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Influence of Metacognitive Awareness and Mathematics Performance on Students' Self-Regulation and Critical Thinking Skills

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Abstract
Aim: This study explored the roles of metacognitive awareness and students' mathematics performance in the relationship between Self-Regulation and Critical Thinking Skills in Mathematics of the Grade 9 students.
Methodology: This research adopted a descriptive research design to determine the levels of self-regulation, critical thinking skills, metacognitive awareness and mathematics performance of 300 Grade 9 students in a public high school in Quezon. Moreover, the researchers conducted the mediation analysis with single mediator using PROCESS MACRO for SPSS to investigate how self-regulation and metacognitive awareness contribute to the development of students' critical thinking skills. The moderation analysis was conducted using PROCESS MACRO for SPSS to determine the moderating effect of mathematics performance to the relationship of their self-regulation and critical thinking skills.
Results: Research has found that self-regulation(SR) is significantly related to critical thinking skills(CTS) (r=0.391, p=0.01). Findings also, revealed that the metacognitive awareness partially mediates the self-regulation and critical thinking skills of the students. This was derived from the significant effects on the following pathways: from SR to MA, from MA to CTS, from SR to CTS, and SR to MA to CTS. The moderation analysis showed that the mathematics performance and self-regulation level of the students has a significant interaction effect on their critical thinking skills.
Conclusion: There is a significant relationship between students' self-regulation and their critical thinking skills in mathematics. Metacognitive awareness mediates the relationship of self-regulation and critical thinking skills of the students. Mathematics performance moderates the relationship of self-regulation and critical thinking skills of the students.

Keywords: *Self-Regulation, Critical Thinking Skills, Metacognitive Awareness, Mathematics Performance*

INTRODUCTION

Students with poor self-regulation struggle the most in class. It affects their confidence to participate in discussions. Self-regulation is an individual's ability to manage their feelings, thoughts, and how they react to a situation. In high school, students should be independent and practice self-regulation to prioritize studying and achieve academic success, instead of wasting time before exams (Cuncic, 2022). Ryan and Connell (1989) identified four subscales of self-regulation: external regulation, introjected regulation, identified regulation, and intrinsic motivation. These are essential for learning and are indicators of future success in life (Grosvenor, 2022). Thus, children who lack self-regulation abilities struggle in social, emotional, behavioral, and/or intellectual domains (Yoo, 2018). Many students come to class unprepared, neglecting assignments, notes, and announcements about upcoming quizzes or exams.

Moreover, Arslan (2014) found that self-regulation predicts metacognition, which was proposed by Flavell as the ability to evaluate and manage one's ideas and knowledge (Flavell, 1979). The term "thinking about thinking" is

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often used to describe metacognition. Metacognitive awareness is knowing how one's thinking works and using it to control learning (Jaleel, 2016). Metacognitive awareness contributes to critical thinking skills which means if MA increases their CTS also increases (Çakıcı, 2018; Aloysius & Rohman, 2016; Sadeghi et.al, 2014).

Moreover, many students overlook the fact that education aims to enhance their thinking rather than simply absorbing information. They should not merely gather data from the internet, but also assess its credibility. CTS aids in acquiring information strategically, which is crucial for problem-solving and making informed decisions. Schools should prioritize teaching and evaluating CTS in the learning process (Firdaus et.al., 2015). They divided this skill into three components: identification and interpretation of information, information analysis, and the evaluation of evidence and arguments. Critical thinkers challenge ideas and arguments based on their own reasoning.

Additionally, CTS are highly needed in any job. Based on World Economic Forum's Future of Jobs Reports, critical thinking skills are included in the list of top 10 job skills in 2025 (Whiting, 2020). The study of de Bie et al. (2015) shows that critical thinkers encounter lesser negative life circumstances. To make good decisions, one must have CTS. Mathematics is one area in which CTS can grow (Aizikovitsh & Amit, 2010; Insorio & Librada, 2020). In the curriculum of mathematical education worldwide, initiatives to strengthen the CTS of mathematics have become a vital priority (Mason et al., 2010; Firdaus et al., 2015). These skills are widely acknowledged to be significant in the field of mathematics education, particularly in problem-solving. Students should develop these skills to be successful in this age of globalization (Belecina & Ocampo, 2018).

Drawn from the study of Nauman (2017), the problem of a lack of CTS among Pakistani researchers is very serious. These skills affect the quality of their research output. In the Phillippines many learning areas in basic education (and higher education programs) feature critical thinking in their respective curriculum, and yet many Filipinos "educated" remain uncritical (Marquez, 2017). Additionally, the researcher noticed that in Dr. Maria D. Pastrana National High School students also have difficulty in learning mathematics. The MPS (mean percentage score) of several classes ranging from 40-60 only in Mathematics. This study aims to promote students' self-regulation, enhancing skills like metacognitive awareness and critical thinking for future benefits, despite their reliance on teachers for previously taught activities.

There were studies conducted to assess and develop individuals' metacognitive awareness (Jaleel, 2016; Pantiwati & Husamah, 2017) or their critical thinking skills (Kong, 2014) or their self-regulation (Nilson, 2013) however only a few (Akcaoğlu et al., 2022) investigated the relationship between these variables and how mathematics performance influences these relationships. This motivated the researcher to investigate if a significant relationship exists between SR and CTS and the roles of MA and MP in this relationship.

Research Questions

The present study explored the roles of Metacognitive Awareness and students' mathematics performance in the relationship between the Self-Regulation and Critical Thinking Skills in Mathematics of the Grade 9 students of Dr. Maria D. Pastrana National High School. For this intention, the following research questions were constructed:

1. What is the student's level of self-regulation in terms of:
   1.1 external regulation;
   1.2 introjected regulation;
   1.3 identified regulation; and
   1.4 intrinsic motivation?
2. What is the perceived level of students' metacognitive knowledge in terms of:
   2.1 declarative knowledge;
   2.2 procedural knowledge; and
   2.3 conditional knowledge?
3. How may the respondents' level of metacognitive regulation be described as to:

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3.1 planning;
3.2 comprehension monitoring;
3.3 information management strategies;
3.4 debugging strategies; and
3.5 evaluation?

4. What is the mean performance level of students' critical thinking skills in terms of the following:
   4.1 identification and interpretation of information;
   4.2 information analysis; and
   4.3 evaluation of the evidence and arguments?
5. What is the students' level of performance in Mathematics?
6. Is the students' level of self-regulation significantly related to their level of critical thinking skills in Mathematics?
7. Does the metacognitive awareness of the students mediate the relationship between self-regulation and their critical thinking skills in Mathematics?
8. Does students' mathematics performance moderate the relationship between self-regulation and critical thinking skills in Mathematics?

