



Self-Regulated Online Learning and Students' Attitude as Predictors of Skill Proficiency Development in Mathematics

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Abstract

This study aimed to determine if self-regulated online learning and student's attitude were predictors of skill proficiency development in Mathematics. 200 GE 4 students of UM North Campuses were the respondents of this research. The statistical tools used were Mean, Pearson-r, and Regression Analysis. Quantitative non-experimental research utilizing correlational technique with regression analysis was the research design of this paper. Results revealed high self-regulated online learning among GE 4 students in terms of metacognitive skill, time management, environmental structuring, persistence, and help seeking was high. The level of students' attitude towards learning Mathematics yielded a descriptive equivalent of high confidence in Mathematics, the importance of Mathematics, and engagement in Mathematics. The level of skill proficiency development of the students in Mathematics yielded a high-level result in terms of conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive disposition. There was a positive significant relationship between self-regulated online learning and students' attitude to skill proficiency development in Mathematics. However, between the two independent variables, students' attitude was the only predictor of skill proficiency development in Mathematics.

Keywords: MAED – Teaching Mathematics, self-regulated online learning, students' attitude, skill proficiency development

A. Introduction

Myriad research revealed how the COVID-19 pandemic worsened students' skill proficiency development in Mathematics. Studies revealed that due to the so-called "COVID slide", on average, students would lose more interest in math than in reading. Another study based on NWEA data predicted students could learn fewer math in 2020-21 compared in what they would learn in a normal year. This is further strengthened by a study based on the FastBridge test data which showed that a troubling 2.5 to 4.5 months of learning lost in math, compared to a month or two in reading brought about by COVID-19 (Sawchuk & Sparks, 2020).

Studying skill proficiency development in mathematics is essential. Mathematical skills have long been recognized as crucial for academic success and efficient functioning in everyday life. Studying Mathematics teaches us accuracy, consistency, and mental discipline. These are

essential skills needed for effective and responsible problem solving and decision-making in everyday life. Due to the global awareness of the importance of mathematical knowledge and the concern about underachievement in mathematics, the performance of students in mathematics from primary school to higher education is still a topic of concern (Brezavscek, Jerebic, Rus, & Znidarsic, 2020).

The relationship between self-regulated online learning and mathematics achievement is a concept which can be based on a social cognitive theory. This theory suggested that student's achievement is influenced by how they monitor (self-observation), evaluate (self-judgment), and respond (self-response) on learning (Zimmerman, 1989 as cited by Broadbent & Poon, 2015). Moreover, a study on the correlation between student attitude and performance in Math found a positive and significant correlation between the two variables. According to these studies, students' performance in Mathematics is significantly related to the students' attitude towards Mathematics (Okyere, 2019).

In UM North Campuses, students had hard times in coping with the new normal, especially on Mathematics learning. They asked when everything would be back to normal where classroom instruction will be done physically face-to-face. On the other side, the researchers have not come across a study investigating the relationship between self-regulated online learning and students' attitude to skill proficiency development in Mathematics, thus, establishing the research gap of the study. Based on the scenarios mentioned above, the researchers desired to conduct a study to explore the said variables, hence the study's urgency.

B. Literature Review

This chapter discusses the theories, facts, and concepts of various authors of this study to supply a strong frame of references about the variables treated under the study. Self-regulated online learning is the first independent variable of the study. This variable is further scrutinized into different indicators: metacognitive skills, time management, environmental structuring, persistence, and help-seeking (Jansen, Leeuwen, Janssen, Kester, & Kalz, 2016). The second independent variable is students' attitude towards Mathematics with three indicators: confidence in Mathematics, importance, and engagement in Mathematics (Sanchal & Sharma, 2017). The study's dependent variable of the study is the skill proficiency development of the students in Mathematics. Mathematics should not be defined as mere problem solving, but instead, it should be defined realistically. Thus, Mathematics proficiency should be viewed as a theory-based discipline and relevant and meaningful subject (Milgram, 2010).

1. Theoretical Framework

This study is anchored on the Goal orientation theory by Dweck (1986). This theory has been used in training settings to promote learning, self-efficacy, skill retention, and generalization and help employees better deal with complex work situations. Goal orientation theory states that students who allowed themselves to set learning goals, which can be achieved through self-regulation, can enhance their commitment to attaining them, which is necessary for goals to affect skill development proficiency in Mathematics. Additionally, this is also based on the Theory of Planned Behavior by Montaño and Kasprzyk (2008), which states that attitude is determined by the individual's belief about attributes of performing the behavior, weighted by evaluations of those outcomes or attributes. Thus, a person who believes positively valued products will result from performing will have a positive attitude towards the behavior. Conversely, a person with a negatively valued attitude will have a negative attitude. Hence, the student's having a positive attitude towards mathematics will most likely have high mathematics proficiency.

