner.

Based on Table 2, it was shown that the overall description under the Revision Strategy construct had moderate results. The mean score of students' perception of the Revision Strategy as they learn Physics is 3.16 with a standard deviation of .684. This means that students' revision strategies are sometimes manifested. Revision strategy is when students smooth out the flow of their thoughts. It involves repetitive learning of word or vocabulary lists, memorization techniques which can be used to learn any other knowledge, such as rules and tables (Wegner et al., 2013). Additionally, there are fluency problems to be solved that involve reading comprehension and real-life situations. Since physics involves mathematics, repetition is fundamental to becoming competent with it as students gain fluency. Repetition in learning physics improves retention of students, which is a desirable factor to improve the problem-solving skills of the students (Voice & Stirton, 2020). Thus, in coherence with the result, this implies that students were having difficulties in physics because they were not consistent in revising their learnings. Students easily give up when faced with hard-to-solve problems, which demotivates them from attempting to solve such challenges.

6. CONCLUSIONS

Based on the results of the study, the following conclusions are made: The study found out that there are (5) five constructs of learning strategies in Physics among college students namely Cooperation Strategy, Elaboration Strategy, Revision Strategy, Organizational Strategy, and Control Strategy, with Control Strategy having the highest mean.

Moreover, this study recognizes the usefulness of the Interest Driven Creator (IDC) Theory in investigating educational themes such as the learning strategies of students. Through this, we were able to acquire salient information that helped us understand how students adjust and adapt learning strategies to achieve scientific knowledge and skills. This theory also teaches the students that they will excel in learning performance, acquire 21st century skills, and develop creative habits if they repeat this creation process in their everyday learning routines. Thus, this implies that students should become interested in learning Physics, focus their attention on learning, spend time and energy, make an effort without feeling that they are making effort, and enjoy learning.

Furthermore, the Constructs of Learning Strategies in Physics among students in Davao del Norte State College was developed and established an excellent reliability score, allowing the students to reflect on their learning, and gain insights on what strategies they need to add or incorporate to better their understanding and combat their difficulties in Physics. As a result, it gives both the students who have already units in Physics courses, and incoming students the chance to develop and enhance their learning strategies as they gear towards more challenging Physics concepts and calculations.

Lastly, the research hypothesis was rejected because there are constructs of learning strategies in Physics among students at Davao del Norte State College.

ACKNOWLEDGMENT

The researchers would like to acknowledge the college students of Davao del Norte State College for taking part in the success of this study. The researchers would like to thank the Institute of Teacher Education and Davao del Norte State College for allowing the researchers to conduct the investigation.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

REFERENCES

Adolphus, T., Alamina, J., & Aderonmu, T. S. B. (2013). The Effects of Collaborative Learning on Problem Solving Abilities among Senior Secondary School Physics Students in Simple Harmonic Motion. *Journal of Education and* Practice, *4*(25), 95–100.

American Psychological Association. (2023). *Students experiencing low self-compassion or low perceptions of competence*. https://www.apa.org/ed/schools/primer/self-esteem

Anggaryani, M., Prastowo, T., Suprapto, J., Lassa, J., Madlazim, F. Alifteria, F. A., Agusty, A. I., & Lestari, N. A. (2023). Virtuali reality as experiential learning to promote STEM-DRR in tertiary education. *ASM Science Journal*, *18*, 1-12. https://doi.org/10.32802/asmscj.2023.1370

Akinbobola, A. O. (2015). Enhancing transfer of knowledge in Physics through effective teaching strategies. *Journal of Education and Practice*, *6*(16), *37-44.*

Appiah-Twumasi, E., Antwi, V., Anderson, I. K., & Sakyi-Hagan, N. (2020). Comparative effects of cooperative learning on students' performance in Mechanics Concept: A case of two secondary schools in Berekum Municiplaity, Ghana. *East African Journal of Education and Social Sciences*, *1*(1), 139-151. https://doi.org/10.46606/eajess2020v01i01.0015

Badmus, O. T. & Jita, L. C. (2022). Pedagogical implications of spatial visualization abilit: A correlate of students' achievement in Physics. *Journal of Turkish Science Education*, *19*(1), 97-110. 10.36681/tused.2022.112

Bajana, A. C. & Castanares, G. & Aoanan, G. (2017, October 18). *Attitude towards Physics of education students of the University of the Immaculate Conception* [Poster presentation]. 19th Samahang Pisika ng Visayas at Mindanao, University of San Carlos, Cebu City, Philippines. 10.13140/RG.2.2.25752.01284.

Bensley, D. A., & Lilienfeld, S. O. (2017). Psychological misconceptions: Recent scientific advances and unresolved issues. *Current Directions in Psychological Scienc*e, *26*, 377–382.

