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The Influence of Self-Regulated Learning on Learning Outcomes Moderated by The Flipped Classroom Model in Basic Mathematics Concept Lectures for Prospective Elementary School Teachers

Irni Rachmawati Putri, Wuri Wuryandani, Bambang Saptono , Irfan Wahyu Prananto

Universitas Negeri Yogyakarta
irnirachmawati.2023@student.uny.ac.id

Abstract. *This study aims to analyze the moderating effect of the flipped classroom model on the relationship between self-regulated learning (SLR) and the learning outcomes of prospective elementary school teachers in fundamental mathematics concepts. By examining how the flipped classroom influences the impact of SLR on academic performance, the study seeks to provide insights into effective teaching strategies for improving learning outcomes in challenging subjects. The research uses a quantitative approach by applying linear regression and moderation regression data analysis techniques. The subjects of this study were 38 people, 7 of whom were male students and 31 female students, with each subject in the age range of 16-18 years, who acted as class D PGSD students, Yogyakarta State University, Class of 2024. The results showed that the effect of SLR on the learning outcomes of PGSD students in introductory mathematics concept lectures was only 1.2%. However, suppose SLR is applied to the practice of flipped classroom learning. In that case, it can moderate the effect of the SLR variable on the learning outcomes of basic mathematics concepts of number concepts by up to 43.3%. This concludes that the SLR of students will significantly affect the existence of learning practices designed with the flipped classroom model. Thus, implementing the flipped classroom substantially moderates the effect of SLR on the learning outcomes of elementary school teacher candidates in introductory mathematics concept lectures.*

Keywords*: Self-regulated Learning, Learning Outcomes, Flipped Classroom*

INTRODUCTION

Education is currently faced with the critical role of sustainable education. The criteria for implementing sustainability education include (a) focusing on learning, (b) interdisciplinary and holistic education, (c) education that uses a variety of methods, (d) education based on a systems thinking approach, (e) education that brings up values (f) education that prioritizes local cultural approaches, global issues and languages that are easily understood by various parties and (g) lifelong learning (Mochtar et.al, 2014). According to Trilling & Fadel, 2009, there are three groups of competencies developed in 21st-century learning, including (1) life and career skills, (2) learning and innovation skills, and (3) information, media, and technology skills (Mochtar et al., 2014). Therefore, referring to the 21st-century teaching framework, it is essential to consider teaching practices that stimulate technology integration, one of which is the flipped classroom learning model.

The flipped classroom model effectively integrates technology and face-to-face learning, creating a more flexible and responsive learning environment (Fung et al., 2021). Its advantage is that it can potentially develop self-regulated learning competencies in students, including at the tertiary level. SRL skills in higher education are critical because they allow students to regulate their learning process and adjust learning strategies according to their needs (Abeysekera & Dawson, 2015). Through this SLR, students can be encouraged to maximize their learning outcomes. The

data from preliminary studies on PGSD student lectures at Yogyakarta State University also shows that students' learning readiness is less than optimal in class because the learning model applied does not facilitate students. This also causes students to be very dependent on lecturers' instructions and can indirectly impact less than optimal learning outcomes.

Self-Regulated Learning(SRL) is an essential concept describing students' ability to independently organize, monitor, and evaluate their learning process (Rizka 2023). According to Zimmerman (2002), SRL is not just a passive activity but an active process in which students consciously manage cognitive, motivational, and behavioral aspects of learning. Thus, SRL requires a high level of self-awareness from students regarding the material being studied and the learning strategies used. The main components of SRL consist of cognitive, motivational, and behavioral aspects. The cognitive component includes students' ability to manage information effectively through planned learning strategies (Mardiasi, 2021). This aspect also involves planning and organizing learning activities adjusted to the formulated academic objectives, thus ensuring that the learning process runs systematically and efficiently (Pintrich & Groot, 1990).

The behavioral component in SRL involves managing external factors that affect the learning process. This management includes efficient time management, setting up a supportive learning environment, and the ability to manage distractions that may arise during the learning process (Kristiyani, 2020). For example, students who implement SRL effectively will design a structured study schedule, choose a learning environment with minimal distractions, and proactively avoid activities that have the potential to disrupt concentration. Thus, this behavioral component supports the cognitive and motivational components, ensuring that students are in optimal condition to achieve the learning goals that have been set. One of them is through learning, which is designed with a flipped classroom model.

Conceptually, the Flipped classroom is categorized as a type of blended learning where the learning system is known as a flipped classroom (Khusna, 2023). This concept is implemented through learning stages that are reversed from the stage system in conventional classes. The flow of this flipped classroom includes (a) material delivered at home through technology media (b) follow-up material is worked on in class face-to-face, (c) students independently understand the material before implementing face-to-face learning in class, (d) class time is focused on improving student understanding through discussion (Slomanson, 2014).

The implications of the Flipped classrooms through the use of technology media can stimulate student interest with the use of media variations and enable open and more comprehensive learning access for students to understand the material (Capone et al., 2017). The use of technology media as a blended learning system of the flipped classroom type cana supporting force for the development of qualified learning. (Akçayır, 2018).