Hypothesis

Based on the problem cited, the hypotheses were formed:

H_0: There is no significant relationship between students' self-regulation and their critical thinking skills in Mathematics.

H_0: Metacognitive awareness does not mediate the relationship between self-regulation and critical thinking skills of the students.

H_0: Mathematics performance does not moderate the relationship between self-regulation and critical thinking skills of the students.

METHODS

Research Design

This research adopted a descriptive research design to determine the Grade 9 students' self-regulation, critical thinking skills, metacognitive awareness, and mathematics performance. The researchers utilized a mediation model to investigate how self-regulation and metacognitive awareness contribute to the development of students' critical thinking skills. The moderating model was utilized to determine the moderating effect of mathematics performance of the students on their self-regulation and critical thinking skills. Each analysis was calculated using PROCESS MACRO by Hayes.

Population and Sampling

The researchers utilized a method called stratified sampling to choose the participants for the study. Specifically, the Grade 9 students served as the respondents. The respondents were selected from various sections within this grade level and who completed answering all of the three instruments, the surveys and the test. The purpose was to ensure that students with different levels of academic performance (high performing, mid performing, and low performing) were appropriately represented. There were only a total of 300 respondents or almost 50% of Grade 9 students from Dr. Maria D. Pastrana National High School involved in the study. These respondents were handled by different mathematics teacher. The researcher considered the willingness and availability of the respondents to participate in this study. The students' Mathematics grades were taken into account as a means to investigate whether their performance moderates the relationship between self-regulation and the level of critical thinking skills.

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Instrument

The study used adopted questionnaires such as the Self-Regulation Questionnaire for Academic (SRQA) (Ryan and Connell, 1989), Metacognitive Awareness Inventory (MAI) (Schraw and Dennison, 1994), and researcher made problem-solving tasks with Holistic Critical Thinking Scoring Rubrics (HCTSR) (Facion & Facione, 2011) that were administered to selected 300 grade 9 students in a public high school in Quezon. The problem-solving task only involved the competencies and topics that respondents need to learn on the first four weeks of the third quarter. The researcher included guide questions to allow students to effectively demonstrate their critical thinking skills across three components. The researchers ensured that the topics and concepts covered in the test had already been discussed by the math teachers of the respondents. The respondents only has an hour to answer this test.

Data Collection

The data which were gathered through surveys and test were thoroughly examined and analyzed in accordance with the study's purpose and in strict compliance with all research protocols. Every step was taken to ensure that the research was conducted ethically.

Treatment of Data

In this study, the researchers used the Mean and Standard Deviation to determine the level of self-regulation among students across four distinct subscales, their levels of metacognitive awareness (encompassing both metacognitive knowledge and metacognitive regulation), as well as their critical thinking skills. To determine the students' level of performance in Mathematics, frequency and percentage were used. To determine the relationship between students' self-regulation and critical thinking skill, Pearson r was used. Moreover, mediation analysis with a single mediator was conducted using PROCESS MACRO for SPSS to determine whether metacognitive awareness mediates the relationship between the students' self-regulation and critical thinking skills in Mathematics. Moderation analysis was conducted using PROCESS MACRO for SPSS to determine whether the students' mathematics performance moderates the relationship between self-regulation and critical thinking skills.

Ethical Considerations

The researchers thoroughly followed ethical research protocols to protect the rights and well-being of all involved individuals and institutions. This commitment was driven by the responsibility to protect participants and stakeholders and maintain the principles of ethical research, promoting trust and integrity. The researcher sought permission from the school head of Dr. Maria D. Pastrana National High School and from the School Division Superintendent of Quezon by presenting a letter of request to conduct the study.

RESULTS AND DISCUSSION

This part of the study presents the data analysis and discussion of the results obtained from the survey of 300 ninth-grade students at Dr. Maria D. Pastrana National High School. The researcher employed three different instruments, namely the Self-Regulation Questionnaire, the Critical Thinking Tests, and the Metacognitive Awareness Survey, to gather data.

The Students' Level of Self-Regulation in terms of the Four Subscales

This section presents the students' level of self-regulation in terms of the four subscales. Descriptive statistics including mean and standard deviation are used to determine the respondents' level on each subscale. Also, verbal interpretation was included to aid in understanding the data.

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Table 1. *Student's Level of Self-Regulation in terms of External Regulation*

Statement	Mean	SD	VI
2.Because I'll get in trouble if I don't.	3.30	0.81	High
6.Because that's what I'm supposed to do.	3.59	0.64	High
9.So that the teacher won't yell at me.	2.76	1.01	Moderate
14.Because that's the rule.	3.37	0.81	High
20.Because that's what I'm supposed to do.	3.36	0.76	High
24.Because I want the teacher to say nice things about me.	2.88	2.56	Moderate
25.Because that's what I'm supposed to do.	3.45	0.73	High
28.Because I will get in trouble if I don't do well.	2.70	1.05	Moderate
32.Because I might get a reward if I do well.	2.63	1.05	Moderate
Overall	**3.12**	**0.53**	**Moderate**

Legend: 1.00-1.75(Very Low); 1.76-2.50(Low); 2.51-3.25(Moderate); 3.26-4.00(High)

Shown in table 1, is the level of students' external regulation. The statement "Because that's what I'm supposed to do" as students' reason for doing homework got the highest mean value (m=3.59; sd=0.64) and at a high level. This finding implies that many students believe that doing homework is an expectation or requirement that they need to fulfill. Also, the statement "Because I might get a reward if I do well" as students' reason for trying to do well in school is at a moderate level (m=2.63; sd=1.05). The findings indicate that the importance of rewards as a driving factor for academic success varies among the students surveyed, with some valuing rewards more highly than others. Generally, the students have a moderate level of external regulation (m=3.12; sd=0.53) which indicates that they are likely driven by factors such as rules, obligation, reward, recognition, or approval from teachers. This implies that students were concerned with the rewards or consequences associated with their academic performance. Externally regulated individuals conform to external expectations for rewards or to avoid punishments (Li, 2023).

