FLEXIBLE LEARNING APPROACH VIA REFLECTIVE THINKING: ITS EFFECT ON STUDENTS' MATHEMATICAL COMPREHENSION AND METACOGNITIVE SKILLS

Elsie R. Tusoy and Denis A. Tan*

Science Education Department, Central Mindanao University, University Town, Musuan, Bukidnon, 8710 Philippines

Correspondence Tel.: +639177103100, *Email: denistan@cmu.edu.ph

ABSTRACT: *The main purpose of the study was to determine the effectiveness of reflective thinking on the mathematical comprehension and metacognitive skills of Bachelor of Secondary Education major in Mathematics students in a state college in Trento, Agusan del Sur. The pre-experimental pretest-posttest research design was used in the study. The data gathering tools were teacher-made test for mathematical comprehension and adapted questionnaire for metacognitive skills. The instruments were administered to a single group of students, identified through cluster random sampling technique. The statistical tools used to obtain the results were weighted mean and paired t-test. Results revealed that with reflective thinking, the level of mathematical comprehension of students was average and their metacognitive skills was at high level. Moreover, there was a significant increase on student's mathematical comprehension based on their pre-test and posttest scores. However, there was no significant difference in the metacognitive skills of the students. Lastly, the mathematical comprehension of the students, after using reflective thinking as an intervention, reached the mastery level based on the standard set by the college.*

Keywords: Flexible Learning Approach, Mathematical Comprehension, Metacognitive Skills, Pre-Experimental Design, Reflective Thinking

1. INTRODUCTION

In the case of mathematics education, there have been worries that learning Mathematics away from the school environment may obstruct inquiry-based approaches to learning mathematics in several ways and student engagement in mathematics is expected to be particularly difficult [1]. Mathematical comprehension, as an ability that is very significant, must be possessed by students in learning Mathematics. However, as pandemic continues to emerge and flexible learning has been adapted by many universities, it is not easy to achieve mathematical comprehension because the learning method is new and not commonly used in a normal setting [2]. In addition, metacognition is crucial to the talent of learning in the new normal. Students awareness on inward examination on how they learn and to judge which methods are effective particularly when faced with new forms of learning online is underdeveloped because they lack metacognitive skills [3].

Several research endeavors have been conducted to identify factors associated with students' achievement such as teachers' skills and competencies [4, 5, 6, 7], teachers' awareness, perceptions, and challenges [8-12], contemporary pedagogies [13,-18] and others [19,- 25], however, little has been done on exploring the mathematical comprehension and metacognitive skills when students are exposed to reflective thinking. Reflective thinking is also a future skill that students should learn in order to meet the problems and respond to the expectations of the twenty-first century [26].

Reflective thinking has a significant relationship with mathematics academic achievement. It is useful to integrate reflective activities to develop mathematical comprehension and other mathematics-related activities [27]. Furthermore, reflection can make it possible for students to be metacognitively responsive to their cognitive process, encourage deep understanding, monitor what they have learned, appreciate the learning experiences, and evaluate the learning process and performance of students [28]. Moreover, cooperative learning supported by reflective thinking activities could have a positive effect on students' critical thinking skills and metacognitive skills [29].

Amid the turmoil of the pandemic, very limited studies are investigating the effect of reflective thinking in the mathematical comprehension and metacognitive skills of college students particularly in Trento, Agusan del Sur, Philippines. Such findings call for research on this matter so that better insight and understanding can be obtained. Given the current situation in the education system, the researcher found it vital and beneficial to conduct a study in relation to the effect of reflective thinking in

flexible learning on the mathematical comprehension and metacognitive skills of students throughout the course of transition and transformation towards learning in the new normal.

2. MATERIALS AND METHODS

This study utilized pre-experimental pretest-posttest research design to determine the effect of flexible learning approach via reflective thinking on students' mathematical comprehension and metacognitive skills. A homogeneous class was exposed to the intervention. A pretest-posttest design was used to determine the significant difference in the mathematical comprehension and metacognitive skills of the students.

