Research Article

Strategic Learning and Metacognitive Skills in Mathematics of The Bachelor of Industrial Technology at A University in Roxas City, Capiz

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ABSTRACT

Students frequently believe that mathematics is a challenging subject to learn. The learners must have the necessary skills to study the material quickly as a result. The idea that learners can select various methods for completing particular tasks is implied frequently by the term "strategic learning skills". This strategy can help students develop their critical-thinking and artistic abilities in the classroom. The investigation aims to determine the level of strategic learning skills of students that affect their level of metacognitive skills in Mathematics. The study used the survey-correlational method of research in gathering data. The participants of this study were the 158 BS in Industrial Technology second-year students, officially enrolled in Capiz State University – Main Campus randomly selected using stratified sampling. Data were gathered using a 50-item researcher-made Strategic Learning Skills Questionnaire and a 35-item standardized Metacognitive Skills Questionnaire. Frequency count, percentage, mean, standard deviation, One-way ANOVA, and Pearson r were used as statistical tools. Inferential tests were at the alpha level of significance set at 0.05. Findings revealed that the level of strategic learning skills of the second-year learners of the BS in Industrial Technology was "high". In consonance, the level of their metacognitive skills in Mathematics was "evident". These led to the conclusion that there were no appreciable differences in the metacognitive abilities among the strategic learning skill levels of the second-year BS in Industrial Technology learners. There was no connection between the second-year students of BS in Industrial Technology's strategic learning and metacognitive skills in Mathematics.

Keywords: *Mathematics, Metacognitive skills, Strategic learning skills*

Introduction

Mathematics is one of the fundamental educational components that students must master to structure their lives. Rhodes (2019) deduced that this field of study relies on metacognition. Interestingly, metacognition was considered a strong predictor of learning performance. The introduction of metacognition at

such a prominent position in the process of learning is based on the premise that this capacity is beneficial to making sure that individual gains skills for self-learning (Akpunar, 2011). Learners in modern information culture have to assume ownership of their learning and be knowledgeable of how to do so. In today's world, how people learn is more important than what they learn, and learners must be able to learn. Students who do so can plan, organize, and assess the outcomes of their educational experience, and perform better without the need for someone to educate them during their lives. Individuals learning to learn can identify and evaluate the requirements they have for learning, objectives, learning methods, tactics, and materials. The critical capacities or learning to learn necessitates the development of people's metacognition skills as well as their effective and efficient application of these skills. It is with this notion that the ability to learn is linked to metacognition, and the process begins with metacognition development (Oguz and Ataseven, 2016).

Strategic learning skills include making deliberate judgments and taking action to improve academic progress or attain an educational objective. Learners should take a proactive part in the educational process, discovering the way to acquire information and investigation at a higher stage, employing particular methods of learning and adjusting them to various sorts of classes and tasks, integrating information by obtaining an educational objective, self-assessing, evaluation, and maintaining (controlling) learning are all examples of strategic instruction in college (Giordano, n.d.). In like manner, strategic thinking not only assists students in achieving success in all sorts of schooling but also assists them in continuing their education in school and at employment (Moshirvaziri, 2021). The relationship between students' intentional abilities in learning and metacognitive skills is critical in mathematics and critical learning capabilities is the process by which students construct knowledge.

When it pertains to learning Mathematics, kids have varied perceptions according to the researcher. This course is a tough topic for many that lead to an absence of engagement in class, motivation to attend class, and low achievement in the subject. It was observed by the investigator that learners faltered when the teacher starts to raise questions concerning the lesson throughout the online class discussion. One should regularly pose inquiries and encourages the students to ask inquiries as well. In this manner, the learner will be at ease and can compose their thoughts and evaluate their learning. One could gauge how students address issues and challenges, as well as how learners' mindsets work, particularly when.

This tendency occurs in educational environments and is seen by the researcher, prompting her to conduct the study to evaluate students' strategic learning skills and their influence on students' metacognitive skills in the Mathematics topic. Purposely, the investigator as a Mathematics Instructor intended to figure out how strategic students are when studying Mathematics and what strategic learning skills they should have.

Methods

The survey-correlational research approach was used in this study. As postulated by Fraenkel and Wallen (2019), surveys as descriptive methods further examine the efficacy and precision of the research's objectives. In this process, a researcher attempts to gather data on events that are not possible to observe, surveys can be valuable. This approach was widely used in information science and libraries to examine attitudes and characteristics on various topics. Further, a correlation study looks at the connections among multiple sets of data and aids in determining the degree to which certain factors were related to one another, probability is counted, percentage terms, mean, and average deviation were the descriptive statistics employed in the study. In congruence with this, ANOVA and Pearson r were used as inferential statistics including the significance threshold was established at 0.05. Participants in this study were the 158 BS in Industrial Technology second-year students who had been officially accepted at Capiz State University - Main Campus for the period covered by the academic calendar of 2021-2022 and were chosen at random using stratified sampling.