Table 2.
Student's Level of Self-Regulation in terms of Introjected Regulation

Statement	Mean	SD	VI
1.Because I want the teacher to think I'm a good student.	2.79	0.88	Moderate
4.Because I will feel bad about myself if I don't do it.	3.18	0.90	Moderate
10.Because I want the teacher to think I'm a good student.	2.97	0.92	Moderate
12.Because I'll be ashamed of myself if it didn't get done.	3.26	0.79	High
17.Because I want the other students to think I'm smart.	2.23	0.93	Low
18.Because I feel ashamed of myself when I don't try.	3.14	0.83	Moderate
26.So my teachers will think I'm a good student	2.67	0.91	Moderate
29.Because I'll feel really bad about myself if I don't do well.	2.98	0.91	Moderate
31.Because I will feel really proud of myself if I do well.	3.53	0.76	High
Overall	**2.97**	**0.48**	**Moderate**

Legend: 1.00-1.75(Very Low); 1.76-2.50(Low); 2.51-3.25(Moderate); 3.26-4.00(High)

Table 2 shows the results of students' reasons for their actions in school, specifically focusing on introjected regulation. The statement "Because I will feel really proud of myself if I do well" has the highest mean value (m=3.53; sd=0.76) with verbal interpretation of High. Findings reveal that most students share a similar viewpoint for trying to do well in school which is primarily driven by their desire to experience a sense of personal pride. The statement "Because I want the other students to think I'm smart" for trying to answer hard questions in class (

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m=2.23; sd=0.93) is at a low level. In this case, the data indicates that the desire to impress others with their intelligence is not strongly prevalent among students.

Generally, students' level of introjected regulation is at a moderate level (m=2.97; sd=0.48). This implies that to some extent students engage in activities to avoid feelings of guilt, gain approval from others, or uphold one's self-esteem. According to Guay (2017), introjected regulation as partially controlled actions motivated by internal forces like obligation or guilt.

Table 3.
Student's Level of Self-Regulation in terms of Identified Regulation

Statement	Mean	SD	VI
5.Because I want to understand the subject.	3.60	0.62	High
8.Because it's important to me to do my homework.	3.42	0.72	High
11.Because I want to learn new things.	3.64	0.63	High
16.Because it's important to me to work on my classwork.	3.37	0.74	High
21.To find out if I'm right or wrong.	3.43	0.75	High
23.Because it's important to me to try to answer hard questions in class.	2.96	0.89	Moderate
30.Because it's important to me to try to do well in school.	3.38	0.76	High
Overall	**3.40**	**0.44**	**High**

Legend: 1.00-1.75(Very Low); 1.76-2.50(Low); 2.51-3.25(Moderate); 3.26-4.00(High)

Table 3 concerns the motivational factors driving students' behavior within the educational setting, with particular emphasis on the construct of identified regulation. The statement "Because I want to learn new things" for doing their classwork has the highest mean (m = 3.64; sd = 0.63) in the table. The data showed that students are highly motivated by the desire to acquire new knowledge and expand their understanding of different subjects. This statement "Because it's important to me to try to answer hard questions in class" as students' reason of action has a (m=2.96; sd = 0.89) and is at a moderate level. The result implies that while not all students might view answering hard questions as equally important, there is a general recognition of its significance among the student population. Some students might value the intellectual challenge, the opportunity to demonstrate knowledge, or the desire to actively participate in class discussions.

Generally, the result shows that identified regulation scores, based on a sample dataset, had a mean value of (m=3.40; sd=0.44). This suggests that, on average, individuals in the sample exhibit a relatively high level of identified regulation, indicating that they engage in activities based on personal values and identification with the goals and principles of those activities. When an individual has high identified regulation, they do things due to self-importance. According to Cook and Artino (2016), identified regulation refers to a type of motivation where an individual feels a personal connection to a goal that was originally influenced by external factors. The person has internalized the external pressure and now views the goal as something they personally desire to achieve. However, the goal is not inherently desirable, but rather it is valued because it has practical benefits or usefulness. In other words, the person sees the goal as a means to an end rather than as an end in itself.

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Table 4.
Student's Level of Self-Regulation in terms of Intrinsic Motivation

Statement	Mean	SD	VI
3.Because it's fun.	3.01	0.85	Moderate
7.Because I enjoy doing my homework.	2.93	0.79	Moderate
13.Because it's fun.	3.07	0.77	Moderate
15.Because I enjoy doing my classwork.	3.13	0.78	Moderate
19.Because I enjoy answering hard questions.	2.52	0.93	Moderate
22.Because it's fun to answer hard questions.	2.48	0.90	Low
27.Because I enjoy doing my schoolwork well.	3.10	0.84	Moderate
Overall	**2.89**	**0.54**	**Moderate**

Legend: 1.00-1.75(Very Low); 1.76-2.50(Low); 2.51-3.25(Moderate); 3.26-4.00(High)

Table 4 displays information regarding the students' level of intrinsic motivation. The statement "Because I enjoy doing my classwork" as students' reason for their action has a (m=3.13; sd=0.78). The result suggests that a moderate proportion of the students find their classwork enjoyable, which could be a motivating factor for their engagement and effort in completing it. However, the statement which has the lowest mean (m=2.48; sd=0.90) is "Because it's fun to answer hard questions". This students' reason for doing things in school is at a low level. While some students may find it fun or enjoyable to answer hard questions, this did not resonate strongly with most of the students surveyed.

Overall, the participants in this study have a moderate level of intrinsic motivation (m=2.89; sd=0.54), with some variability across specific items. This means that, on average, the participants showed a reasonable amount of internal drive or interest in the activities or tasks they were engaged in. According to Trevino and DeFreitas (2014) intrinsically motivated individuals have an inner drive to pursue an activity or goal for its inherent value or enjoyment. If students have intrinsic motivation, they are inclined to actively participate in their studies and find pleasure in the learning experience. Consequently, they develop better study habits, which lead to improved academic performance.

Metacognitive Awareness: Metacognitive Knowledge And Metacognitive Regulation

Table 5 presents the level of metacognitive awareness in two divisions: metacognitive knowledge and metacognitive regulation. Data were gathered via MAI, with students indicating True or False for each statement. Metacognitive knowledge consists of declarative knowledge, procedural knowledge, and conditional knowledge.

Table 5.
Students' Level of Metacognitive Awareness in its Two Divisions: Metacognitive Knowledge and Metacognitive Regulation

METACOGNITIVE AWARENESS	Mean	SD	VI
Metacognitive knowledge			
Declarative Knowledge	4.93	1.58	Moderate
Procedural Knowledge	2.98	1.00	High
Conditional knowledge	3.92	1.06	High

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Metacognitive Regulation			
Planning	5.20	1.58	High
Comprehension Monitoring	4.98	1.44	High
Information Management Strategies	6.80	2.03	High
Debugging Strategies	4.28	0.93	High
Evaluation	4.05	1.39	High

Based on the table, students have a moderate level of declarative knowledge (m=4.93; sd=1.58) which implies that, on average, students understand their intellectual strengths and weaknesses. Also, students have a high level of both procedural (m=2.98; sd=1.00) and conditional knowledge (m=3.92; sd=1.06). This implies that the students learn best when they know something about the topic. They become motivated to learn more when they need to. The table also displays the students' high level of metacognitive regulation across all five aspects. Their high level of planning (m=5.20; sd=1.58) means that students are mindful of how much time they must finish a task. Their high level of comprehension monitoring (m=4.98; sd=1.44) indicates that students evaluate their own understanding. This allows for a self-assessment of comprehension and can help identify areas that may need more focus or review. Students' high level of information management strategies (m=6.80; sd=2.03) which indicates that students can easily identify important information and concentrate on its relevance. Their high level of debugging strategies (m=4.28; sd=0.93) implies that students revisit and reassess their initial beliefs or assumptions when they encounter confusion or errors in their learning process. Lastly, students' high level of evaluation (m=4.05; sd=1.39) implies that they can accurately assess how well they performed.