The participants of the study were 30 second year Bachelor of Secondary Education Mathematics students of ASSCAT – Trento External Studies Center. The researcher selected one (1) regular homogeneous group of students for the experimental group. The students that belonged to the selected group were the participants of the study. Students at these groups were expected to be diverse learners, thus, has different students' learning styles, family backgrounds, socioeconomic status, gender, age, religion, and ethnicity.

The primary source of the data was the students' pretest scores and posttest scores from the teacher-made questionnaire. A 50-item content validated multiple-choice test (1 point each) was used by the researcher. A table of specification of linear algebra was constructed to ensure that the test measures the content that was intended to be measured. The test questionnaire has undergone validity and reliability testing. The questionnaire was assessed by experts

to established validity. After validation, the questionnaire was pilot tested. The reliability index using Cronbach alpha test was 0.820, implying a good internal consistency. To measure the level of students' metacognitive skills, the researcher adopted the Metacognitive Skills Scale [30]. It is a 30-item questionnaire with items answered on a five-point-scale-ranging from strongly agree to strongly disagree. Reverse scoring procedure was done for a negative statement.

The researcher sent a written communication before the conduct of the study to campus administrator of Agusan del Sur State College of Agriculture and Technology – Trento External Studies Center to allow the researcher to conduct the study.

Before the start of the experiment, a preliminary test was conducted through google form due to restrictions on the face-to-face meetings to determine pre-existing subject knowledge. After the pretest, the study proper was conducted through applying the reflective thinking strategy guided by the following procedures:

1. Distribution of learning module.
2. Random selection of students.
3. Assess the student's reflection on the given topic through random phone calls during their regular class schedule. Students were asked with these reflective questions:

a. What have you learned?
b. What specific topic that you didn't understand?
c. What can you do to improve your understanding?
d. How will you teach this topic to someone easily?
e. How could you use it in real world?

Learning modules of linear algebra were distributed to 30 students. During the distribution, students were informed that there will be random phone calls during their regular class schedule to assess their reflection on the topics. Selection of students was done through fish bowl/lottery method. Every week there were 5-7 students being called and were ask with these questions: What have you learned? What specific topic that you didn't understand? What can you do to improve your understanding? How will you teach this topic to someone easily? How could you use it in real world? These processes were repeated for the entire semester. The posttest was conducted through google form, data were retrieved, analyzed and interpreted to obtain results.

The data collected were tabulated and analyzed using appropriate statistical tools using software. Descriptive statistics was used in order to obtain the frequency values, percentages and mean of the students' mathematical comprehension scores (pretest and posttest) and the metacognitive skills scores. Paired Sample t-test was used to determine the significant difference in the students' mathematical comprehension and metacognitive skills after applying flexible learning approach via reflective thinking. One-sample t-test was used to determine is a significant difference between the students' level of mathematical comprehension and students' mastery level set by the college.

.RESULTS AND DISCUSSIONS

This section presents the analysis and interpretation of data gathered from the students' scores and students' survey relevant to testing the hypothesis of the study. Tables are also shown in this chapter to give a convenient analysis of the data. The order of presentation follows the sequence of the objectives identified in the study.

3.1 Students' mathematical comprehension

Table 1 shows the level of mathematical comprehension of students before and after exposure to flexible learning approach via reflective thinking. The over-all mean as to pretest and post-test, together with the respective qualitative description are also shown below.

Table 1. Level of Student's Mathematical Comprehension.

Range	Pretest		Post Test		
	f	%	f	%	Qualitative Description
96% – 100%	0	0%	0	0%	Mathematical comprehension is mastered.
86% – 95%	0	0%	0	0%	Mathematical comprehension is closely approximating mastery.
66% – 85%	0	0%	14	47%	Mathematical comprehension is moving towards mastery.
35% – 65%	11	37%	6	20%	Mathematical comprehension is moderate.
15% – 34%	19	63%	10	33%	Mathematical comprehension is low
5% – 14%	0	0%	0	0%	Mathematical comprehension is very low
0% – 4%	0	0%	0	0%	Mathematical comprehension has no mastery.
Mean	33.67% (Mathematical comprehension is Low)		50.2% (Mathematical Comprehension is Moderate)		