The first independent variable, self-regulated online learning, is based on the study of Jansen et al. (2016). They validated the self-regulated online learning questionnaire using the exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). Based on the study, among the three models: theoretical, exploratory, and exploratory-theoretical, the exploratory model shows the best fit. Metacognitive skills, environmental structuring, time management, help-seeking, and persistence were the indicators of self-regulated online learning as depicted in the exploratory model. The second independent variable, which is student's attitude towards learning Mathematics, is grounded on the study of Sanchal and Sharma (2017). According to the researchers, student's attitudes towards Mathematics can be reflected from the three

categories: confidence in Mathematics, the importance of Mathematics, and engagement in Mathematics.

Lastly, the study's dependent variable is skill proficiency development in Mathematics, commonly known as Mathematics Proficiency. Mathematics proficiency can be untangled in five strands: conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive disposition. The five strands of Mathematics proficiency were championed by Kilpatrick, Swafford, and Findell (2001).

2. Conceptual Framework

Presented in Figure 1 is the conceptual framework of the study. As the framework shows, the first independent variable is self-regulated online learning (Jansen et al., 2016) with the indicators, namely, *metacognitive skills*, *time management*, *environmental structuring*, *persistence*, and *help-seeking*. In this study, *metacognitive skills* of online inquiry refer to planning the online investigations, monitoring and controlling the progress through the online inquiry process, and reflecting on what was learned after reading certain information. Secondly, *time management* refers to how student-managed their time in an online setup. Also, in this study, *environmental structuring* refers to creating a sense of place in online learning environments. *Persistence* in this study relates to the ability to complete an online course despite obstacles or adverse circumstances. Lastly, this study defines help-seeking as seeking help from classmates or even instructors when faced with problems, confusion, and clarifications.

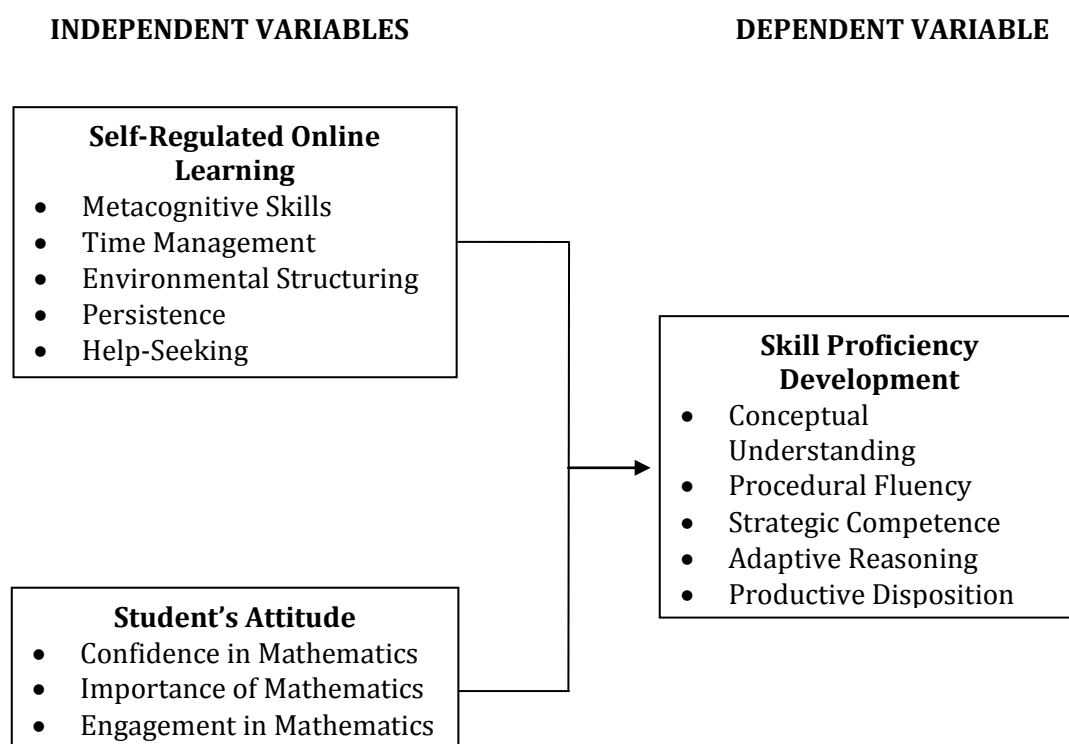


Figure 1. Conceptual Framework of the Study

The second independent variable is student attitude (Sanchal & Sharma, 2017), with the indicators namely, *confidence in Mathematics*, *the importance of Mathematics*, and *engagement in Mathematics*. *Confidence in Mathematics* in this study is what the individual thinks or believes about Mathematics. Added to that, *the importance of Mathematics* is when students see mathematics as necessary in real lives. Lastly, *engagement in Mathematics* refers to students feeling, or emotions associated with learning Mathematics.