A 50-item researcher-made Strategic Learning Skills Questionnaire was made to

measure the students' strategic learning skills. A questionnaire consisted of practice testing, distributed practice, interleaved practice, elaborative interrogation, and self-explanation. The data-gathering instrument underwent content validation by a panel of experts. Subsequently, after the face and content validation, it was pilot tested to thirty (30) students who were not included as participants in the study. The aftermath of the pilot testing was used in determining Cronbach's Alpha and reliability testing of the research instrument using the Statistical Package for Social Science (SPSS) software. Along with the above procedures was reliability testing of the instrument, and the reliability index was .974 implying that that the instrument was reliable and valid. Learners' metacognitive skills in Mathematics were measured using a 35-item standardized metacognitive skills questionnaire adopted from Ruance, (2020). Their analytical abilities in mathematics were assessed by employing a 35-item conventional metacognitive skills questionnaire developed by Ruance (2020). Further, declarative understanding, procedural understanding, contingent understanding, organizing, appraisal, and comprehension monitoring were all classified. A questionnaire was adapted from a recent study, it wasn't subjected to reliability testing. The Statistical Software Program for Social Sciences, or SPSS, software was used to process, encode, and analyze the obtained data. The findings were kept completely private. For the entire investigation, ethical issues were observed.

Results and Discussion
Descriptive Data Analysis
Table 1. Level of Strategic Learning Skills of the Bachelor of Industrial Technology Second-Year Students

Mean and Standard Deviation of Strategic Learning Skills			
Variable	Mean	Description	SD
Strategic Learning Skills	3.51	High	0.75

Scale	Description
4.21 – 5.00	Very High
3.41 – 4.20	High
2.61 – 3.40	Moderate
1.81 – 2.60	Low
1.00 – 1.80	Very Low

Second-year BS in Industrial Technology students had "high" strategic learning skills (M = 3.51, SD = 0.75). The participants' high level of proactive learning skills implies that the second-year BS in Industrial Technology students apply their strategic learning abilities majority of the time. It showed that learners are strategic enough to manage and participate in their education. Interestingly, the outcome suggests that the students monitored their understanding and evaluated the concepts covered in the lecture. Along with this, learners are aware of what they are unaware of as well as what they must know. Data revealed that the high degree of proactive learning skills implies that they practice studying related ideas on the same occasion. Participants went back and collect previously learned concepts regularly, and they establish connections between the various concepts to be acquired and clarify how they operate together. In the process of learning, the investigator creates difficulties after learning and answers them to evaluate if they are progressing.

This finding is corroborated by Malmberg, Järvenoja, & Järvelä, 2013 who averred that learners need to have the chance to take part in their own problem-solving and engagement in order to be strategic. This also applies on how learning is regulated. Challenge situations encourage learners to adjust and modify their strategic activity. Without challenges, there is no need for the regulation of learning (Hadwin et al., 2011).

Table 2. Level of Metacognitive Skills of the Bachelor of Industrial Technology Second-Year Students

Mean and Standard Deviation of Metacognitive Skills in Mathematics

Variable	Mean	Description	SD
Metacognitive Skills in Mathematics	3.60	Evident	0.77

Scale	Description
4.21 – 5.00	Very Evident
3.41 – 4.20	Evident
2.61 – 3.40	Moderately Evident
1.81 – 2.60	Less Evident
1.00 – 1.80	Least Evident

Second-year BS in Industrial Technology students have "evident" analytical abilities in Mathematics (M = 3.60, SD = 0.77). Involved participants' apparent level of metacognitive skills suggests that second-year BS in Industrial Technology students express their metacognitive skills majority of the time. Respondents are aware of their cognitive strengths and shortcomings and their way of learning. An assessment can be done to the extent to which they comprehend something and determine what knowledge is essential to learn. As indicated in the outcomes, learners are cognizant of the study strategies they employ and that each strategy serves a specific function.

Respondents being investigated employed several learning tactics depending on the situation, and they find themselves evaluating the efficacy of these strategies while studying. As reflected in the study, the results suggest that pupils acquire best when they are engaged in the issue and know something about it.

The result is parallel to the findings of Ruance (2020) that the level of metacognitive skills of the Grade 10 students was "evident". Paradoxically, the result contradicts the study of Güner, P. &Erbay, H. N. (2021), where the results revealed that students had poor metacognitive skills.

