

## The Relation of Moodle-Based Self-Regulated Learning with Grade 11 Students' Metacognitive Skills

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### ABSTRACT

*This research investigates the relation between Moodle based self-regulated learning and Metacognitive skills of grade 11 students in XYZ High School Tangerang, within the context of online asynchronous Applied Mathematics course. The research sample contained 105 students enrolled in this course. Researchers employed quantitative methods, collected data through survey questionnaires and analyzed it using correlation and linear regression methodologies. The results revealed a strong correlation (Pearson Correlation value = .619) between Moodle-based self-regulated learning and grade 11 students' metacognitive skills in online asynchronous Applied Mathematics course in XYZ High School. The linear regression analysis indicated that Moodle-based self-regulated learning has a significant contribution towards students' metacognitive skills as represented by the linear equation  $Y = 46.647 + 0.414X$ . This research makes an important contribution by how Moodle-based self-regulated learning can enhance students' metacognitive skills in the context of online asynchronous Applied Mathematics course.*

## INTRODUCTION

To accommodate effective learning, its approaches must take students' views, experiences, and involvement into consideration. When students are given the freedom to organize and choose their own learning experiences, class activities can be student-centered, and teachers can be facilitators or moderators of their learning (Bremner et al., 2022). Teachers here can help them to explore what, when, and how students learn, either through student discussion or technology-based mediums. One of the mediums that can be used in the classroom is Moodle. This platform acts as a technology-based learning management system where classroom materials, assignments, and scores can be accessed through the internet and gadgets such as computers, laptops, and tablets (Cole & Foster, 2008). Students who use Moodle have the freedom to access certain learning materials without time and space constraints (Alifiyanti et al., 2018).

In addition, Moodle can also assist students to monitor learning experiences on their own, which is also known as self-regulated learning, a strategy where students learn to become controllers of their own learning activities. It involves motivation, goals, making decisions and acting in the learning process (Fasikhah & Fatimah, 2013). This learning strategy has four dimensions, namely motivation, method, performance outcome, environment or social conditions (Latipah, 2010). Thus, self-regulated learning is a learning strategy that involves students actively managing and controlling their own learning process, starting from planning, monitoring, controlling, and self-evaluating systematically to achieve goals in learning by using various cognitive, motivational strategies, and behavior. It aims to increase student awareness on the strategies (Khoerunnisa et al., 2021). Through this strategy, students can take responsibility to delve into, construct, develop, and expand their potential in learning.

Self-regulated learning also increases students' metacognitive skills (Darmawan et al., 2018). Metacognitive skills are abilities to regulate learning activities carried out by planning, setting goals, organizing, self-monitoring, and self-evaluating (Kristiyani, 2016). Students who have metacognitive skills can develop a systematic method for solving problems which includes selecting, remembering, re-recognizing, organizing the information they encounter and solving problems (Rusliah, 2021). Metacognitive abilities are important for students to raise awareness when they make mistakes, then evaluate and assess the effectiveness of the strategies used in learning (Lestari et al., 2019). Therefore, students' metacognitive skills are abilities to think about how to regulate the learning activities carried out and develop a systematic way of solving a problem. In conclusion, self-regulated learning can enhance students' metacognitive skills.

XYZ High School Tangerang has implemented Moodle as a self-regulated learning medium since 2020. To evaluate the use of Moodle and to study deeper into how Moodle and self-regulated learning affects students' metacognitive skills in said school, we summarized a research question as follows: "Does Moodle-based self-regulated learning related to grade 11 students' metacognitive skills in the online asynchronous applied mathematics course?" Tailing from this question, the research objective is to describe whether a relation is present between Moodle-based self-regulated learning and students' metacognitive skills. The significance of this research are as follows: (1) for XYZ High School to consider using or modifying the online asynchronous applied mathematics course; (2) as a variable indicator reference for future research, and (3) to create a detailed instrument to measure the relation between Moodle-based self-regulated learning and grade 11 students' metacognitive skills in the online asynchronous applied mathematics course in XYZ High School Tangerang.