As presented from the table, before using reflective thinking as an intervention, 37% of the students got a moderate mathematical comprehension, while the remaining 63% had a low mathematical comprehension. Moreover, after applying reflective thinking, 33% had a low mathematical comprehension, 20% had a moderate mathematical comprehension while the remaining 47% got a high level which indicates that their mathematical comprehension is moving towards mastery. The mean value of pretest is 33.67% which points to a low-level mathematical comprehension while their post-test got a mean value of 50.20%, indicates a moderate mathematical comprehension. Learning linear algebra has always been difficult. Students usually feel lost in the world of linear algebra and they feel under pressure at the number of new definitions and the lack of connection with previous mathematical knowledge [31, 32]. However, mathematical comprehension can be said to develop in a positive way as a result of self-evaluation [33].

3.2. Students' metacognitive skills

Table 2 shows the level of metacognitive skills of the students before and after exposure to flexible learning approach via reflective thinking.

Table 2. Level of Student's Metacognitive Skills

When learning strategy that I used fails in learning process, I employ new one.	4.07	Above average	4.13	Above average
I determine which learning strategy I should employ before I start studying.	4.03	Above average	3.93	Above average
I check if I understood a subject during learning	3.97	Above average	4.17	Above average
I revise my study plan that I used in Learning and make necessary corrections.	3.97	Above average	4.13	Above average
It is important for me to build meaningful relations between learned subjects during learning.	3.97	Above average	4.07	Above average
I search for how I learned a subject most effectively while learning.	3.93	Above average	4.13	Above average

Till I reach a result, I organize the conditions for keeping my attention.	3.93	Above average	4.13	Above average
I know the other subject matters that I can use an effective learning strategy in a subject.	3.93	Above average	4.07	Above average
It is important for me to overview y learning from time to time to determine how much and what I learned.	3.93	Above average	3.97	Above average
I asses of the cognitive strategy that I employ has been successful or not.	3.93	Above average	3.77	Above average
I determine what I will learn about a subject before I start studying it.	3.9	Above average	4	Above average
I don't spare much time for monitoring how much I learned about the subject during the learning process. *	3.9	Above average	3.77	Above average
I check if I effectively use my time during learning.	3.87	Above average	4.03	Above average
I critically make a plan before beginning to study a text.	3.87	Above average	3.93	Above average
During learning process, I have difficulty to determine in which conditions I can learn and those I have failed to learn. *	3.87	Above average	3.73	Above average
I know how much time I need to learn a subject.	3.83	Above average	4.03	Above average
I have difficulty in understanding the reason of the trouble I experienced during learning. *	3.7	Above average	4.17	Above average
I revise and correct the learning strategies while studying a subject.	3.7	Above average	3.73	Above average
I have difficulty in planning my learning a subject in accordance with my own learning qualities. *	3.57	Above average	3.6	Above average
I don't have an exact idea of how to organize my learning. *	3.5	Above average	2.9	Average
I have difficulty in distinguishing important parts about a text or learning objectives. *	3.43	Above average	3.47	Above average
While learning a subject, I am not aware of employing which strategy and how to use it. *	2.7	Moderate	3.27	Moderate
MEAN	3.9	Above Average	3.98	Above Average

*negative indicators (reversed scoring)

Legend:

Rating	Interval	Descriptive Level	
5	4.51-5.00	Very High	Metacognitive Skill is excellent
4	3.51-4.50	High	Metacognitive Skill is above average
3	2.51-3.50	Moderate	Metacognitive Skill is average
2	1.51-2.50	Low	Metacognitive Skill is below average
1	1.00-1.50	Very Low	Metacognitive Skill is very poor

As presented from the table 2, before applying the reflective thinking, the following three questions got the highest mean: "I prepare the learning environment that is necessary for learning process" (4.33), "If the learning couldn't be accomplished, I search for other strategies that could be effective" (4.2), "I use my previous experiences while organizing my new learning" (4.17), all indicate a high level, which implies that the metacognitive skill is above average. On the other hand, following three questions that are negatively listed got the lowest mean: "I don't have an exact idea of how to organize my learning" (3.5), "I have difficulty in distinguishing important parts about a text or learning objectives" (3.43) and "While learning a subject, I am not aware of employing which strategy and how to use it" (2.7) which all indicate a moderate engagement. The overall mean for pretest is 3.90, signifying that before the flexible learning via reflective thinking, the metacognitive skills of the students are above average.