Thirdly, the dependent variable of the study is skill proficiency in Mathematics, which is supported by Kilpatrick, Swafford, and Findell (2001), who states that Mathematics proficiency is divided into five strands: conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive disposition. In this study, *conceptual understanding* refers to the integrated and functional grasp of mathematical ideas, which enables them [students] to learn new ideas by connecting them to what they already know. Secondly, *procedural fluency* is the skill of carrying out procedures flexibly, accurately, efficiently, and appropriately. Also, in this study, *strategic competence* refers to the ability to formulate, represent, and solve mathematical problems. *Adaptive reasoning* in this study refers to the capacity for logical thought, reflection, explanation, and justification. Lastly, *productive disposition* in this study is the inclination to see mathematics as sensible, practical, and worthwhile, coupled with a belief in diligence and one's efficacy.

3. *Correlation between Measures*

In this section, the researchers present the related literature discussing the relationship between self-regulated online learning and skill proficiency development in Mathematics and the relationship between student's attitudes and skill proficiency development in Mathematics. The first part discusses self-regulated online learning concerning the dependent variable, followed by the relationship of the second independent variable to the dependent variable.

Online learning has grown rapidly in the last decade, and students need to understand how to use SRL strategies effectively within online environments to achieve academic success. Self-regulation strategies such as time management, metacognition, critical thinking, and effort regulation were found to be significantly correlated with academic success in online learning, although the effect sizes were smaller than those found in traditional learning. In contrast, rehearsals, organization, and refinement show that there are few SRL strategies that are empirically supported within the online environment, indicating that these strategies are less useful to online learners. Lastly, the authors argue that in an online learning environment, peer teaching should be practiced and prioritized to determine what learning strategy is relevant to apply. Motivation as a mediating factor is also of significant focus to understand the relationship of learner self-regulation on academic success within the online environment (Broadbent & Poon, 2015).

In addition to academic online learning, self-regulated learning is also found to improve students' motivation and confidence. With increased motivation and confidence, students will be more active learning to obtain good learning outcomes. Therefore, to accomplish high learning achievement, the use of a self-regulated learning strategy should be highly considered (Fauzi & Widjanti, 2018).

Another study sought to find a link between student self-regulation and involvement in mathematics and science learning and academic performance. Studies have shown that there is a positive correlation between the direction of learning goals in mathematics and the natural sciences, the value of tasks, self-efficacy and self-regulation and performance. The research found that learning goal orientation, task value, self-efficacy, and self-regulation directly affect achievement in both mathematics and science. The most effective variable was self-efficacy learning the direction of the goal, followed by self-regulation in both mathematics and science. This is because school performance depends not only on cognitive factors, but also on other non-cognitive factors such as learning goal direction, self-efficacy, self-regulation, and many other similar factors. Self-regulated learners, who take on the responsibility of their learning in this way, can examine each stage of their education and thus attain success at the desired level (Mutawah, Thomas, & Khine, 2017).

However, as shown in another study, the relationship between SRL and math performance is very weak, depending on the grade level and the content area tested. These results suggest that the difference in the impact of SRL on performance is likely to remain ambiguous. This is because the SRL is measured differently and the components of the SRL that are less relevant to performance are measured differently. Alternatively, factors such as self-efficacy are often based on ability-related measurements and remain strongly associated with performance. (Harding et al., 2019).

Moving on to the discussion on the relationship between student's attitude and skill proficiency development in Mathematics, it was mentioned in a study that all attitude aspects were highly positively correlated with attitude. Factors of attitude such as usefulness, confidence, enjoyment, and motivation contributed significantly to the formed attitudes and that as these variables increased, students' attitudes became more positive. This is in line with some studies that posit that these factors are crucial in shaping students' attitudes and consequently their achievement in mathematics. However, the regression analysis shows that in Tanzania, only the enjoyment of mathematics significantly predicted the students' performance. This means that students learn better when they enjoyed the lessons. Therefore, it is up to teachers to employ strategies that will make mathematics lessons more enjoyable. The study shows that using humor as a teaching strategy makes a lesson interesting and enjoyable. As a result, students perform better (Mazana, Montero, & Casmir, 2019; Ngussa & Mbuti, 2017; OECD, 2013; Van der Bergh, 2013; Zakaria & Nordin, 2008).