## LITERATURE REVIEW

### *Self-Regulated Learning*

According to Fasikhah and Fatimah (2013), self-regulated learning refers to the situation where students learn to be in control of their own learning activities. It involves motivation, goals, and making decisions and acting in the learning process. In line with Latipah (2010) defines self-regulated learning as having four dimensions, namely motivation, method, performance outcome, and environment or social conditions. social). Metacognition is a person's ability to regulate, plan, organize, instruct, monitor and evaluate oneself in the learning process. In terms of motivation, students feel competent, have self-confidence and independence. In terms of behavior, they choose, structure and organize the learning environment to be more optimal.

Thus, it can be concluded that self-regulated learning is a learning strategy that involves students actively managing and controlling their own learning process, starting from planning, monitoring, controlling and evaluating themselves systematically to achieve learning goals using various cognitive and motivational strategies, and behavior.

### *Characteristics of Self-regulated Learning*

Several experts have provided their opinions regarding the characteristics of self-regulated learning, including:

a. Zimmerman & Schunk (2011)

Proposed that self-regulated learning involves three main components, namely metacognition, motivation and behavior. They emphasize that individuals who carry out self-regulated learning must have metacognitive abilities to organize students' thoughts about learning, strong motivation to achieve learning goals, and organized behavior to carry out actions that are in accordance with learning goals.

b. Bandura (1997)

States that students who carry out self-regulated learning must have high self-confidence or self-efficacy, namely their belief in their ability to succeed in learning. Bandura also emphasized the importance of motivation, self-monitoring, and setting an optimal learning environment.

c. Pintrich (2004)

Explains that students who carry out self-regulated learning must have specific learning goals, effective learning strategies, and the ability to monitor and evaluate progress in achieving these learning goals. Pintrich also emphasized the importance of motivation, emotional regulation skills, and the ability to overcome obstacles in the learning process.

Thus, it can be concluded that self-regulated learning involves: 1) Students' ability to organize and control learning progress using various learning strategies, skills and knowledge; and 2) Involves aspects such as motivation, setting specific learning goals, self-monitoring and the use of feedback.

### *Moodle-based Learning Management System*

Learning Management System (LMS) is an information technology system that aims to support and control the learning process, provide learning materials, and bridge interactions between teachers and students online (in the network). LMS can make it easier to access the material provided through several available features such as discussion forums, chat features, and teacher assignments (Fitriani, 2020). The flexibility of the LMS allows teachers or students to access it anywhere, anytime, and with any device such as PC, tablet, and smartphone (Alifiyanti et al., 2018).

One of the Learning Management Systems is Moodle, or Modular Object-Oriented

Dynamic Learning Environment. This tool is a free, open-source system that can help support learning in e-learning portals (Puspitasari & Jamaluddin, 2018). According to Cole & Foster (2008), Moodle can be accessed via a website that can be accessed easily with a web browser and has now expanded into the realm of smartphone application use.

Moodle has been implemented since 2004 and is still often used by teachers, educators and students to access various kinds of learning materials such as links (in the form of e-books, videos, articles, etc.), discussion forums, chat features, and so on (Wulandari, 2015). This system can help teachers evaluate students' progress in understanding material through quizzes, assignments, and providing grades and feedback. In addition, students can monitor their learning through a calendar, a list of existing assignments, and reminders to submit assignments.

### ***Metacognitive Skills***

An important knowledge dimension that students need to possess is metacognitive skills. Rooted from the word “metacognition”, this term was first introduced by Flavell in 1976. According to the Graduate Competency Standard No. 20 in 2016 (*Standar Kompetensi Lulusan No. 20 Tahun 2016*) and the 2013 Revised Curriculum, Indonesia recognized metacognitive skills as one of the compulsory skills needed in students (Lestari et al., 2019,). In simple words, metacognition is defined as thinking how to think (Rinaldi, 2017). Students think to process information acquired in learning and do the necessary strategies to achieve a certain learning objective efficiently, effectively, and optimally. Rusliah interprets metacognition generally as students' conscious effort to act on a process or result of thought to control and evaluate their cognitive processes. In conclusion, metacognition is an ability that happens consciously towards their learning process or result to help control and evaluate their learning experience.