Overall, the result implies high level of metacognitive knowledge and metacognitive regulation and that these two are important factors in student learning and academic success, and that teaching students' strategies for monitoring and controlling their own learning processes can lead to improved academic outcomes.

Level of students' critical thinking skills in Mathematics

The following data describes the students' level of critical thinking skills in a mathematics test. Table 6 displays the perceived mean level that students demonstrate critical thinking skills in mathematics test under three components. The test involves problems regarding Quadrilaterals.

Table 6
Mean Perceived Level of Students' Critical Thinking Skills in its Three Components

CRITICAL THINKING SKILLS	Mean	SD	VI
Identification and Interpretation of Information	2.71	0.58	Achieving
Information Analysis	2.11	0.78	Developing
Evaluation of the evidence and arguments	1.63	0.81	Initiating
Overall	**2.15**	**0.72**	**Developing**

Legend: 1.00-1.75(Initiating); 1.76-2.50(Developing); 2.51-3.25(Achieving); 3.26-4.00(Advancing)

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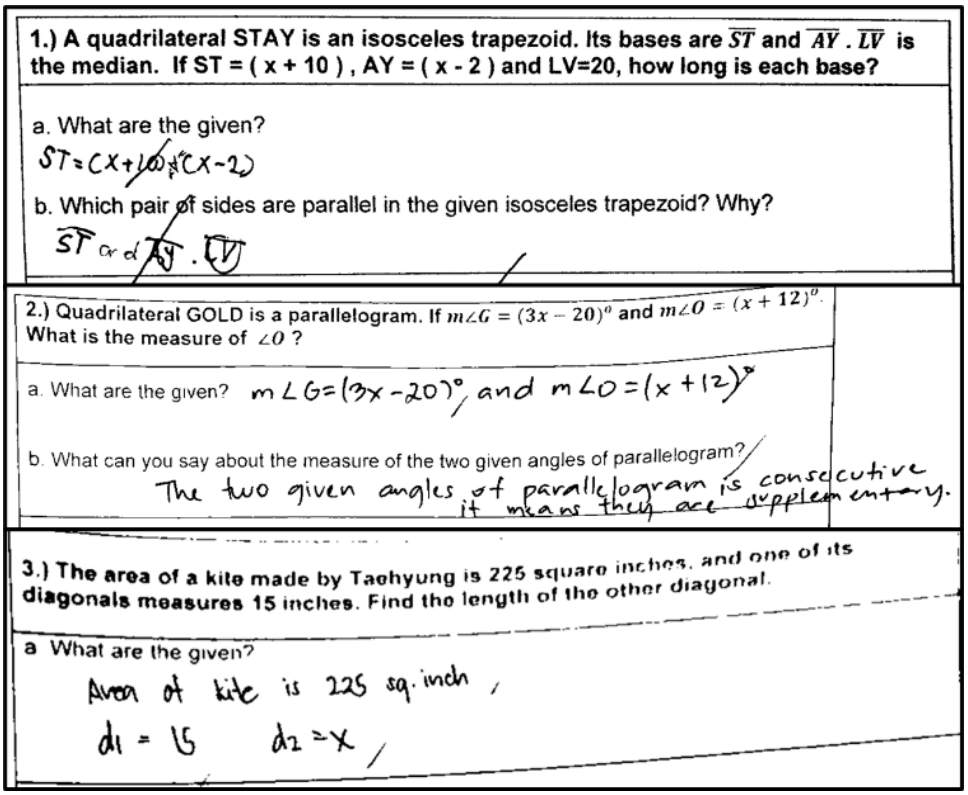

Figure 1. *Answer of students on the test for Critical Thinking Skills*

Figure 1 shows the students answer on the test. Based on their answer, most students were able to answer the question "What are the given?" in each problem completely although few of them miss out on one or two given information. They know how to give interpretation for the information that they have identified wherein they associate the given on the theorems or concepts and on the definition they know. Students are at an achieving level of critical thinking skills in terms of identification and interpretation of information (m=2.72; sd=0.58) as shown in Table 6. This indicates that they can identify some relevant information and interpret its evidence, statements, questions with minor errors.

Furthermore, the data reveals that in terms of information analysis they are at a developing level (m=2.11; sd=0.78). This level indicates that students only offer superficial analysis of information however they have shown an incorrect approach to solve the problem.

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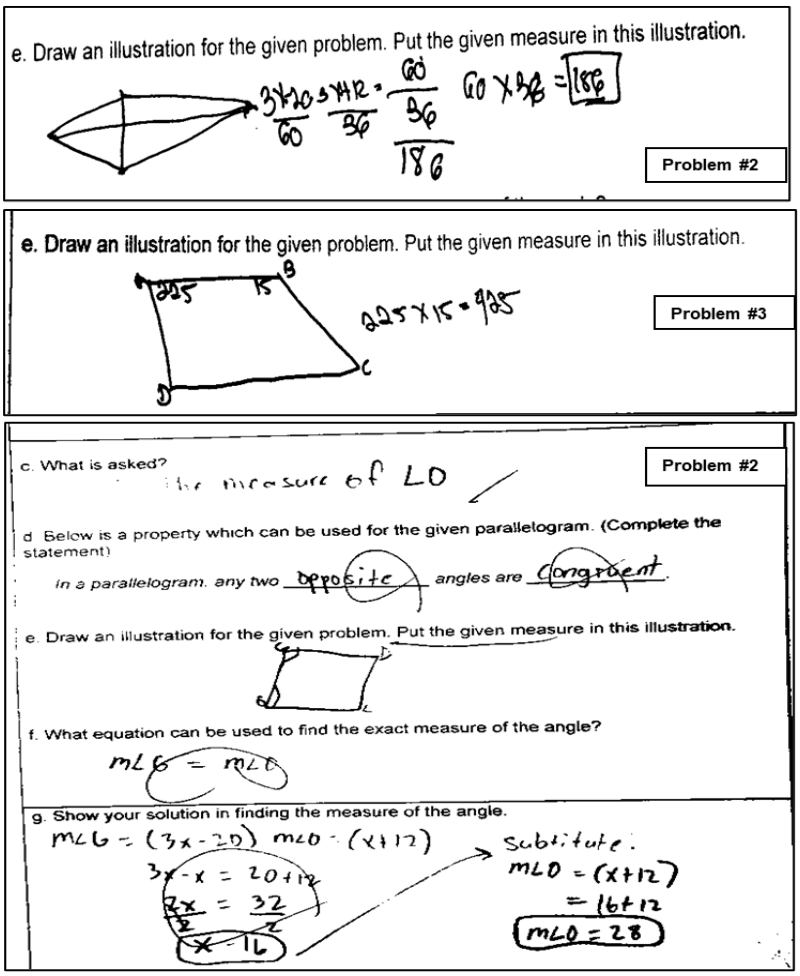