Attitudes have influenced students' efforts and behaviors in mathematics in many ways. Students who are motivated to learn math could complete all assignments, perform follow-up tasks, pay attention to class teachers, and make sure they don't miss a lesson. However, in one study, a significant proportion of students disagreed with this expectation and were reflected in their disastrous performance. They were not able to complete and practice the task and had difficulty to complete them (Langat, 2015).

C. Methodology

1. Research Design

This research is quantitative, non-experimental research utilizing causal-effect technique with regression analysis. The method used was quantitative research which is the process of collecting and analyzing numerical data. It can be used to find patterns and averages, make predictions, causal test relationships, and generalize results to broader populations (Bhandari, 2020). Non-experimental studies, on the other hand, are purely observational, and the results are intended to be purely descriptive (Thompson & Panacek, 2007). This kind of research design applies to studies where the independent variable of the study is unchanged. Purposively, Regression analysis was used in this study. It is a way of mathematically sorting out which of those variables does indeed have an impact. It answers the questions: Which factors matter most? Which can we ignore? How do those factors interact with each other? And, perhaps most importantly, how certain are we about all these factors (Gallo, 2015)?

2. Research Respondent

The respondents who participated in this study were the students enrolled in GE 4 (Mathematics in the Modern World) for SY 2020-2021 of the University situated in North Campuses. Out of 2745 population, there were a total of 200 students enrolled in GE 4 in UM North Branches who were considered as respondents. Those students were said to be equipped with the five strands of Mathematics proficiency: conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive disposition while undergoing this new normal education platform, online learning. The respondents can withdraw anytime if they feel threatened in the conduct of the study.

The respondents of this study included the first-year students who were enrolled in GE 4 (Mathematics in the Modern World) for the 1st and 2nd Sem of SY 2020-2021. The study will not include second year through fourth-year students who were both enrolled and not enrolled in GE 4 subject. The samples were chosen from the campuses of the UM North except one campus, which is situated in Davao City because the said school does not offer undergraduate programs. Students from the public schools were excluded from the conduct of the study. Along the process, when the respondents felt uncomfortable answering the questionnaire, they thought that some items were vague to understand. When they feel inadequate in their physical condition, they were given the freedom to withdraw from their involvement in the study.

The study was conducted in the North Campuses of University of Mindanao which is composed of four campuses. Three of which are located exclusively in Davao del Norte area and the other branch, which has no undergraduate programs offered, is situated in Davao City.

3. Instruments

The researchers used a downloaded, adapted, and modified questionnaire as an inquiry device which gained widespread acceptance as a practical way of eliciting data to answer specific problems in this research. The panel members and thesis adviser validated it as internal validators, and each item also validated external validators. The items in the questionnaire were subjected to a reliability test for internal consistency of the items using Cronbach's Alpha. The questionnaires were pilot tested to a private tertiary academic institution which was not part of the identified respondents of the study. After which, the distribution and administration of the final survey were conducted to the respondents.

To determine the students' level of self-regulated online learning, the researchers used the questionnaire validated by Jansen et al. (2016) using EFA and CFA. The questionnaire was named Self-Regulated Online Learning Questionnaire with five indicators, namely: metacognitive skills (15 items), time management (5 items), environmental structuring (5 items), persistence (5 items), and help-seeking (5 items) with a 35 total number of items.

To determine the level of student's attitude towards learning Mathematics, the researchers used the questionnaire crafted by Sanchal and Sharma (2017). The questionnaire consists of statements on the following three categories: confidence in Mathematics (10 items), the importance of Mathematics (10 items), and engagement in Mathematics (10 items) with 30 total items in all. Same with the first independent variable, the students rated their attitude towards learning Mathematics in a 5-point Likert scale response.

To determine the skill proficiency development of the students in Mathematics, the researchers utilized the downloaded questionnaire formulated by Barham (2020). The questionnaire was intended for Pre-service teachers measuring their perceptions of professional development needs related to the five strands of mathematical proficiency. However, the said questionnaire was contextualized by the researchers to suit the target respondents of the study.