Additionally, after applying the intervention, the following three questions got the highest mean: "I use my previous experiences while organizing my new learning" (4.47), "If the learning couldn't be accomplished, I search for other strategies that could be effective" (4.47), and "I plan how and when to use the resources that will help me learn a subject well" (4.3), ranging from above average to excellent metacognitive skills. On the contrary, the three negatively stated questions got the lowest mean: "I have difficulty in distinguishing important parts about a text or learning objectives" (3.47), "While learning a subject, I am not aware of employing which strategy and how to use it" (3.27) and "I don't have an exact idea of how to organize my learning" (2.9), all imply moderate metacognitive skills. The overall mean for post- test is 3.98, which means that the over-all metacognitive skills of the students after applying the intervention is above average.

Furthermore, based on the results of the pre-test and post-test, questions "I use my previous experiences while organizing my new learning", "If the learning couldn't be accomplished, I search for other strategies that could be effective", "I plan how and when to use the resources that will help me learn a subject well" and "I know which subjects I can learn easily and which I will have difficulty in learning" showed evident increase on their levels. This means that after using reflective thinking as an intervention, the students used their previous experiences while organizing their new learning, they tend to search for other strategies and they planned how and when to use the resources that could be effective for them in learning. Likewise, they also knew which subjects they can learn easily and which they will have difficulty. This means students had improved on strategizing what they have learned after applying reflective thinking.

Also, based on the results, questions "I don't have an exact idea of how to organize my learning", "During learning process, I have difficulty to determine in which conditions I can learn and those I have failed to learn" and "I don't spare much time for monitoring how much I learned about the subject during the learning process" showed noticeable drop from their pretest means to post-test means, with 0.60, 0.14 and 0.13 respectively. This means that students already had an exact idea of how to organize their learning. Also, during their learning process, it's now possible for them to distinguish which situations they can learn in and which they can't and they devote much time to keeping track of how much they've learned about the subject during the course of their studies. Furthermore, based on the results, questions "I asses of the cognitive strategy that I employ has been successful or not", "I determine which learning strategy I should employ before I start studying", "I prepare the learning environment that is necessary for

learning process", "I search for the reasons of the failure while learning a subject" also showed evident decrease from their pretest means to posttest means, with 0.16, 0.10, 0.10 and 0.07 respectively. This means that a number of students found it hard to evaluate whether or not the cognitive method they used is effective. Before they begin studying, they're some can't fully determine which learning strategy they should use. Moreover,

few of the students can't provide the learning environment that is essential for the learning process to take place and when they're studying a subject and lastly, they can't look for reasons why they're failing.

If students can be aware of and govern their learning by actively participating in reflective thinking, if they can assess what they know, what they need to know and how they bridge that gap in learning contexts, learning will occur [34]. Additionally, in environments with reflective thinking activities, students have more individual responsibility and are more aware of their cognitive processes [35].

Paired t-test between the pretest and posttest scores of the Students' Mathematical Comprehension when exposed to Flexible Learning Approach via Reflective Thinking

Table 3 shows the comparison between the students' mathematical comprehension before and after exposure to flexible learning approach via reflective thinking.

Table 3. Comparison of Student's Mathematical Comprehension for the Pre and Post-test using Paired T-test.

Mean		*t-value*	*p-value*	*Remarks*
Pretest	Post-test			
33.67%	50.20%	4.85	0.00**	Significant

As presented from the table, it shows that the t- value is 4.85 with a probability value of 0.00 implies a highly significant difference, thus null hypothesis is rejected, which means that there is a significant difference between the pre-test and post-test scores. This entails that there is a significant increase on the student's comprehension on linear algebra from 33.36% to 50.20% using reflective thinking as the intervention.