Bug-os, M. A. A., & Caro, V. (2019). Academic performance and attitudes towards General Physics of grade 12 students in a Process-Oriented Guided Inquiry Learning (POGIL). *Science International*, *31*, 31-34.

Chan, T. W., Looi, C. K., Chang, B., Chen, W., Wong, L. H., Wong, S. L., & Chou, C. Y. (2019). IDC theory: creation and the creation loop. *Research and Practice in Technology Enhanced Learning*, *14*, 1-29. https://doi.org/10.1186/s41039-019-0120-5

Connelly, L. M. (2013). Demographic data in research studies. *PubMed*, *22*(4), 269–270. https://pubmed.ncbi.nlm.nih.gov/24147328

Corpuz, A. C. (2017). Difficulties encountered, learning strategies and academic performance in physics of Psychology students. *Journal of Social Sciences (COES&RJ-JSS)*, *6*(2), 365-374.

Ekici, E. (2016). "Why do I slog through Physics?" Understanding high school students' difficulties in Learning Physics. *Journal of Education and Practice*, *7*(7), 95-107. https://files.eric.ed.gov/fulltext/EJ1095264.pdf

Ghani, N. H. M., Abdullah. S., Ismail, M. K., Ahmad, N., Affandi, S., Mohamad, N. A., & Manaf, S. M. A. (2022). An exploratory factor analysis on the open and distance learning among university students during the COVID-19 Pandemic in Malaysia. *Asian Journal of University Education (AJUE)*, *18*(3), 724-734. https://doi.org/10.24191/ajue.v18i3.18956

Guido, R. M. D. (2013). Attitude and motivation towards learning Physics. *Internasional Journal of Engineering Research & Technology*, *2*(1), 2087-2094.

Hair, J. F., Hollingsworth, C. L., Randolph, A. B., Chong, A. Y. (2017). An updated and expanded assessment of PLS-SEM in information systems research. *Industrial Management and Data Systems*, *117*(3), 442– 458. Hamilton, R. (2012). Elaboration effects on learning. In: Seel, N. M. (Ed.), *Encyclopedia of the Sciences of Learning* (pp. 1103–1105).

Springer, Boston, MA. https://doi.org/10.1007/978-1-4419-1428-6_170

Ismail, M. H., Fadzil, H. M., Saat, R. M., & Salleh, M. F. M. (2022). A needs analysis study for the preparation of integrated STEM instructional practices through scientis-teacher-student- partnership (STSP). *ASM Science Journal*, *17*, 2-16. https://doi.org/10.32802/asmscj.2022.1112

Johnson, D. W., Johnson, R., & Holubec, E. (2013). *Cooperation in the classroom* (9th ed.). Edina, MN: Interaction Book Company. Johnson, N. (2012). Teacher's and Student's

Perceptions of Problem Solving Difficulties in Physics, *International Multidisciplinary e-Journal*, *I*(V), 97-101.

Ledesma, R. D., Valero-Mora, O., & Machbeth, G. (2015). The scree test and the number of factors: A dynamic graphics approach. *The Spanish Journal of Psychology*, *18*, Article E11. https://doi.org/10.1017/sjp.2015.13

Keyserlingk, L. V., Rubacj, C., Lee, H. R., Eccles, J. S., & Heckhausen, J. (2022). College students' motivational beliefs and use of goal-oriented control strategies: integrating two theories of motivational behavior. *Motivation and Emotion*, *46*, 601-620. 10.1007/s11031-022-09957-y

Lodge, J. M., Kennedy, G., Lockyer, L., Arguel, A., & Pachman, M. (2018). Understanding Difficulties and resulting Confusion in Learning: *An Integrative review. Frontiers in Education*, 3. https://doi.org/10.3389/feduc.2018.00049

Moges, B. (2019). Practises and challenges of cooperative learning in selected college of Arsi university: As a motivational factor on enhancing students' learning. *Universal Journal of Psychology*, *7*(1), 1-17. https://doi.org/10.13189/ujp.2019.070101

Nwangwa, K. C. K., & Amadi, U. (2018). Mapping as an independent learning strategy for students' academic performance. *Internasional Journal of Innovative Education Research*, *6*(1), 121-127.

Oon, P. & Subramaniam, R. (2011) On the Declining Interest in Physics among Students—From the perspective of teachers, *International Journal of Science Education*, *33*(5), 727-746, 10.1080/09500693.2010.500338

Oral, I. & Erkilic, M. (2022). Investigating the 21st century skill of undergraduate students: Physics success, attitudes, and perception. *Journal of Turkish Science Education*, *19*(1), 288-305. 10.36681/tused.2022.122

Osei, J. K., & Appiah-Twumasi, E. (2018). Cooperative learning strategy: Effective student-centered intervention to enhance performance and knowledge retention. *Internasional Journal of Innovative Research and Adnaced Studies*, *5*(5), 151-156.