4. Technique of Data Analysis

During the conduct of data gathering of this research, the following steps were considered. First, the researchers had undergone an outline defense. After the outline defense, the manuscript had undergone internal and external validation of the research instrument. Checking of the ethical consideration of the research was the next step after validating the research instruments. Certificate of Approval was sent to the researchers after complying to the UM Ethics Review Committee (UMERC). Then, the researchers proceeded to conduct of the pilot testing to test the reliability of the questionnaires. After passing the reliability testing, the researchers advanced to the next step, and that was to administer the questionnaires to the target respondents.

The researchers secured a letter of permission and certification to conduct the study from the Program Coordinator of the Graduate School that served as proof that UM Tagum College officially recognized the research. After which, the letter of certification was given to the campus directors/deans for approval. Upon approval of the Director/Dean, the researchers personally administered the questionnaires to all respondents. Furthermore, the researchers also utilized online data collection by forwarding the link of the questionnaires in Google Form to the respective Deans of Colleges.

The researchers gave the respondents further instruction and orientation to guide them on going along with the questionnaires. This was to ensure one hundred percent accuracy in the answering and retrieval of questionnaires. The gathered data were tabulated, analyzed, and interpreted with the aid of the prescribed tools.

The following statistical tools were used in this study in interpreting the data gathered by the researchers:

Mean. This was used to measure the level of self-regulated online learning and student's attitude towards learning Mathematics.

Pearson-r. This was used to describe the significance of the relationship between self-regulated online learning and skill proficiency development of the students in Mathematics, and student's attitude and their skill proficiency development in Mathematics.

Multiple Regression Analysis. This was used to determine if self-regulated online learning and student's attitude would significantly predict the skill proficiency development of the students in Mathematics.

D. Findings and Discussion

Results, analysis, and intervention drawn out from the conduct of the study are introduced in this part. The data presented were both in tabular and textual forms. All inferential results were analyzed and interpreted at a 0.05 level of significance. Chronologically, tables and its interpretation were arranged in the subsequent subheadings: level of self-regulated online learning, level of students' attitude, level of skill proficiency development in Mathematics, significance of the relationship between self-regulated online learning and students' attitude to skill proficiency development in Mathematics, and regression analysis on self-regulated online learning and students' attitude as predictors of skill proficiency development in Mathematics.

The standard deviation was used to determine the error on unknown samples. It cannot be noted that the standard deviation ranges from 0.66 – 0.84, which is lesser than 1.0 as the typical standard deviation for the 5-point Likert scale (Wittink& Bayer, 1994). This means that the ratings in the accomplished questionnaires are closed to the mean, indicating the consistency of responses among the respondents.

1. Level of Self-Regulated Online Learning

The mean scores for self-regulated online learning with an overall mean of 3.99 described as high with a standard deviation of 0.67 were presented in Table 1. The high level could be attributed to the high rating given by the respondents in all indicators in terms of *metacognitive skill, time management, environmental structuring, persistence, and help-seeking*. The cited total mean score was the outcome acquired from the subsequent computed mean scores from the highest to lowest indicators: 4.17 or high for *environmental structuring*; 4.03 or high for *persistence*; 4.02 or high for *metacognitive skill*; 3.89 or high for *help-seeking*; and 3.85 or high for *time management*. This further means that the students find a comfortable place to study, manage to keep working until they finish a particular task, think about what they need to learn before they begin a task, ask other classmates for ideas when they do not fully understand some specific concepts and find time on this course (GE 4) amidst other activities.

Table 1. Level of Self-Regulated Online Learning

Indicator	Mean	SD	Descriptive Equivalent
Metacognitive Skill	4.02	0.681	High
Time Management	3.85	0.783	High
Environmental Structuring	4.17	0.742	High
Persistence	4.03	0.715	High
Help-Seeking	3.89	0.788	High
Overall	3.99	0.656	High

It was found out that the degree of self-regulated online learning of the GE 4 students of selected UM North Campuses was high. This is because of the high rating assumed by the respondents in terms of metacognitive skill, time management, environmental structuring, persistence, and help seeking, which means that the level of self-regulated online learning of the students was much observed. It means that the students find a comfortable place to study, manage to keep working until they finish a certain task, think about what they really need to

learn before they begin a task, ask other classmates for ideas when they do not fully understand some specific concepts, and find time on this course (GE 4) amidst other activities.

Various authors supported the high descriptive equivalent in the level of self-regulated online learning. This was in parallel to the study of Gilbert (2015), who said that the demand for the conduct of online courses was to provide quality education, regardless of time and location. The need for flexible learning is not just timely for the current situation (emergence of COVID-19 public health crisis). It also has the potential to create educational opportunities for individuals who may have faced unsurpassable barriers before the expansion of online educational programs.