Kristiyani (2016) states that metacognitive skills are students' ability to regulate their own learning activities by planning, establishing, defining goals, organizing, self-monitoring and self-evaluating. In accordance with Rusliah (2021) describes this skill as an individual's capability to develop a systematic method of problem-solving by choosing, remembering, recalling, organizing information, and solving the problem. Lestari et al. (2019) also adds that metacognitive skills are very important in students' learning experience, as students need to be aware of what they should do in the midst of problems. Students can learn how to evaluate and assess their learning strategies in class.

Therefore, we can conclude that metacognitive skill is an ability to think about how to think to help students regulate their learning activities and formulate a systematic method to solve a particular problem.

### ***Characteristic of Metacognitive Skills***

According to Baker & Brown (1980), the aspects of metacognitive skills are (1) checking the output that can surface, (2) planning the next strategy, (3) monitoring the effectiveness of the strategy, and (4) evaluating the strategy. Wilson & Clarke (2004) says that metacognitive skills are categorized into several characteristics, as follows.

- a. Awareness: the awareness of an individual in the learning process that encompasses problem-solving process, knowledge acquisition, problem-solving strategies, and decision-making.
- b. Evaluation: the evaluation process done by an individual regarding their thought process, abilities, and thought limitations. This characteristic enables them to think more effectively in the classroom.
- c. Regulation: the use of metacognitive skills aids an individual to direct their knowledge or make a strategy using that knowledge. The regulation process can be done by planning, self-correcting, and strategy-making.

Similar to that, Veenman & Spaans (2005) describes metacognitive skills (or metacognitive regulation) as a skill where someone regulates and controls their knowledge in the learning process that involves aspects such as planning, monitoring, evaluating, and analysis on the task at hand. Nurfadhilah (2016) emphasizes that point again by grouping it into five (5) parts:

- a. Planning: the method of choosing strategies and resource allocation by the student to make sure the learning process runs effectively.
- b. Monitoring:
  - Information management strategies: the usage of abilities and strategies to process knowledge better
  - Comprehension monitoring: the evaluation process of learning
  - Debugging strategies: correcting important details such as understanding and learning performance mistakes
- c. Evaluation: the evaluation of learning performance

Based on the characteristics and definitions given above, we can conclude that there are several indicators of metacognitive skills, which are as follows.

- a. Students can plan their learning activities by choosing resources, manage study time, and accommodate learning environments.
- b. Students can monitor their learning process by assessing their understanding and performance in the classroom.
- c. Students can evaluate strengths and weaknesses from their learning.

### ***Moodle-Based Self-Regulated Learning Indicators***

Through the features in Moodle, it supports self-regulated learning activities. There are several indicators of Moodle-based self-regulated learning activities:

1. Using self-study facilities: Moodle provides various learning resources such as text, videos and images that can help students understand the concepts being taught. Moodle also helps students choose the most suitable learning resources for themselves.
2. Controlling the independent learning process: Features in Moodle are useful for helping students organize their independent learning process, such as: task lists, calendars, and reminders.
3. Reflecting and evaluating the self-learning process: Moodle provides features for collecting assignments, receiving and responding to feedback from teachers.

### ***Relation of Moodle-based Self-Regulated Learning and Metacognitive Skills***

The change that happens in education due to the industrial revolution and globalization in educational technology has grown significantly high, thus giving an expectation to the current situation to evolve in inclusivity, media-usage, flexibility, and accessibility for every student (Sutikno, 2016). This change shifted the paradigm of teacher-centered learning into a more student-centered approach, which needs many efforts and strategies to bear fruit. Sutikno explains that a good and efficient strategy to reach this goal is self-regulated learning. Along with Moodle as a medium, self-regulated learning could give a fundamental contribution towards the process and result of students' learning, which also pushes them to be active and responsible in the classroom. To do this, students need to be aware of the importance of their own internal processes before acting on it by planning, controlling, self-directing, optimizing their potential, and making use of available resources. Metacognitive skills are one of the abilities that students need to maximize their potential. This skill is related to how students acquire knowledge and how to monitor it (Lestari et al., 2019). Metacognitive skills are crucial for students' development to help trigger them to be actively planning, evaluating, and monitoring their learning process.

Moodle-based self-regulated learning in correlation with metacognitive skills helps students to learn more flexibly and effectively. The LMS enables students to direct and control their learning process, as well as help them learn flexibly and develop their metacognitive skills by increasing self-awareness, facilitating reflection and evaluation, and accessing resources independently.