Figure 2. *Answer of students on the test for Critical Thinking Skills*

Figure 2 shows some of the students' answers on the administered test. The students understood the math problem however they could not identify the applicable theorem or concept to use in solving the problem. This aligns with their moderate level of declarative knowledge as students struggled to recall information. Some students drew geometric shapes accurately, like a kite, parallelogram, and trapezoid, however they did not label them correctly. In addition, there was also a student confused about the quadrilaterals' shapes. For instance, in problem number 2 the student drew a kite instead of a parallelogram and in problem number 3, they drew a trapezoid instead of a kite. Moreover, in problem number 2, the student gave an incorrect theorem and based her formula or equation on this which led her to an incorrect answer.

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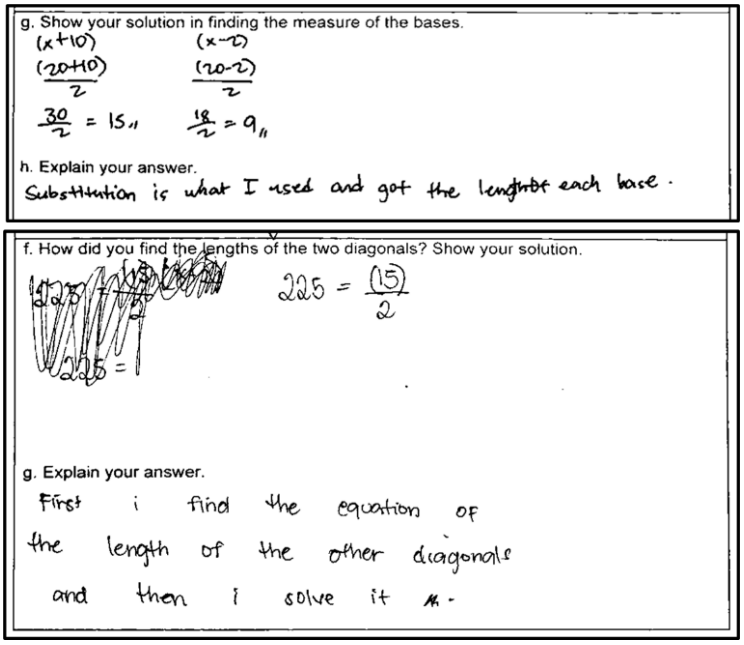

Figure 3. *Answer of students on the test for Critical Thinking Skills*

Figure 3 shows the students' answer on the test for critical thinking skills in terms of evaluation of evidence and arguments. It was apparent that the students struggled to provide the correct answer and failed to offer sufficient reasoning to support their response. Moreover, students are at initiating level (m=1.63; sd=0.81) in terms evaluation of evidence and arguments. This means that most students gave an incorrect answer and had shown no solution to the problem. In addition to this, students did not justify the results or procedure nor explain reasons. They had some difficulties in analyzing the strengths and weaknesses of arguments and in using evidence to support their own answer. Some of the students were able to answer the problem correctly yet they were not able to explain how they got their answer.

Generally, students' level of critical thinking skills is only at a developing level (m=2.15; sd=0.72). These findings suggest that there is a need for further development and improvement of critical thinking skills among the student population. Although students may demonstrate an achieving level in certain aspects, there remains potential for enhancement, specifically in the assessment of evidence and arguments. Also, the students' skill in information analysis can still be improved. This skill includes illustration of the problem unfortunately many of them failed to illustrate the given. This is supported by the findings obtained from the study of Shatri and Buza (2017) they emphasized the advantageous impact of incorporating visualization in the teaching and learning process. It fosters the development of students' critical thinking abilities and enhances their overall academic performance. By focusing on developing these skills, students may be better equipped to succeed in mathematics and beyond.

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Mathematics Performance

Table 7
Level of Students' Performance in Mathematics

Average Grade in Mathematics (1st-2nd Quarter)			
Interval	**f**	**%**	**VI**
75-82	100	33.333	LOW Performing
83-89	100	33.333	MID Performing
90-100	100	33.333	HIGH Performing
	300	100%	

Shown above is the frequency of students' level of mathematics performance. This is represented by the average grade on the first two grading periods. The grade of 75 is the lowest passing grade in the DepEd K to 12 Grading System. The grade interval 75-82 indicates that the students are low performing. During the conduct of the CTS test, these students were not able to differentiate kinds of quadrilaterals. There were some who drew a trapezoid instead of a kite. Many of them could not even perform a simple equation on problem solving.

Furthermore, the grade interval 83-89 indicates that the students are at the mid level of performance in mathematics. These students have the willingness to learn mathematics although they need more guidance in doing math activity. In addition, the curriculum guides for the K to 12 Education Program incorporate standards and a grading system based on competencies. This curriculum guide provides grading scale with description. The grades in the interval 90-100 have a corresponding description as *"Outstanding"* in the DepEd curriculum guides. This indicates that students with grades in this interval are high performing students. They are most likely to be honor students. They know how and when to use the formula or an equation and can evaluate their own equations. They have even memorized the definitions and theorems or concepts that have been discussed in their math class.

The relationship between self-regulation and critical thinking skills

The following data displays the relationship among metacognitive awareness, self-regulation and critical thinking skills.

Table 8
Test of Correlation between Student's Self-Regulation and Critical Thinking Skills

	SR	MA	CTS
Self-Regulation(SR)	1	.397**	.391**
Metacognitive Awareness(MA)	.397**	1	.300**
Critical Thinking Skills(CTS)	.391**	.300**	1

***. Correlation is significant at the 0.01 level(2-tailed).*

Table 8 presents the correlation between the Self-Regulation(SR) and Critical Thinking Skills(CTS) with a computed value of 0.391 at 0.01 level of significance. This suggests that as an individual's self-regulation gets higher, the higher the critical thinking skills are. This is consistent with the study of Kahrizi and Farahian (2014) where a significant relationship between SR and CTS was found.