2. Level of Students' Attitude towards Learning Mathematics

The mean scores for the indicators of self-regulated online learning with an overall mean of 3.67 described as high with a standard deviation of 0.713 was presented in Table 2. The high level could be attributed to the high rating given by the respondents in all indicators in terms of *confidence in Mathematics*, *importance in Mathematics*, and *engagement in Mathematics*. The cited total mean score was the outcome acquired from the subsequent computed mean scores from the highest to lowest indicators: 3.99 or high for the *importance of Mathematics*; 3.58 or high for *confidence in Mathematics*; and 3.42 or high for *engagement in Mathematics*. Furthermore, it means that the students appreciate the importance of Mathematics in everyday life, want to develop their problem-solving skills, and have usually enjoyed studying in their Mathematics class.

Table 2. Level of Students' Attitude towards Learning Mathematics

Indicator	Mean	SD	Descriptive Equivalent
Confidence in Mathematics	3.58	0.742	High
Importance of Mathematics	3.99	0.767	High
Engagement in Mathematics	3.42	0.839	High
Overall	3.67	0.713	High

It was found out that the degree of students' attitude towards learning Mathematics of the GE 4 students of selected UM North Campuses was high. This is because of the high rating assumed by the respondents in terms of confidence in Mathematics, importance of Mathematics, and engagement in Mathematics, which means that the level of students' attitude was much manifested. It means that the students appreciate the importance of Mathematics in everyday life, want to develop their problem-solving skills, and have usually enjoyed studying in their Mathematics class.

The high-level result of students' attitude was in parallel to the study of Sanchal and Sharma (2017). They said that student's attitudes towards learning Mathematics improved when there is an increase in confidence, seeing the importance of Mathematics, and engagement in Mathematics lessons. The findings in their study showed that the sporting context could have allowed students to express their mathematical ideas more comfortably, giving them more confidence.

3. Level of Skill Proficiency Development in Mathematics

The mean scores for the indicators of skill proficiency development in Mathematics with an overall mean of 3.61 described as high with a standard deviation of 0.711 were presented in Table 3. The high level could be attributed to the high rating given by the respondents in all indicators in terms of *conceptual understanding*, *procedural fluency*, *strategic competence*, *adaptive reasoning*, and *productive disposition*. The cited total mean score was the outcome acquired from the subsequent computed mean scores from the highest to lowest indicators: 3.66 or high for *conceptual understanding*; 3.65 or high for *strategic competence*; 3.62 or high for

adaptive reasoning; 3.60 or high for *productive disposition*; and 3.50 or high for *procedural fluency*. The result further indicates that the students develop their comprehension of mathematical operations, apply strategies to learn mathematical concepts, solve mathematical problems in a step-by-step process, relate mathematical issues in daily life situations, put effort into learning Mathematics, solve mathematical problems using mental operations and strategies, and detect errors and mistakes in their computations.

Table 3. Level of Skill Proficiency Development in Mathematics

Indicator	Mean	SD	Descriptive Equivalent
Conceptual Understanding	3.66	0.774	High
Procedural Fluency	3.50	0.731	High
Strategic Competence	3.65	0.780	High
Adaptive Reasoning	3.62	0.790	High
Productive Disposition	3.60	0.766	High
Overall	3.61	0.711	High

It was found out that the degree skill proficiency development in Mathematics of the GE 4 students of selected UM North Campuses was high. This is because of the high rating given by the respondents in terms of conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive disposition, which means that the level of skill proficiency development of the students in Mathematics was much manifested. It means that the students develop their comprehension of mathematical operations, apply strategies to learn mathematical concepts, solve mathematical problems in step-by-step process, relate mathematical problems in daily life situation, put effort in learning Mathematics, solve mathematical problems using mental operations and strategies, and detect errors and mistakes in their computations.

The high descriptive equivalent in the level of skill proficiency development in Mathematics was supported by various authors. This was in parallel to the study of Kilpatrick, Swafford, and Findell (2001). They said that Mathematics Proficiency was classified into five strands: conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive disposition. Thus, to increase students' Mathematical proficiency, one has to look into these five strands to improve their proficiency in mathematics fully.

4. Significance on the Relationship between Self-Regulated Online Learning and Students' Attitude to Skill Proficiency Development in Mathematics

Relatively, determining whether self-regulated online learning and students' attitude have a significant relationship to skill proficiency development is one of the objectives of this study. After that, Pearson-r was utilized to investigate the correlation between variables. More so, presented in table 4 are the analyzed and interpreted results of the significant relationship between *self-regulated online learning* and *students' attitude to skill proficiency development in Mathematics*.