With all of these in mind, the use of Moodle in learning can aid metacognitive skills by increasing self-awareness, facilitating reflection and evaluation, as well as accessing resources independently. In the context of self-regulated learning, Moodle can help students learn flexibility and independence in learning, by facilitating them to direct and control their learning process.

## METHOD

The research approach used is quantitative research, which aims to objectively find a certain phenomenon's scientific truth. The steps are planning, conducting, and concluding the research and its findings to answer a particular research question (Mukhadis, 2018). Similarly, Hermawan & Amirullah (2016) explained the steps to conduct quantitative research as follows: problem finding, problem description, hypothesis submission, research description, instrument making, data collection, analysis, and conclusion (2016). To conduct this research, we determined the problem, identified the focus of the problem, made the instrument, collected data, analysed data, and made a conclusion.

The subject of this research consists of one hundred and five grade 11 students in XYZ High School that enrolled in the online asynchronous applied mathematics course. The research took place from 3<sup>rd</sup> – 14<sup>th</sup> April 2023.

Data collection techniques are ways that researchers use to collect data objectively to explain or answer a research question (Syahrums & Salim, 2012). We used a questionnaire to collect the data, a collection technique that comprises a set of questions or statements to be filled in by respondents (Purnomo & Palupi, 2016). The questionnaire used the Likert scale score range (one to five), where respondents choose from a range of “feelings” such as strongly agree, agree, neutral, disagree, and strongly disagree. A questionnaire is used to see a relation between Moodle-based self-regulated learning and grade 11 students' metacognitive skills.

The questionnaire used is based on the variables of “Moodle-based self-regulated learning” and “Metacognitive skills”. In Table 1, we explain the indicators of the two variables and the outline of the questionnaire.

**Table 1.** Instrument Outline based on Research Variables and Indicators

Variable	Indicator	Instrument Outline	Statement
Moodle-based self-regulated learning	Using Moodle to access learning resources like	Usage of Moodle to access learning resources such as videos or texts.	12, 35, 8, 19, 31, 63
		Effectiveness of Moodle usage to understand concepts learned in class.	13, 56
	texts and videos independently to help students understand	Ease of access and usage of learning resources to deepen students' knowledge of concepts learned in Moodle.	22, 11
		Time of accessing learning resources to deepen understanding of concepts learned in class through Moodle.	66, 54
	concepts learned in class.	Usage of features in Moodle such as learning videos and texts to deepen students' understanding of concepts learned.	2, 24
		Using features in Moodle such as assignment lists, calendars, and	Usage of assignment lists in Moodle to make sure tasks given by teacher are not missed.
		Usage of calendar in Moodle as a reminder of assignment schedules and learning activities.	3, 39

Variable	Indicator	Instrument Outline	Statement
Metacognitive skills	reminders to manage independent learning process.	Usage of reminder feature in Moodle to remind students to complete assignments and learning activities.	4, 46
		Usage of assignment lists in Moodle to help manage time and independent learning processes	49, 17
		Usage of calendar in Moodle to know the assignments and organize learning activities.	40, 42
		Usage of reminders in Moodle to help students stay focused in assignments and learning activities.	10, 53
		Effectiveness of features in Moodle such as assignment lists, calendars, and reminders in helping students be more independent in learning.	1, 44
		Usage of assignment submission features in Moodle to send completed assignments or tasks	60, 34
	Using features such as assignment submission and teacher feedback to evaluate independent learning process.	Usage of assignment submission features in Moodle to help manage assignments.	27, 64
		Usage of teacher feedback features in Moodle to correct mistakes and increase lesson understanding.	69, 45
		Evaluation of completed assignments in Moodle to measure students' understanding towards lessons.	36, 16
		Usage of teacher feedback features in Moodle to create better learning plans in the future.	7, 58
		Usage of assignment submission and teacher feedback features to achieve effective learning objectives.	23, 15
	Students are able to plan learning activities by choosing learning resources, managing learning time, and accommodating a conducive learning environment.	Students' ability to determine effective learning resources to support lesson understanding.	70, 14
		Effective learning time management to make sure of students' assignment completion.	43, 71
		Conducive learning environment search to support students' focus and concentration during learning.	52, 62
		On-time assignment submission due to good time management.	6
		Students' ability to monitor the current lesson understanding.	29, 59
	Students are able to monitor learning processes by assessing learning understanding and performance.	Students' ability to identify frequent mistakes in the learning process.	41, 57
		Students' ability to monitor daily learning progress	67, 20
		Students' ability to develop effective learning strategy to eradicate struggles in lesson understanding.	51, 37
		Students' ability to identify the cause of learning performance.	18, 47
	Students' ability to monitor learning activities consistently.	65, 38	
	Students' ability to monitor learning skills and solutions.	9, 55	
Students are able to evaluate their strengths and weaknesses from the learning process and activities.	Students' ability to identify strengths in learning strategies.	26, 28	
	Students' ability to assess effectiveness of learning strategies.	48, 68	
	Frequency of students' reflection and evaluation about learning activities.	21, 30	
	Students' ability to create effective learning plans based on students' prior evaluation.	50, 32	