Owolabi, O. T., & Adedayo, J. O. (2012). Effect of Teacher's Qualification on the Performance of Senior Secondary School Physics Students: Implication on Technology in Nigeria. *English Language Teaching*, *5*(6), 72-77. https://doi.org/10.5539/elt.v5n6p72

Pallant, J. (2011). *SPSS survival manual: A step by step guide to data analysis using the SPSS program*. (4th ed.). Allen & Unwin, Berkshire.

Pallant, J. (2020). *SPSS Survival Manual: A step by step guide to data analysis using IBM SPSS* (7th ed.). Routledge. https://doi.org/10.4324/9781003117452

Priawasana, E., Degeng, I. N. S., Utaya, S., & Kuswandi, D. (2020). An experimental analysis on the impact of elaboration learning on learning achievement and critical thinking. *Universal Journal of Educational Research*, *8*(7), 3274-3279. 10.13189/ujer.2020.080757

Reddy, M., & Panacharoensawad, B. (2017). Students problem-solving difficulties and implications in Physics: An empirical study on influencing factors. *Journal of Education and Practice*, *8*(14), 59-62.

Sartika, D., & Humairah, N. A. (2018). Analyzing students' problem solving difficulties on modern physics. *Journal of Physics*, *1028*, 012205. https://doi.org/10.1088/17426596/1028/1/012205

Schmidt, R. A., & Marzano, R. J. (2015). *Revising knowledge: Classroom techniques to help students examine their deeper understanding*. Learning Sciences International.

Schweder, S. (2019). The role of control strategies, self-efficacy, and learning behavior in self-directed learning. *International Journal of School & Educational Psychology*, *7*(sup1), 29-41.

Shirazi, S. (2017). Student experience of school science. *Internasional Journal of Science Education*, *39*(14), 1891-1912. 10.1080/09500693.2017.1356943

Tabachnick, B. G., & Fidell, L. S. (2013). Using multivariate statistics (6th ed.). Boston, MA: Pearson.
Tay, B. (2013). Elaboration and organization strategies used by prospective class teachers while studying social studies education textbooks. *Egitim Arastirmalari-Eurasian Journal of Educational Research*, *51*, 229-252

Voice, A. & Stirton, A. (2020). Space reptitition: Towards more effective learning in STEM. *New Directions in the Teaching of Physical Sciences*, *15*(1), 1-10. https://doi.org/10.29311/ndtps.v0i15.3376

Vosniadou, S. (Ed.), (2013). *International handbook of research on conceptual change* (2nd ed.). New York, NY: Routledge.

Wang, Y. L., & Guan, H. F. (2020). Exploring demotivation factors of Chinese learners of

English as a foreign language based on positive psychology. *Rev. Argent. Clin. Psicol. 29*, 851–861. doi: 10.24205/03276716.2020.116

Wangchuk, D., Wangdi, D., Tshomo, S., & Zangmo, J. (2023). Exploring students' perceived difficulties of learning Physics. *Educational Innovation and Practice*, *6*, 1-11. https://doi.org/10.17102/eip.6.2023.03

Wangdi, N., & Zangmo, D. (2021). Inculcating the habit of revision to enhance students' learning outcomes. *Universe International Journal of Interdisciplinary Research*, *2*(6), 66-77. https://www.doi-ds.org/doilink/12.2021-17341444/UIJIR

Wegner, C., Minnaert, L., & Strehlke, F. (2013). The importance of learning strategies and how the project 'Kolumbus-Kids' promotes them successfully. *European Journal of Science and Mathematics Education*, *1*(3), 137–143. https://doi.org/10.30935/scimath/9393

Weinstein, Y., Madan, C. R., & Sumeracki, M. A. (2018). Teaching the science of learning. *Cognitive Research: Principles and Implications*, *3*(1), 1-17. https://doi.org/10.1186/s41235-017-0087-y

Wong, B., Chiu Y., Murray, O., Horsburgh, J. & Copsey-Blake, M. (2022): 'Biology is easy, physics is hard': Student perceptions of the ideal and the typical student across STEM higher education, *International Studies in Sociology of Education*, *32*(1), 118-139. https://doi.org/10.1080/09620214.2022.2122532

Zusho, A. (2017). Toward an integrated model of student learning in the college classroom. *Educ. Psychol. Rev. 29*, 301–324. https://doi.org/10.1007/s10648-017-9408-4