The gathered outcomes exposed that all the independent variables, namely, *self-regulated online learning* and *students' attitude*, are significantly related to *skill proficiency development in Mathematics*. The r-value for the relationship between *self-regulated online learning* and *skill proficiency development in Mathematics* is 0.231* with a p-value of 0.001 and a coefficient of determination of 0.053, which shows a positive correlation.

Thus, the gathered outcomes exposed that students' attitude is significantly related to skill proficiency development in Mathematics. The r-value for the relationship between *students' attitude* and *skill proficiency development in Mathematics* 0.448* with a p-value of 0.000 and a coefficient of determination of 0.201, shows a positive correlation. Furthermore, as presented in

the table, the hypothesis that there is no significant relationship between self-regulated online learning and students' attitude to skill proficiency development in Mathematics is also rejected.

Table 4. Significance on the Relationship between Self-Regulated Online Learning and Students' Attitude to Skill Proficiency Development in Mathematics

Independent Variables	Dependent Variable	r-value	r-squared	p-value	Decision
Self-Regulated Online Learning	Skill Proficiency Development in Mathematics	0.231*	0.053	0.001	H ₀ is rejected
Students' Attitude	Mathematics	0.448*	0.201	0.000	H ₀ is rejected

*Significant at 0.05 level of significance

The result of the study showed that there was a significant relationship between self-regulated online learning and students' attitude to skill proficiency development in Mathematics. The computed r-value for each relationship with a p-value of less than 0.05 indicated a positive relationship between the variables. The positive r-value indicated a direct correlation between the variables, which further indicates that as the level of students' self-regulation on their online learning increases, their skill proficiency development in Mathematics goes high as well. Also, as their attitude towards Mathematics increases, their skill proficiency development goes high as well. Conversely, as the level of self-regulated online learning and students' attitude decreases, their skill proficiency development in Mathematics also goes down.

The result is in accordance with Broadbent and Poon (2015). They stated that Self-regulated learning strategies of time management, metacognition, critical thinking, and effort regulation were found to have significant positive correlations with academic success in online settings, albeit these effect sizes were smaller than those found in the traditional classroom. In addition, the result of the study confirmed with Fauzi and Widjajanti (2018). They mentioned that self-regulated learning is very influential to student skill proficiency development at different levels, from elementary to university. The researchers concluded that students with high self-regulated learning certainly have high achievement, and students with low self-regulated have low achievement.

5. Regression Analysis on Self-Regulated Online Learning and Students' Attitude as Predictors of Skill Proficiency Development in Mathematics

Presented in table 5 is the regression analysis on self-regulated online learning and students' attitude to skill proficiency development in Mathematics. The table shows a computed F-ratio of 26.545 and a p-value of 0.000, which means that the two independent variables can significantly predict skill proficiency development in Mathematics when taken as a whole. The R-value is 0.461, indicating a positive relationship between self-regulated online learning and students' attitude to skill proficiency development in Mathematics. The overall R² is 0.212, indicating that 21.2% of the skill proficiency development in Mathematics is explained by self-regulated online learning and students' attitude. The remaining percentage is accountable to other variables not included in the study.

Moreover, self-regulated online learning has a beta of 0.111 with a p-value of 0.093; and students' attitude has a beta of 0.416 with a p-value of 0.000. Only students' attitude has a corresponding p-value of 0.000, which is lesser than the 0.05 level of significance. Hence, only students' attitudes can significantly predict skill proficiency development in Mathematics. More so, self-regulated online learning does not significantly predict the skill proficiency development of the students in Mathematics.

Table 5. Regression Analysis on Self-Regulated Online Learning and Students' Attitude as Predictors to Skill Proficiency Development in Mathematics

Independent Variables	Unstandardized Coefficient		Standardized Coefficient Beta	t-value	p-value	Decision
	B	SE				
(constant)	1.601	0.321				
Self-Regulated Online Learning	0.121	0.072	0.111	1.687	0.093	H ₀ is not rejected
Students' Attitude	0.415	0.066	0.416	6.307	0.000	H ₀ is rejected
Dependent Variable: Skill Proficiency Development in Mathematics						
R = 0.461 R ² = 0.212						
F-ratio = 26.545 p-value = 0.000						

The regression analysis on the variables under study revealed that students' attitude is a predictor to the skill proficiency development of the students in Mathematics. On the other hand, self-regulated online learning is not a predictor to skill proficiency development in Mathematics. This finding was reported as reflected in the table wherein only students' attitude as a predictor to skill proficiency development in Mathematics posted a p-value which is lesser than 0.05. However, when taken as a whole, both self-regulated online learning and students' attitude have a predictive ability to the development of their skill proficiency development in Mathematics. This implies that self-regulated learners who also have a positive attitude towards learning Mathematics tends to have a high skill proficiency development in Mathematics.