Reflective learning environments are created on the basis of educating individuals who think critically [36]. Moreover, reflective strategy contributed to the development of students critical thinking skills [29]. Mathematical comprehension can be said to develop in a positive way as a result of self-evaluation. At the end of the learning activities with self-evaluation strategy, students can learn to think critically [33]. Likewise, as mentioned from the student's feedback, reflective thinking strategy aided them to reflect, evaluate, improve and recall what they have learned on the previous lessons. It helped them to increase their performance because they were able to know what or where they need to improve more.

Paired t-test between the pretest and posttest scores of the Students' Metacognitive Skills when exposed to Flexible Learning Approach via Reflective Thinking

Table 4 shows the comparison of metacognitive skills of the students before and after exposure to flexible learning approach via reflective thinking.

Table 4. Comparison of Student's Metacognitive Skills for the Pretest and Posttest using Paired T-test.

Mean		*t-value*	*p-value*	*Remarks*
Pretest	Posttest			
3.90	3.98	1.035	0.309	Not Significant

Table 4 above reveals the statistical result on the comparison between the pretest and posttest scores on the metacognitive skills of the students. As shown, the t-value is 1.035, with p-value of 0.309 which indicates no significant difference. Thus, the result accepts the null hypothesis. This implies that the metacognitive skills of the students before and after the application of flexible learning via reflective thinking are comparable and all possibilities remain.

Although the null result regarding the effect of reflective thinking to metacognitive skills was unexpected, lack of an effect is that students did not recognize the value or benefit of metacognitive skills and the associated activity since it was being used in only one of their courses [37]. Furthermore, in order to maintain use of metacognitive skills, students have to be explicitly taught about them. Since most studies focused on the effects of a specific intervention or strategy to promote metacognition, it is difficult to map the natural development (or lack thereof) of metacognition in college students [38].

Students' Level of Mathematical Comprehension and Students' Mastery Level Set by the College.

Table 5 shows the comparison of the levels of mathematical comprehension of the students before and after exposure to flexible learning approach via reflective thinking, as set by the Agusan del Sur State College of Agriculture and Technology.

Table 5. Students' Level of Mathematical Comprehension as Set by the College.

	Pretest		Posttest		
Scores	F	%	f	%	
98% - 100%	0	0%	0	0.00%	Excellent
95% - 97%	0	0%	0	0.00%	Superior
92% - 94%	0	0%	0	0.00%	Very Good
89% - 91%	0	0%	0	0.00%	Good
86% - 88%	0	0%	8	26.67 %	Highly Satisfactory
83% - 85%	0	0%	6	20.00 %	Satisfactory
80% - 82%	0	0%	0	0.00%	Better than Average
77%- 79%	3	10%	0	0.00%	Average
75% - 76%	0	0%	0	0.00%	Passing Grade
75% Below	27	90%	16	53.33 %	Failure
Mean	66.83% (Failure)		75.10% (Passing Grade)		

As depicted from the table, during the pretest, 10% of the students got an average grade while the remaining 90% of the students failed. This means that before applying the intervention, almost all of the students got failure grade in linear algebra. Moreover, after applying the flexible learning approach via reflective thinking, the number of students with a failure grade decreases from 90% into 53.33%. Also, 20% got a satisfactory result, while the remaining 26.67% got highly satisfactory grade. The respective means of pretest and posttest were equal to 66.83% and 75.10% which indicate a failure, and passing grade. This further implies that some of the respondents reached the mastery level after applying the intervention which is the reflective thinking.

Reflective thinking can help students improve their mathematical problem-solving skills. It can help you improve your accuracy and focus when completing a math issue [26]. As a result of their reflective thinking, the students will arrive at the correct and logical response. This is also in line to the result of reflective learning is a learning process that provides students the opportunity to examine and investigate the problems that is triggered by experience, analyzing of individual the experiences, and facilitate the learning of the experiences. These lessons are identified to improve mathematical ability of the students [39].