The tests used for data analysis will be for validity and reliability, normality, data linearity, Pearson correlation and simple linear regression. The purpose of these methods is to find out whether the instrument and data used can be trusted and analyzed further. To conduct the analysis, we used Microsoft Excel for the validity and reliability tests and SPSS for the normality, linearity, correlation, and regression tests.

The research hypotheses consist of the Pearson Correlation Test Hypothesis and Linear Regression Hypothesis. Pearson correlation test hypotheses consist of H0 (Null hypothesis): There is no significant relationship between Moodle-based self-regulated learning and grade 11 students' metacognitive skills in XYZ High School Tangerang who take the online asynchronous Applied Mathematics course and H1 (Alternative hypothesis): There is a significant relationship between Moodle-based self-regulated learning and grade 11 students' metacognitive skills in XYZ High School Tangerang who take the online asynchronous Applied Mathematics course. Linear regression hypotheses comprise of H0: There is no significant linear relationship between Moodle-based self-regulated learning and grade 11 students' metacognitive skills in XYZ High School taking the online asynchronous Applied Mathematics course after being controlled by other variables and H1: There is a significant linear relationship between Moodle-based self-regulated learning and grade 11 students' metacognitive skills in XYZ High School taking the online asynchronous Applied Mathematics course after being controlled by other variables.

## RESULT AND DISCUSSION

We gave the questionnaire to students enrolled in the Applied Mathematics Independent Course that implements Moodle-based self-regulated learning. The purpose of this questionnaire is to understand Moodle-based self-regulated learning and students' metacognitive skills. In each sub-chapter, we present the findings and discussion of each test.

### *Validity and Reliability Test Findings*

Table 2 shows the findings based on the calculations of validity and reliability done manually in Microsoft Excel.

**Table 2.** Findings of Validity and Reliability Test Table

Variable	Indicator	Instrument Questions	R count	R table (n-2 & $\alpha=5\%$ )	Description	Cronbach Alpha ( $\alpha=5\%$ )	Description
Moodle-based self-regulated learning	Using Moodle to access learning resources like texts and videos independently to help students understand concepts learned in class.	Statement 2	.27	.19	Valid	.7	Reliable
		Statement 8	.59	.19	Valid	.7	Reliable
		Statement 11	.56	.19	Valid	.7	Reliable
		Statement 12	.54	.19	Valid	.7	Reliable
		Statement 13	.54	.19	Valid	.7	Reliable
		Statement 19	.56	.19	Valid	.7	Reliable
		Statement 22	.63	.19	Valid	.7	Reliable
		Statement 24	.41	.19	Valid	.7	Reliable
		Statement 31	.60	.19	Valid	.7	Reliable
		Statement 35	.57	.19	Valid	.7	Reliable
	Statement 54	.68	.19	Valid	.7	Reliable	
	Statement 56	.58	.19	Valid	.7	Reliable	
	Statement 63	.63	.19	Valid	.7	Reliable	
	Statement 66	.57	.19	Valid	.7	Reliable	
	Using features in Moodle such as assignment lists, calendars, and reminders to manage independent learning process.	Statement 1	.46	.19	Valid	.7	Reliable
		Statement 3	.39	.19	Valid	.7	Reliable
		Statement 4	.45	.19	Valid	.7	Reliable
		Statement 10	.58	.19	Valid	.7	Reliable
		Statement 17	.48	.19	Valid	.7	Reliable
		Statement 25	.50	.19	Valid	.7	Reliable
Statement 39		.52	.19	Valid	.7	Reliable	
Statement 40		.55	.19	Valid	.7	Reliable	