This is in accordance with the Theory of Planned Behavior by Montaño and Kasprzyk (2008), which is the anchored theory for the relationship between students' attitude and skill proficiency development in Mathematics. The said theory stated that attitude is determined by the individual's belief about attributes of performing the behavior, weighted evaluations of those outcomes or attributes. Thus, a person who believes positively valued outcomes will result from performing will have a positive attitude towards the behavior. Conversely, a person with a negatively valued attitude will have a negative attitude. Hence, students having a positive attitude towards Mathematics will most likely have high Mathematics Proficiency.

The study also revealed that self-regulated online learning is not a predictor to skill proficiency development in Mathematics. This contradicts the Goal Orientation Theory of Dweck (1986), who stated that students who allowed themselves to set learning goals, which can be achieved through self-regulation, can enhance their commitment to attaining them, which is necessary for goals to affect skill proficiency development in Mathematics. However, this result was supported by Harding et al. (2019). They reported that ambiguous association between SRL and skill proficiency of the students in Mathematics was due to differing methods of measuring SRL or measuring components of SRL that are weakly related to performance.

Finally, the result that both self-regulated online learning and students' attitude, when taken as a whole, have a predictive ability to skill proficiency development in Mathematics was supported by Langat (2015). In his stance, he posited that to develop students' skill proficiency in Mathematics, a student should have a positive attitude towards learning Mathematics and show commitment to know by regulating their learning. He further exemplified that despite the high level of self-regulated online learning, students' skill proficiency development in Mathematics tends to be unassociated because of students' disinterest and lack of commitment.

E. Conclusion

Referring to the results and discussion, the researchers concluded that the level of self-regulated online learning of the students was high. Also, the level of students' attitude towards learning Mathematics was high. The level of the skill proficiency development of the students in Mathematics was high as well. For the significant relationship between variables, both self-regulated online learning and students' attitude have a significant relationship to the development of the students' skill proficiency in Mathematics. Furthermore, only students' attitude was found to be a predictor of skill proficiency development in Mathematics. However, when taken as a whole, both self-regulated online learning and students' attitude have predictive ability to skill proficiency development in Mathematics.

After a profound consideration of the possible implications of the findings and conclusion of the study, the researchers came up with several recommendations on how students can develop their skill proficiency in Mathematics.

First, to raise the level of self-regulated online learning among the students to very high, the teachers may post a class schedule where tasks were enlisted with their corresponding deadline to develop their study plan. Once the student plans for their learning, they may become aware of how to cope with the subject. Through this, students can monitor their learning, making them more in control in managing their time. Particularly, since time management got the lowest mean, to raise the self-regulated online learning of the students, a seminar on how to manage time effectively and efficiently would be conducted more so that most of them are working students.

Second, to raise the level of students' attitude towards learning Mathematics to very high, the teachers may provide an authentic learning experience to elicit active participation among the students. The integration of Mathematics software such as Geogebra and the likes were recommended to increase students' engagement in Mathematics. Furthermore, considering the present situation in this new normal, teachers are encouraged to maximize the utilization of their respective Learning Management System (LMS) as this will be the channel/ medium of most of the students' activities.

Third, to raise the level of skill proficiency development in Mathematics to very high, teachers may provide the step-by-step process on how a particular problem was solved, visible to the learners. Also, giving feedback to students' submitted output is recommended for them to be aware of the errors and mistakes they have committed. Through this, student's level of procedural fluency in accurately answering the word problems will be increased. As the cliché goes, give a man a fish, and you feed him for a day. Teach a man to fish, and you feed him for a lifetime. It is better to teach the students how to solve for the correct answer rather than merely giving them the right answer.

Lastly, the researchers recommended inculcating the value of a sense of responsibility to the students through orientation and seminars or pieces of training related to this topic. Furthermore, since it was found out that the reason for the non-predictor of self-regulated online learning to the dependent variable was due to its components that may have a weak association to students' skill proficiency development in Mathematics, the researchers recommended looking for other indicators/components of self-regulated online learning that would significantly predict the skill proficiency development of the students in Mathematics.

F. References

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