Table 6 shows the one sample t-test of students' level of mathematical comprehension and students' mastery level set by the college before and after exposure to flexible learning approach via
reflective thinking.

Table 6. One Sample t-test of Students' Level of Mathematical Comprehension and Students' Mastery Level Set by the College.

One-Sample Test						
	Test Value = 75					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference Lower	Upper
Mathematical Comprehension	.053	29	.958	.10000	-3.7236	3.9236

As depicted from the table, the t-value is 0.053, with probability value of 0.958 which indicates no significant difference. Thus, the result accepts the null hypothesis. This implies that the students' level of mathematical comprehension which is 75.10% is not statistically different from the students' mastery level of 75% set by the college.

Comprehension process that students developed during their attempt to solve the problem is one of many factors which influenced a student's performance in class when tackling word (or textbook) problems. Some less formal representations based on learners' real-world knowledge that support the creation of a 'situation model' may be included in the comprehension process [40]. In addition, students don't know how to make use of all of the information accessible to them, and, perhaps more crucially, they don't know what they don't know [41].

4 CONCLUSIONS AND RECOMMENDATION

Based on the findings of the study, the following conclusions were drawn:

The pretest result of the students' mathematical comprehension points to a low level while their post-test indicated a moderate level. The students had an improvement with their mathematical comprehension after applying the flexible learning via reflective thinking as based on the mean results of their pretest and post test scores.

In terms of their metacognitive skills, both pretest and post test scores indicated as above average. Nevertheless, there is still a slight increase on the mean after using the intervention.

There is a significant difference on the students' mathematical comprehension when exposed to flexible learning approach via reflective thinking. Indeed, it is an effective strategy or intervention in increasing the students' mathematical comprehension. Self-evaluation strategy, as part of reflective thinking, helped the students learn to think critically and it enabled them to improve their mathematical understanding.

There is no significant difference on the students' metacognitive skills after the intervention. The students' metacognitive skills before and after applying flexible learning approach via reflective thinking are comparable.

Lastly, the students' level of mathematical comprehension which is 75.10% is not statistically different from the students' mastery level of 75% set by Agusan del Sur State College of Agriculture and technology.

Based on the findings and conclusions of the study, the following recommendations are given:

For mathematics instructors, it is recommended to use Reflective Thinking Strategy during this new normal in managing classes and discover more innovation for learning strategies to increase students' mathematical comprehension. They may attend seminars, workshops, trainings, and advance courses for personal and professional growth to give students meaningful learning experiences and achieve better results in mathematical comprehension.

The use of fun but substantial learning activities focusing on reflective thinking is recommended that would engage and motivate students to learn to love mathematics to increase metacognitive level of the students.

It is also suggested that students may write down any queries they had or topics they wanted to learn or improve. They are encouraged to share their reflections with their classmates or discuss them with the class, which often led to them, students, helping one another to better understand misconceptions or the lesson.

It is recommended that administrators/ unit heads will contemplate programs for instructors and students that would enhance metacognitive skills and improve teaching strategies for the betterment of learning process.

Finally, future researchers are encouraged to do robust studies on students' mathematical comprehension and metacognitive skills with the use of other strategies aside from reflective thinking to promote overall mathematics learning of the students. This study will be conducted for a longer period of time and not only in one subject.

5. REFERENCES

[1] Kalogeropoulos, P., Roche, A., Russo, J., Vats, S., & Russo, T. (2021). Learning Mathematics from Home during COVID-19: Insights from Two Inquiry-Focussed Primary Schools. *EURASIA Journal of Mathematics, Science and Technology Education*, *17*(5).

[2] Syati, L. M. I. A., & Priatna, N. (2021, May). The analysis of students' mathematical understanding ability in solving two-variables linear equation Ssystem during the Covid-19 pandemic. In *Journal of Physics: Conference Series* (Vol. 1882, No. 1, p. 012066). IOP Publishing.

[3] Anthonysamy, L. (2021). The use of metacognitive strategies for undisrupted online learning: Preparing university students in the age of pandemic. *Education and Information Technologies*, 1-19.