Variable	Indicator	Instrument Questions	R count	R table (n-2 & $\alpha=5\%$ )	Description	Cronbach Alpha ( $\alpha=5\%$ )	Description
Metacognitive Skills	Using features such as assignment submission and teacher feedback to evaluate independent learning process.	Statement 42	.52	.19	Valid	.7	Reliable
		Statement 44	.59	.19	Valid	.7	Reliable
		Statement 46	.65	.19	Valid	.7	Reliable
		Statement 49	.68	.19	Valid	.7	Reliable
		Statement 53	.41	.19	Valid	.7	Reliable
		Statement 61	.47	.19	Valid	.7	Reliable
		Statement 7	.42	.19	Valid	.7	Reliable
		Statement 15	.43	.19	Valid	.7	Reliable
		Statement 16	.43	.19	Valid	.7	Reliable
		Statement 23	.62	.19	Valid	.7	Reliable
		Statement 27	.58	.19	Valid	.7	Reliable
		Statement 34	.41	.19	Valid	.7	Reliable
		Statement 36	.59	.19	Valid	.7	Reliable
		Statement 45	.65	.19	Valid	.7	Reliable
		Statement 58	.56	.19	Valid	.7	Reliable
		Statement 60	.43	.19	Valid	.7	Reliable
		Statement 64	.69	.19	Valid	.7	Reliable
		Statement 69	.66	.19	Valid	.7	Reliable
	Students are able to plan learning activities by choosing learning resources, managing learning time, and accommodating a conducive learning environment.	Statement 6	.52	.19	Valid	.7	Reliable
		Statement 14	.50	.19	Valid	.7	Reliable
		Statement 43	.55	.19	Valid	.7	Reliable
		Statement 52	.58	.19	Valid	.7	Reliable
		Statement 62	.55	.19	Valid	.7	Reliable
		Statement 70	.59	.19	Valid	.7	Reliable
		Statement 71	.52	.19	Valid	.7	Reliable
		Statement 9	.50	.19	Valid	.7	Reliable
		Statement 18	.33	.19	Valid	.7	Reliable
	Students are able to monitor learning processes by assessing learning understanding and performance.	Statement 20	.63	.19	Valid	.7	Reliable
		Statement 29	.48	.19	Valid	.7	Reliable
		Statement 37	.49	.19	Valid	.7	Reliable
		Statement 38	.57	.19	Valid	.7	Reliable
		Statement 41	.41	.19	Valid	.7	Reliable
		Statement 47	.53	.19	Valid	.7	Reliable
		Statement 51	.48	.19	Valid	.7	Reliable
		Statement 55	.55	.19	Valid	.7	Reliable
		Statement 57	.55	.19	Valid	.7	Reliable
Statement 59		.58	.19	Valid	.7	Reliable	
Statement 65		.57	.19	Valid	.7	Reliable	
Statement 67		.54	.19	Valid	.7	Reliable	
Statement 21		.49	.19	Valid	.7	Reliable	
Students are able to evaluate their strengths and weaknesses from the learning process and activities.		Statement 26	.51	.19	Valid	.7	Reliable
		Statement 28	.50	.19	Valid	.7	Reliable
		Statement 30	.60	.19	Valid	.7	Reliable
		Statement 32	.58	.19	Valid	.7	Reliable
		Statement 48	.45	.19	Valid	.7	Reliable
	Statement 50	.69	.19	Valid	.7	Reliable	
	Statement 68	.40	.19	Valid	.7	Reliable	

Based on table 2, it can be concluded that all questions in the instrument have a validity value of R-count > R-table and reliability value of Cronbach's Alpha > .70, thus all of them can be regarded as valid and reliable. Due to this fact, data can continue to the normality and linearity tests.

### Normality Test Findings

Table 3 shows the findings of normality test done in SPSS.