The analysis also revealed that there is a positive significant relationship between SR and MA(r=0.397, p=0.01). Additionally, metacognitive awareness exhibits a significant positive correlation with critical thinking skills (r=0.300, p=0.01). This suggests that as an individual's SR increases, their level of MA also increases. Similarly, as MA improves, so does one's level of CTS.

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Moreover, this result is consistent with the study of Arslan (2014) that demonstrates how aspects of SR are positively correlated with metacognition. Similarly, Stephanou and Mpiontini's (2017) investigation on students' MA, their management of it during assignments or homework, and their utilization of four forms of regulation (external, introjected, identified, and intrinsic) also supports these results. Also, it was mentioned in their study that to better understand metacognition requires a deeper look at self-regulation. In a variety of fields, including education, MA and SR are seen as essential skills for successful learning (Efklides, 2014; Gomes, et al., 2014; Panadero, 2017)

In addition, the result is also supported by the study of Arslan (2018) which stated that the level of critical thinking and the students' metacognitive skills were found to be positively and significantly correlated. Additionally, Samsudin and Hardini (2019) found that students' metacognitive skills had a big impact on their CTS. Many studies in this field revealed a robust, favorable, and substantial link between students' metacognition and CTS (Arslan et al., 2013; Karasakaloğlu et al., 2012).

Metacognitive awareness as a mediator on the relationship between students' self-regulation and critical thinking skills

This part of the study shows the result of the investigation on how metacognitive awareness influences the relationship between self-regulation and critical thinking skills among students.

Table 9

The Mediating Effect of the Metacognitive Awareness on the Relationship of Self-Regulation and Critical Thinking Skills of the Students

	B	SE	t	p	LLCI	ULCI
SR→MA	0.0996	0.0144	6.9053	.0000	.0712	.1279
MA→CTS	1.0505	.3808	2.7588	.0062	.3011	1.7999
SR→MA→CTS	.1046	.0373			.0401	.1885
Direct Effect	.6110	.1021	5.9858	.0000	.4101	.8119
Indirect Effect	.1046	.0373			.0401	.1885
Total Effect	.7156	.0958	7.4681	.0000	.5270	.9042

R=0.4227; R-sq=0.1787; F(2,297)=32.3108, p=0.0000

The results presented in Table 9 depict the outcomes of a mediation analysis performed using Model 4 PROCESS Macro for SPSS. The purpose of this analysis was to explore the connection between self-regulation, metacognitive awareness, and critical thinking skills, and to assess whether MA acted as a mediator in the relationship between SR and CTS. The analysis findings demonstrated a positive relationship between SR and MA (B=0.0996, p<0.01). Additionally, MA was found to have a positive effect on CTS (*B*=1.505, p<0.01). The indirect effect of SR on CTS was statistically significant, as the confidence intervals did not include zero (B=0.1046, 95% CI 0.0401, 0.1885). Moreover, SR exhibited a significant direct effect on CTS (B=0.6110, p<0.01) when considering the mediator in the model. In other words, SR is directly and indirectly related to CTS through MA, which implies that partial mediation was observed. The model accounted for a total of 17.9% of the variance in the dependent variable. These results suggest that enhancing individuals' SR can lead to an increase in MA, which, in turn, can enhance one's CTS.

This result aligns with the study of Akcaoglu et.al. (2022), they investigated the mediating role of MA in the relationship between teachers' SR and CTS. They discovered that improving people's CTS requires taking SR and MA into account. This suggests that individuals who have high levels of metacognitive awareness may be more likely to effectively regulate their own thinking and behavior, leading to the development of stronger critical thinking skills.

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Mathematics performance as a moderator on the relationship between students' self-regulation and critical thinking skills

This part of the study shows the result of the investigation on how mathematics performance influences the relationship between self-regulation and critical thinking skills among students.

Table 10.
The Moderating Effect of the Mathematics Performance on the Relationship of Self-Regulation and Critical Thinking Skills

	Coefficient	SE	t	p	LLCI	ULCI
constant	2.1072	.0266	79.2367	.0000	2.0548	2.1595
Self-regulation	.3070	.0722	4.2521	.0000	.1649	.4491
Mathematics performance	-.5442	.0327	-16.6565	.0000	-.6086	-.4799
Int_1	-.3888	.0883	-4.5258	.0000	-.5737	-.2260

R=.7686; R-sq=.5907; F(3,296)=142.4117, p=.0000

The result of moderation analysis summary is presented in Table 10. This study was conducted to determine if mathematics performance moderated the relationship between self-regulation and critical thinking skills. The results revealed a significant impact of Mathematics Performance(MP) on the relationship between Self-Regulation and Critical Thinking Skills. The t-value (-4.5258) indicates that this result is statistically significant, with a p-value of 0.000. The results indicated that both SR (B=0.3070, p=0.000) and MP (B=-0.5442, p=0.000) had significant effects on CTS. It was also revealed that there is a significant interaction between SR and MP (B=-0.3888, p=0.000). Particularly, the analysis shows that when students have low MP, they may have high SR but lower CTS. On the other hand, students with high MP also tend to have high SR and high CTS. This means that the strength and direction of the relationship between SR and CTS may differ depending on an individual's level of MP. This suggests that Mathematics Performance has a significant moderating effect on the relationship between SR and CTS.

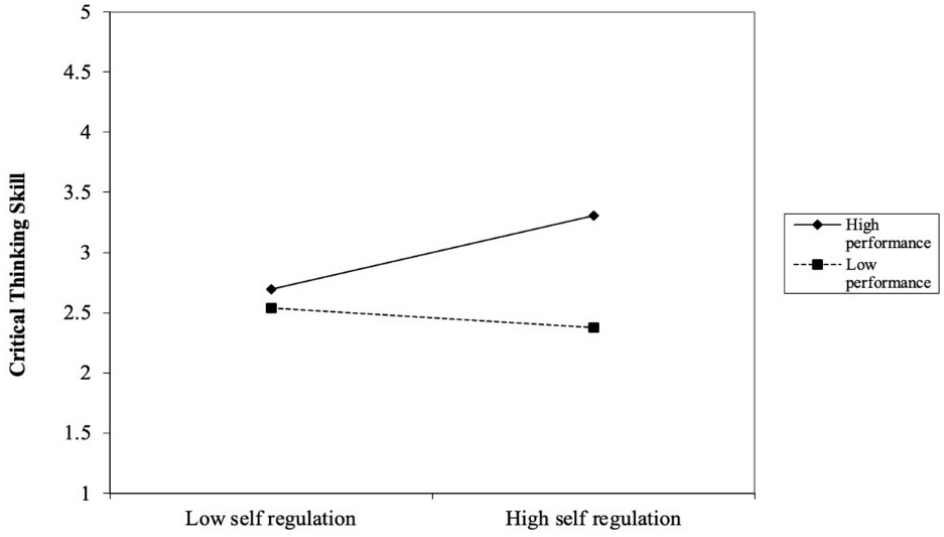

Figure 4. *The slope analysis of the Moderating Effect of the Mathematics Performance to the Relationship of Self-regulation and CTS*