[5] Caballes, D. G., & Tiria, R. A. (2020). The digital skills of secondary school teachers in Manila. *CiiT International Journal of Software Engineering and Technology, 12*(3), 33-37.

[6] Caballes, D. G., & Doblada, J. C. L. (2021). Relationship of teachers' technology skills and selected profile: basis for redesigning training for online distance learning modality. *Instabright International Journal of Multidisciplinary Research, 3*(1), 17-22.

[7] Caballes, D. G., & Dapitan, D. A. (2019). Determining the level of ICT skills of junior high school faculty of Tagumpay National High School. *CiiT International Journal of Wireless Communication, 11*(5), 80-85.

[8] Caballes, D. G., Panol, R. F., Vasquez, A. G., & Valdez, M. R. (2021). Competency level of science teachers in teaching evolution: basis for training design. *Global Journal of Advanced Research, 8*(8), 235-243.

[9] Caballes, D. G., & Dapitan, D. A. (2020). Teachers' views on force and motion: towards the development of two-tier test. *CiiT International Journal of Automation and Autonomous System, 12(*2), 44-48.

[10] Caballes, D. G., Quintos, C. A., Gapad, E. M., & Valdez, M. R. (2020). Perceptions of teachers on the different strains of online modalities of learning: an adoption to new normal. *CiiT International Journal of Software Engineering and Technology, 12*(4), 69-74.

[11] Caballes, D. G., Peregrino, L. P., & Javillonar, M. G. (2020). Public secondary school teachers' awareness of open educational resources (OER). *CiiT International Journal of Programmable Device Circuits and Systems*, *12*(4), 76-80.

[12] Caballes, D. G., & Narca, M. L. (2020). Philosophical bases of pedagogy in teaching knowledge, skills, attitudes of Sebastinian graduates. *CiiT International Journal of Digital Image and Processing*, *12*(3), 49-52.

[13] Gatilogo, L.M. & Tan, D.A. (2019). Teachers' Motivation, Home Visitation and Performance of Academically At-Risk Students. *International Journal of English and Education*, 8(2), 400-417, April 2019.

[14] Caballes, D. G., & Belen, J. L. (2020). The beginning teachers' challenges in an inquiry-based approach to teaching science: provision for a special science research elective course. *CiiT International Journal of Software Engineering and Technology*, *12*(3), 38-44.

[15] Caballes, D. G., & Capinig, R. A. V. (2020). DepEd commons: sustaining students' learning in physical science. *CiiT International Journal of Data Mining and Knowledge Engineering*, *12*(3), 55-60.

[16] Caballess, D. G., & Abenes, F. M. D. (2020). Readiness of tertiary students in flexible learning approach. *CiiT International Journal of Automation and Autonomous System*, *12*(3), 62-69.

[17] Gayeta, N.E. & Caballes, D. G. (2017). Measuring conceptual change on stoichiometry using mental models and ill-structured problems in a flipped classroom environment. *Asia Pacific Journal of Multidisciplinary Research*, *5*(2), 104-113.

[18] Caballes, D. G., & Belen, J. L. (2020). Contextualization of activities in selected topics in molecular biology. *CiiT International Journal of Biometrics and Bioinformatics*, *12*(1), 6-10.

[19] Caballes, D. G., & Dapitan, D. A. (2019). Exploratory effects of strategic intervention materials in general biology 2. *CiiT International Journal of Biometrics and Bioinformatics*, *11*(3), 37-41.

[20] Caballes, D. G., & Villena, R. R. (2020). Integration of information communication technology in teaching science, technology and society. *CiiT International Journal of Data Mining and Knowledge Engineering*, *12*(2), 34-38.

[21] Asparin, A. A. & Tan, D. A. (2018). Students' Problem Solving Skills in Enhanced Gradual Release of Responsibility Instruction Model. Asian Academic Research Journal of Multidisciplinary, 5(3), 121-128.

[22] Duque, C. & Tan, D. (2018). Students' Mathematics Attitudes and Metacognitive Processes in Mathematical Problem Solving. *European Journal of Education Studies*, 4(11), 1-25.