**Table 3.** Normality Test Findings

One-Sample Kolmogorov-Smirnov Test			Unstandardized Residual
N			105
Normal Parameters <sup>a, b</sup>	Mean		0,0000000
	Std. Deviation		1.258.035.463
Most Extreme Differences	Absolute		0,070
	Positive		0,070
	Negative		-0,049
Test Statistic			0,070
Asymp. Sig. (2-tailed) <sup>c</sup>			.200d
Monte Carlo Sig. (2-tailed) <sup>d</sup>	Sig.		0,234
	99% Confidence Interval	Lower Bound	0,223
		Upper Bound	0,245

Based on table 3, the findings of the normality test using the Kolmogorov-Smirnov method found a significance value (2-tailed) of .234, which is more than .05. Due to this fact, it can be concluded that the data distribution of each variable is normal and can continue to the linearity test.

### Linearity Test Findings

The findings of the linearity test conducted in SPSS are shown in Table 4.

**Table 4.** Linearity Test Findings

ANOVA			Sum of Squares	Df	Mean square	F	Sig.
Metacognitive skills *	Between	(Combined)	20,878,514	60	347,975	2,650	0,000
	Groups	Linearity	10,197,454	1	10,197,454	77,647	0,000
Moodle-based self-regulated learning		Deviation from	10,681,060	59	181,035	1,378	0,134
		Linearity	5,778,533	44	131,330		
			26,657,048	104			

Based on table 4, it can be concluded that the significance value for linearity is .000, which means the value is below .05. The significance value of deviation from linearity is .134 which is above .05. These values reveal that a linear relationship is present between Moodle-based self-regulated learning and grade 11 students' metacognitive skills. Due to this fact, correlation and linear regression tests can be conducted.

### Correlation Test Findings

**Table 5.** Correlation Test Findings

Correlation			Moodle-based Self-regulated learning	Metacognitive skills
Moodle-based Self-regulated learning	Pearson Correlation		1	,619**
	Sig. (2-tailed)			0,000
Metacognitive	N		105	105
	Pearson Correlation		,619**	1

<b>Correlation</b>			
		<b>Moodle-based Self-regulated learning</b>	<b>Metacognitive skills</b>
skills	Sig. (2-tailed)	0,000	
	N	105	105

Based on table 5, the value of Pearson correlation of Moodle-based self-regulated learning and grade 11 students' metacognitive skills is .619. Due to this fact, it can be concluded that a strong correlation is present between the two variables. Hulu & Sinaga (2019) support this as the criterion of a strong correlation is on the range of .51 –.75. This also shows that the correlation direction of the variables is the same, where the higher the value of one variable, the higher the value of the other. Also, the result of both variables' significance value output is .000. This value is less than .05, which shows a significant relationship between the two variables.

**Table 6.** Correlation strength and direction

<b>Parameters</b>	<b>Value</b>	<b>Interpretation</b>
Correlation strength	1. 0,00 – 0,25	1. No correlation
	2. 0,26 – 0,50	2. Medium correlation
	3. 0,51 – 0,75	3. Strong correlation
	4. 0,76 – 1,00	4. Very strong correlation
P-value	P-value < 0,05	Both independent and dependent variables have a significant correlation
	P-value > 0,05	Both independent and dependent variables do not have a significant correlation
Correlation direction	Positive (+)	Same direction – the higher the value of X, the higher the value of Y. Caused by an increase of one variable's value followed by an increase of another.
	Negative (-)	Opposite direction - the higher the value of X, the lower the value of Y. Caused by an increase of one variable's value followed by a decrease of another.

Source: Hulu & Sinaga (2019)

### **Simple Linear Regression Test Findings**

**Table 7.** Model Summary – Linear Regression Test Results

<b>Model</b>	<b>R</b>	<b>R Square</b>	<b>Adjusted R Square</b>	<b>Std. Error of the Estimate</b>
1	,619 <sup>a</sup>	0,383	0,377	12,641

a. Predictors: (Constant), Self-regulated learning

It is shown from the table 7 that the value of adjusted R square or the determinant coefficient is .377, which means Moodle-based self-regulated learning can be explained from students' metacognitive skills for about 37,7%, and the rest are affected by other factors. The linear regression results can be interpreted in an ANOVA table.