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Figure 4 displays the outcomes of a simple slope analysis carried out to gain a deeper understanding of the moderating effects. The line is much steeper for High Performance, this shows that at High level of Mathematics Performance, the impact of Self-Regulation on Critical Thinking Skills is much stronger in comparison to Low level of Mathematics Performance. As the level of Mathematics Performance decreases, the strength of the relationship between Self-Regulation and Critical Thinking Skills decreases. Zeng and Goh (2018) conducted a study comparing the effectiveness of a self-regulated learning (SRL) approach. The study examined four participants, two highly proficient and two with low proficiency in listening. Results showed that strong self-regulatory skills were found in high achievers.

RESULTS and DISCUSSION

Students' reasons in doing things in school were moderately driven by their external regulation, introjected regulation and intrinsic motivation. These three subscales of self-regulation are at a moderate level. The most dominant regulatory subscale among the students is the identified regulation which is on high level.

Regarding the students' metacognitive awareness under the metacognitive knowledge, students' declarative knowledge was at a moderate level. On the other hand, students' procedural knowledge and conditional knowledge had a higher mean value which were both on a high level.

Students had a high level of metacognitive regulation in terms of planning, comprehension monitoring, information management strategies, debugging strategies and evaluation.

The student's skill on identification and interpretation of information are at the achieving level. For information analysis, the students are in the developing level in this area. Lastly, students' skill in the evaluation of evidence and arguments is at the initiating level.

Students' mathematics performance during the first two grading periods was divided into three classifications. There were 100 high performing students, 100 mid- performing students, and 100 low performing students who participated in the study.

The result of the survey for students' Self-Regulation and test for Critical Thinking Skills were tested for correlation at 0.01 level of significance. It was revealed that there is a significant relationship between the two.

The data showed that Self-Regulation has an impact on Critical thinking skills which is considered as a direct effect due to the presence of metacognitive awareness. Self-Regulation influences Metacognitive Awareness and Metacognitive Awareness influences Critical Thinking Skills. The results of the mediation analysis indicated that the connection between Self-Regulation and Critical Thinking Skills is influenced by Metacognitive awareness. It plays a crucial role in explaining how Self-Regulation affects Critical Thinking Skills. This implies that students' may self-regulate for the development of their other skills such as metacognitive awareness and critical thinking skills. These skills will be beneficial not only in their mathematics studies but also in other subjects. Education focuses on fostering human cognition and intellectual growth. According to Hitchcock's (2018) in the Stanford Encyclopedia of Philosophy, one of the aims of education is to cultivate critical thinking. Critical thinking refers to deliberate and purposeful cognitive processes, which can assist students in accomplishing their objectives.

The analysis of moderation demonstrated that the performance in Mathematics plays a crucial role in moderating the relationship between Self-Regulation and Critical Thinking Skills. This means that the strength and direction of the relationship between Self-Regulation and Critical Thinking Skills may differ depending on an individual's level of Mathematics Performance. The impact of Self-Regulation on Critical Thinking Skill is moderated until the Mathematics Performance is at this certain the level (0.3900).

Relying on the data collected, teachers may create a positive and engaging learning environment that incorporates self-regulation strategies when it comes to academic performance such as integrating goal-setting, engaging in self-reflection activities, and providing metacognitive prompts, within their lesson plans to elevate students' critical thinking skills. It can increase the enjoyment and motivation of students to complete their classwork and homework. Students may identify their strengths and weaknesses in self-regulation, and employ effective strategies to regulate their emotions, behaviors, and thoughts to optimize their academic performance and overall

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well-being. This study suggests that teachers may integrate metacognitive reflection activities, provide explicit intstruction on metacognitive strategies, and offer opportunities to practice sel-assessment and self-monitoring.

This research proposes that to enhance CTS, which are fundamental objectives of education, school administrators and educators may utilize the mediating influence of metacognitive awareness in the association between SR and CTS. Thus, fostering metacognitive awareness is a promising strategy for enhancing Critical Thinking Skills among learners.

Although the topics included on the test were already discussed by the respondents' respective teacher, this study still has its limitations. These limitations include the respondents having different teachers who has different teaching approach and strategies which may have impact on how they understand the lesson leading to their critical thinking skills and mathematics grade. Therefore, it is suggested that this research be expanded to include other grade levels in order to obtain a more comprehensive understanding of the influence of metacognitive awareness and mathematics performance on students' self-regulation and critical thinking skills.

REFERENCES

Aizikovitsh, E., & Amit, M. (2010). Evaluating an infusion approach to the teaching of critical thinking skills through mathematics. Procedia-Social and Behavioral Sciences, 2(1), 3818-3822. https://doi.org/10.1016/j.sbspro.2010.03.596

Akcaoğlu, M.Ö., Dirlik, E. M., & Külekçi, E. (2022). The mediating role of metacognitive awareness in the relationship between critical thinking and self-regulation. Thinking Skills and Creativity, 101187.

Aloysius, D.C., & Rohman, F. (2016). The correlation between metacognitive skills and the critical thinking skills of senior high school students in biology learning through the implementation of problem-based learning.

Arslan, S. (2018). Investigating predictive role of critical thinking on metacognition with structural equation modeling. MOJES: Malaysian Online Journal of Educational Sciences, 3(2), 1-10.

Arslan, S. (2014). An Investigation of the Relationships between Metacognition and Self-Regulation with Structural Equation. International Online Journal of Educational Sciences, 6(3).

Belecina, R.R., & Ocampo Jr, J.M. (2018). Effecting change on students' critical thinking in problem solving. Educare, 10(2).

Çakici, D. (2018). Metacognitive Awareness and Critical Thinking Abilities of Pre-Service EFL Teachers. Journal of Education and Learning, 7(5), 116-129.Caruso, S. (2021). Strategies for Declarative Knowledge Instruction. Retrieved from https://hrdevelopmentinfo.com/strategies-for-declarative-knowledge-instruction/#:~:text=In%20addition%20to%20linking%2C%20organizing,Smith%20and%20Ragan%2C%202005).

Cook, D. A., & Artino Jr, A. R. (2016). Motivation to learn: an overview of contemporary theories. Medical education, 50(10), 997-1014.