[23] Tan-Ucang, J. & Tan, D.A. (2013). Students' Beliefs and Mathematics Performance in a Process-Oriented Guided-Inquiry Learning (POGIL) Environment. *CMU Journal of Science*. 17 (2013), 141-157.

[24] Galarosa, K.J.D., & Tan, D.A. (2021). Students' academic performance and motivation in Physics using Microlearning via Cybergogy. Unpublished Thesis. Central Mindanao University.

[25] Tan, R.D.A., Pañares, E.J.A., Pañares, F.J. A. Pagonzaga, E. D., Jumawid, J.A.M., Hinampas, R.T., Tan, D.A. (2021). Investigating the Effect of Social Media on Students' Academic Performance and Well-being During the Pandemic. *International Journal of Scientific & Technology Research*, 10(7), 145-151.

[26] Agustan, S., Juniati, D., & Siswono, T. Y. E. (2017, October). Reflective thinking in solving an algebra problem: A case study of field independent-prospective teacher. In *Journal of Physics: Conference Series* (Vol. 893, No. 1, p. 012002). IOP Publishing.

[27] Deringol, Y. (2019). The relationship between reflective thinking skills and academic achievement in mathematics in fourth grade primary school students.

[28] Kim, Y. (2005). Cultivating reflective thinking: The effects of a reflective thinking tool on learners' learning performance and metacognitive awareness in the context of on-line learning. The Pennsylvania State University.

[29] Erdogan, F. (2019). Effect of Cooperative Learning Supported by Reflective Thinking Activities on Students' Critical Thinking Skills. Eurasian Journal of Educational Research, 19(80), 89-112.

[30] Altindag, M., & Senemoglu, N. (2013). Metacognitive skills scale. Hacettepe Üniversitesi Eğitim Fakültesi Dergisi, 28(28-1), 15-26.

[31] Aydin, S. (2014). Using example generation to explore students' understanding of the concepts of linear dependence/independence in linear algebra. *International Journal of Mathematical Education in Science and Technology*, *45*(6), 813-826.

[32] Bogomolny, M. (2007). Raising students' understanding: Linear algebra. In Proceedings of the 31st Conference of the International Group for the Psychology of Mathematics Education (Vol. 2, pp. 65-72).

[33] Michalsky, T., & Kramarski, B. (2015). Prompting reflections for integrating self-regulation into teacher technology education. Teachers College Record, 117(5), 1–38

[34] Chen, M. R. A., Hwang, G. J., & Chang, Y. Y. (2019). A reflective thinking-promoting approach to enhancing graduate students' flipped learning engagement, participation behaviors, reflective thinking and project learning outcomes. *British Journal of Educational Technology*, *50*(5), 2288-2307.

[35] Yilmaz, F. G. K., & Keser, H. (2016). The impact of reflective thinking activities in e-learning: A critical review of the empirical research. *Computers & Education*, *95*, 163-173.

[36] Colley, B. M., Bilics, A. R., & Lerch, C. M. (2012). Reflection: A key component to thinking critically. The Canadian Journal for the Scholarship of Teaching and Learning, 3(1), 1-19.

[37] Brown, A. L., & Palincsar, A. S. (1982). Inducing strategic learning from texts by means of informed, self-control training (Technical Report No. 262, pp.1–48.) Champaign, IL: University of Illinois at Urbana-Champaign.

[38] Soicher, R. N., & Gurung, R. A. (2017). Do exam wrappers increase metacognition and performance? A single course intervention. Psychology Learning & Teaching, 16(1), 64-73.

[39] Ningsih, Y. L., & Rohana, R. (2016). Prospective Teachers 'ability in Mathematical Problem-Solving Through Reflective Learning. Infinity Journal, 5(2), 75-82.

[40] Voyer, D. (2011). Performance in mathematical problem solving as a function of comprehension and arithmetic skills. *Internationaljournal of science and mathematics education*, *9*(5), 1073-1092.

[41] Schurter, W. A. (2002). Comprehension monitoring: An aid to mathematical problem solving. *Journal of Developmental Education*, *26*(2)