**Table 8.** ANOVA Table – Linear Regression Test Results

<b>ANOVA<sup>a</sup></b>						
<b>Model</b>	<b>Sum of Squares</b>	<b>Df</b>	<b>Mean Square</b>	<b>F</b>	<b>Sig.</b>	
Regression	10,197,454	1	10,197,454	63,813	<,001 <sup>b</sup>	
Residual	16,459,594	103	159,802			
Total	26,657,048	104				

a. Dependent Variable: Metacognitive skills

b. Predictors: (Constant), Moodle-based Self-regulated learning

The ANOVA table (table 8) for linear regression acquires an F-count value of 63.813 and significance value of <.001. The significance value is more than .05, thus shows a significant impact between Moodle-based self-regulated learning and grade 11 students' metacognitive skills in the online asynchronous Applied Mathematics course. The result of this test is a linear equation that can be seen from this table of coefficients.

**Table 9.** Coefficients – Linear Regression Test Results

Coefficients <sup>a</sup>					
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Beta	Beta		
(Constant)	46,647	7,273		6,414	0,000
1 Moodle-based Self-regulated learning	0,414	0,052	0,619	7,988	0,000

Dependent Variable: Metacognitive skill

Based on the coefficient outputs in table 9, the constant (a) value is 46.647 and the regression coefficient (b) is .414. Using the regression equation of  $Y = 46.647 + .414X$ , where Y is the predicted dependent variable value and X is the independent variable value, it can be concluded that in every increase of one point in the Moodle-based self-regulated learning variable there will be a .414-point increase in the grade 11 students' metacognitive skills variable, with 46.647 as the constant value.

This equation shows that there is a positive and significant influence between Moodle-based self-regulated learning and students' metacognitive skills. Also, the positive value of the regression coefficient (b = .414) indicates that there is a linear relationship between the two variables. The implementation of Moodle-based self-regulated learning may have positive effects towards students' metacognitive skills. This depicts the importance of Moodle usage as an effective tool to support students' abilities to control, monitor, and manage their self-understanding in the learning process.

We saw the impact of Moodle-based self-regulated learning and students' metacognitive skills through the presence of these components; (1) components and essence that mutually supports each variable, and (2) Moodle as a platform that promotes self-regulated learning by supplies structured learning resources and activities.

Moodle-based self-regulated learning has both the constituents of metacognitive skills, shown in the way the former facilitates students to actively control, monitor, and manage their learning experiences. Students can only do this type of learning if they have metacognitive skills. In other words, both variables complement each other. Moodle-based self-regulated learning incorporates metacognitive strategies to control and manage their own learning. Their metacognitive skills enable them to understand themselves as learners, monitor what they are learning about, and choose strategies that fit for them. The relation between Moodle-based self-regulated learning and metacognitive skills is strong due to the connecting and dependent bond that they have.

In addition to that, the analysis results show that Moodle has a strong influence in supporting students' learning. They can learn independently with the presence of features and tools inside the platform. Not only that, but they can also get involved in discussion forums, question-and-answer forums, and learning materials. Students can evaluate their learning progress, manage their time, and organize materials in Moodle. This LMS can also facilitate various learning resources such as modules, articles, texts, and videos given by the teacher. Students are given many opportunities to study and understand the materials more effectively because they have easy access to the materials in the class. Moodle has calendars, assignment lists, reminders, and assignment submission features to support their learning process. Students

can also receive feedback from the teacher with a feedback feature. Due to this fact, students can rely on Moodle to learn and be responsible for their learning and assignments. In conclusion, the features in Moodle can assist students in choosing materials, monitoring learning, and evaluating the learning process. All these points are synonymous with the indicators of metacognitive skills.

## CONCLUSION

Through this research, we found that there was a significant relation between Moodle-based self-regulated learning and grade 11 students' metacognitive skills in the online asynchronous applied mathematics course in XYZ High School Tangerang. The findings have an important implication for the said school for the development of students' explorative learning experience. Using Moodle as an LMS, students can grow their metacognitive skills by self-regulated learning. Remembering the importance of each factor that contributes to each variable, we suggest that this research be continued with a qualitative approach to further understand the underlying factors of students' metacognitive skills.

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