Inferential Data Analysis

Table 3. Analysis of Variance of the Difference in the Metacognitive Skills Among the Levels of Strategic Learning Skills of the Bachelor of Industrial Technology Second-Year Students

ANOVA of Metacognitive Skills in Mathematics Among the Levels of Strategic Learning Skills

Source of Variation	SS	Df	MS	F	Sig.
Between Groups	3.27	4	0.82	1.377^{ns}	0.245
Within Groups	90.24	152	0.59		
Total	93.51	156			

* p<0.05 significant @5% alpha level
ns p>0.05 not significant   @5% alpha level

The data demonstrate that there is no significant difference in cognitive ability within the levels of strategic learning skills of second-year Bachelor of Industrial Technology students, F (1.37) = 0.245, p.05. It can be attributed to the lack of a significant difference in metacognitive abilities among the levels of strategic learning skills of BS in Industrial Technology second-year students. It was observed that participants' capacities for strategic learning skills are the same. It goes to say that the students' perceived cognitive capabilities in Mathematics remain consistent regardless of their current grasp of strategic learning skills. It goes further that whether students use their creative learning talents bulk of the time or very infrequently, their potential for metacognitive thinking remains constant. In congruence, students display metacognitive skills while studying strategic learning skills. Indeed, it is reasonable to conclude that how learners handle and control their thinking is not dissimilar to how they develop and strategically apply competencies in their education.

Considering different solutions, the results of Ruance (2020) revealed that there was however no significant variation in Math achievement among Grade 10 pupils across metacognitive skill levels. This study, however, contradicts the research results of Ali (2013), who discovered that the variance in performance in mathematics was significantly affected by the kind of teaching method used and students' understanding of their metacognitive abilities. Along with this, it contradicts to the findings of SáizManzanaresand, Carbonero Martin, 2017 who discovered that metacognitive skills were crucial in guiding the learning process. The same with Zhao and Mo (2016) who claimed that multiple studies have indicated that metacognitive awareness has a substantial influence on participants' academic success. An outcome revealed that the null assumption is accepted, which asserts that there is no significant disparity in metacognitive abilities among the levels of strategic learning skills of the participants.

Table 4. Relationship Between the Strategic Learning Skills and Metacognitive Skills in Mathematics of the Bachelor of Industrial Technology Second-Year Students

Pearson Between Strategic Learning Skills and Metacognitive Skills in Mathematics

Variables	R	Sig.
Strategic Learning Skills and Metacognitive Skills in Mathematics	0.014^{ns}	0.858

$*$ $p<0.05$ significant @5% alpha level ; ns $p>0.05$ not significant @5% alpha level

The statistics show that there is no significant link between planned abilities in learning and metacognitive abilities in second-year Mathematics students. Students' degree of metacognitive skills is unaffected by their amount of strategic learning skills, or vice versa. This goes to say that the learners' tactical abilities in learning and their metacognitive skills have no relationship since cognitive abilities are displayed by learners, it is how they regulate their cognitive skills, whereas strategic learning skills are acquired by the students and can develop over time through exploration of the different approaches they'll use to be strategic learners.

The findings are consistent with the work of Ruance (2020) who discovered no significant relationship between contemporary abilities and metacognitive capabilities. However, a study by Guner and Erbay (2021) revealed that metacognitive abilities influenced students' success in problem-solving. To sum it up, the null assumption which asserts that there truly is no connection between prospective aptitude for learning and analytical abilities in Mathematics among participants, was rejected.

Conclusion

In light of the aforementioned findings of the study, the following conclusions were drawn:

The participants have "high" level of strategic learning skills. The proponent leads to the conclusion that students apply their methodical learning skills majority of the time. In particular, the learners can take on educational activities and assignments with a high level of confidence that they will succeed, as well as a good understanding of how to attempt to finish them. To enunciate, students realized that education and learning are dynamic activities in which they have a great deal of control.

The participants have "evident" metacognitive skills in Mathematics. It paves the way to the conclusion that learners demonstrate their metacognitive skills majority of the time. The learners are at the stage where they are most conscious of their cognitive abilities. In essence, this would bring to the learning community an understanding of how things are learned and can help them have more influence on their learning. While performing a task, students can observe and modify their thought processes. One can build more advanced thinking abilities by reflecting on their learning. It prompted to researcher's realization that learners' evident metacognitive abilities can boost their ability to study autonomously.

There is no statistically significant variation in conceptual abilities between the degrees of strategic learning skills of the respondents. One can understand that the student's

metacognitive skills are unaffected by their present grasp of proactive learning skills. Further, learners' ability to govern their thoughts is unaffected by their strategic learning skills. In essence, how deliberate or not a learner is in their educational endeavours, their metacognitive skills remain the same. One could embark on a venture that students can concentrate on the way they manage their ability to think without worrying about how their creative learning skills might impact it.

There is no significant association between the intentional learning abilities and metacognitive skills of the participants in Mathematics. One can think that the lack of a significant association between both variables implies that students' ability to choose and implement their methods and strategies in their education has no bearing on how they regulate their thinking skills, and vice versa. As an aftermath, when students' strategic learning skills improve or deteriorate, it does not affect their metacognitive skills. In as much as the ability of students to select specific processes for completing certain tasks is not a factor in improving their metacognitive skills. Further study on strategic learning and metacognitive skills in Mathematics shall be conducted.

Acknowledgment

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