Cuncic, A. (2022). How to Develop and Practice Self-Regulation. https://www.verywellmind.com/how-you-can-practice-self-regulation-4163536#:~:text=An%20adult%20with%20poor%20self,with%20a%20mental%20health%20condition.

de Bie, H., Wilhelm, P., & van der Meij, H. (2015). The Halpern critical thinking assessment: Toward a Dutch appraisal of critical thinking. Thinking skills and creativity, 17, 33-44.

Efklides, A. (2014). How Does Metacognition Contribute to the Regulation of Learning? An Integrative Approach. Psychological Topics, 23, 1-30.

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Facione, P.A., & Facione, N.C. (2009). The Holistic Critical Thinking Scoring Rubric-HCTSR: A Tool for Developing and Evaluating Critical Thinking. Retrieved May, 2, 2011.

Firdaus, F., Kailani, I., Bakar, M. N. B., & Bakry, B. (2015). Developing critical thinking skills of students in mathematics learning. Journal of Education and Learning, 9(3), 226-236.

Flavell, J.H. (1979). Metacognition and cognitive monitoring: A new area of cognitive–developmental inquiry. American psychologist, 34(10), 906.

Gomes, M., Monteiro, V., Mata, L., Peixoto, F., Santos, N., & Sanches, C. (2019). The Academic Self-Regulation Questionnaire: a study with Portuguese elementary school children. Psicologia: Reflexão e Crítica, 32.

Grosvenor, M. (2022). Strengthening Executive Function and Self-Regulation in Early Childhood Classroom.

Guay, F. (2017). Applying self-determination theory to education: Regulations types, psychological needs, and autonomy supporting behaviors. Canadian Journal of School Psychology, 37(1), 75-92.

Insorio, A.O., & Librada, A.R.P. (2020). Enhancing Mathematical Critical Thinking and Problem-Solving Skills through Emergenetics® as a Grouping Mechanism. Contemporary Mathematics and Science Education, 2(1), ep21002.

Jaleel, S. (2016). A Study on the Metacognitive Awareness of Secondary School Students. Universal Journal of Educational Research, 4(1), 165-172.

Kahrizi, P., & Farahian, M. (2014). The Relationship Between Self-regulation and Critical Thinking among Iranian EFL Learners. Modern Journal of Language Teaching Methods, 4(4), 157

Karasakaloğlu, N., Saracaloğlu, A.S., & Yılmaz-Özelçi, S. (2012). Türkçe öğretmeni adaylarının okuma stratejileri, eleştirel düşünme tutumları ve üst bilişsel yeterlilikleri [Turkish prospective teachers' reading strategies, critical thinking attitudes and metacognitive competencies]. Ahi Evran Üniversitesi Kırşehir Eğitim Fakültesi Dergisi (KEFAD), 13(1), 207-221. Kenton, W. (2022). Pearson Coefficient. Retrieved from https://www.investopedia.com/terms/p/pearsoncoefficient.asp.

Kong, S.C. (2014). Developing information literacy and critical thinking skills through domain knowledge learning in digital classrooms: An experience of practicing flipped classroom strategy. Computers & education, 78, 160-173.

Li, P. (2023). Extrinsic Motivation: How Many Different Types Are There? https://www.parentingforbrain.com/extrinsic-motivation/#:~:text=External%20Regulation&text=An%20example%20would%20be%20a,this%20action%20is%20externally%20regulated.

Marquez, L.P. (2017). Critical Thinking in Philippine Education: What We Have and What We Need. Journal for Critical Education Policy Studies (JCEPS), 15(2).

Mason, J., Burton, L. and Stacey, K. (2010). Thinking Mathematically, 2nd edition. London: Pearson Education Limited.

Nauman, S. (2017). Lack of critical thinking skills leading to research crisis in developing countries: A case of Pakistan. Learned Publishing, 30(3), 233-236.

Nilson. (2014). Developing children's critical thinking through creative arts exposure: An application of ennis's super-streamlined critical thinking framework. The International Journal of Arts Education, 8, 31-45.

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Nosratinia, M., Saveiy, M., & Zaker, A. (2014). EFL learners' self-efficacy, metacognitive awareness, and use of language learning strategies: How are they associated. Theory and Practice in Language Studies, 4(5), 1080-1092.

Panadero, E. (2017). A Review of Self-Regulated Learning: Six Models and Four Directions for Research. Frontiers in Psychology, 8, 422. https://doi.org/10.3389/fpsyg.2017.00422

Pantiwati, Y., & Husamah, H. (2017). Self and peer assessments in active learning model to increase metacognitive awareness and cognitive abilities. International Journal of Instruction, 10(4).

Ryan, R.M., & Connell, J.P. (1989). Perceived locus of causality and internalization: Examining reasons for acting in two domains. Journal of Personality and Social Psychology, 57, 749-761.

Sadeghi, B., Hassani, M.T. & Rahmatkhah, M. (2014). The Relationship between EFL Learners' Metacognitive Strategies, and Their Critical Thinking, Journal of Language Teaching & Research, 5(5), 1167-1175.

Samsudin, D., & Hardini, T. (2019). THE INFLUENCE OF LEARNING STYLES AND METACOGNITIVE SKILLS ON STUDENTS'CRITICAL THINKING IN THE CONTEXT OF STUDENT CREATIVITY PROGRAM. International Journal of Education, 11(2), 117-124.

Schraw, G., & Dennison, R.S. (1994). Assessing metacognitive awareness. Contemporary educational psychology, 19(4), 460-475.

Shatri, K., & Buza, K. (2017). The use of visualization in teaching and learning process for developing critical thinking of students. European Journal of Social Sciences Education and Research, 4(1), 71-74.

Stephanou, G., & Mpiontini, M.H. (2017). Metacognitive Knowledge and Metacognitive Regulation in Self-Regulatory Learning Style, and in Its Effects on Performance Expectation and Subsequent Performance across Diverse School Subjects. Psychology, 8, 1941-1975.

Trevino, N. N., & DeFreitas, S. C. (2014). The relationship between intrinsic motivation and academic achievement for first generation Latino college students. Social Psychology of Education, 17, 293-306.

Whiting, K. (2020). These are the top 10 job skills of tomorrow – and how long it takes to learn them. World Economic Forum, https://www.weforum.org/agenda/2020/10/top-10-work-skills-of-tomorrow-how-long-it-takes-to-learn-them/

Yoo, C. (2018). How to Support Self-Regulation Difficulties in Children. https://www.foothillsacademy.org/community/articles/self-regulation-difficulties#:~:text=Children's%20lack%20of%20self%2Dregulation,they%20need%20to%20manage%20stress

Zeng, Y., & Goh, C.C. (2018). A self-regulated learning approach to extensive listening and its impact on listening achievement and metacognitive awareness. Studies in Second Language Learning and Teaching, 8(2), 193-218.