Jonathan Bergmann and Aaron Sams first introduced the flipped classroom model with the concept of reversing traditional habits, where what is usually done in class is now done at home. In contrast, tasks that are generally done as homework are now completed in class (Bergmann & Sams, 2012). One of the most significant benefits is that this model encourages students to be more active in learning (Cui & Coleman, 2020). Students engage with subject matter outside of class, and class time is used for collaborative activities (Nugraha, 2020). That way, the flipped classroom facilitates active student participation and strengthens their understanding through direct practice and deeper interaction in the school.

Flipped classrooms have become one of the rapidly developing pedagogical approaches in the world of education, especially at the higher education level, including in the Basic Concepts of Mathematics course (Patandean, 2021). The relationship between self-regulated learning (SRL) and flipped classrooms shows that the two concepts support each other in improving student learning outcomes. Self-regulated learning is the ability of students to plan, monitor, and evaluate their learning independently. In the context of a flipped classroom, students must study the material independently before the class session begins, which indirectly facilitates the development of their

SRL skills. This shows a correlation or relevance between the SLR concept and learning outcomes through the flipped classroom (Hertina, 2024).

The relationship between self-regulated learning and flipped classrooms on learning outcomes can be explained by the process of students studying the material before class, which helps them develop SRL skills (Hariyadi, 2023). This encourages them to be more active and independent in learning, which has been shown to increase a deeper understanding of concepts and skills. Research shows that flipped classrooms increase student engagement, which leads to better learning outcomes in higher education contexts, including in the Basic Concepts of Mathematics course.

A flipped classroom is a pedagogical approach that shifts much of the process of delivering information from the classroom to outside the classroom, utilizes technology to introduce basic concepts, and uses class time for interactive and collaborative activities (Bergmann & Sams, 2012). This model is in line with constructivism theory, which emphasizes the importance of direct experience and social interaction in learning (Piaget, 1970).

Previous studies have shown that flipped classrooms can strengthen the development of SRL in students, and SRL impacts learning outcomes. Abeysekera and Dawson (2015) suggested that this model increases student engagement and motivates them to develop SRL skills because students have to prepare materials before class and are actively involved in activities during class sessions. This finding is supported by Divjak et al. (2022), who reported that the flipped classroom model allows students to manage their time and learning strategies more effectively. Thus, flipped classrooms serve as an effective tool in improving SRL and significantly impact learning outcomes.

Self-regulated learning(SRL) is important in increasing the effectiveness of flipped classroom learning. In this model, students must learn outside the classroom using various learning resources, such as videos, modules, or articles provided by the teacher (Risnani, 2019). Students must organize learning strategies, set goals, and manage time well to understand the material before classroom activities. According to Zimmerman (2002), SRL skills involve three main stages: planning, monitoring, and self-evaluation. These three stages are developed through the flipped classroom model because students must prepare before facing interactive activities in class (Ramadhani, 2023).

In addition, research conducted by Abeysekera and Dawson (2015) stated that flipped classrooms can increase students' active involvement in learning and encourage them to develop better SRL skills. This involvement occurs because students face the challenge of mastering the material independently before class, so they must plan their study time wisely and use effective learning strategies.

Several studies have shown that flipped classrooms positively affect learning outcomes. According to research by Divjak et al. (2022), the flipped classroom model allows students to manage their time and learning strategies more effectively, which results in a deeper understanding of concepts. On the other hand, Bergmann and Sams (2012), pioneers in developing the flipped classroom model, emphasize that this approach gives teachers more time to interact directly with students during class sessions. This time is used for collaborative activities and more complex problem-solving, which supports active learning processes and helps improve critical thinking skills.

In addition, research conducted by Zainuddin and Attaran (2016) in Indonesia showed similar results. The study found that students who studied using flipped classrooms showed increased conceptual understanding and better learning outcomes compared to traditional learning models. The use of technology to deliver primary material before class, as well as a focus on collaborative activities during class, helped increase student engagement and motivation.

In line with that, local research by Sunardi et al. (2020) confirmed that flipped classrooms also have a positive impact in Indonesia's learning context, especially in courses that require in-depth understanding of concepts, such as Basic Concepts of Mathematics. With flipped

classrooms, students are better prepared to face challenges in understanding complex material because they can learn at their own pace before class sessions.

In addition to the above research, the results of research conducted by Wijayanto et.al (2020) showed that flipped classrooms can improve students' self-regulated learning in MIPA learning. Likewise, research conducted by Ramadhany (2021) showed that SRL enhances students' learning outcomes at SMKN 10 Surabaya. Likewise, research by Supardi & Triansyah (2022) showed the ability of SRL to improve learning independence in online learning. In line with that, Marchy et al. (2023) they are also stated that SRL increases interest and learning outcomes assisted by the context of interactive learning media. However, referring to the results of a study conducted by Rasheed et al., (2020) found that there are still few studies that focus on SRL in flipped classrooms compared to research related to the flipped classroom model, especially on the influence of flipped classrooms on whether they mediate the impact of SLR on the learning outcomes of prospective elementary school teacher students. Thus, the researcher is interested in conducting a research entitled "The Effect of Self-Regulated Learning on Learning Outcomes Moderated by the Flipped Classroom Model in Basic Mathematics Concepts Lectures for Elementary School Teacher Candidates." Thus, this study's results are expected to serve as a valuable reference for developing innovative and effective teaching practices in higher education. Specifically, it aims to enhance the teaching of fundamental mathematics concepts for prospective elementary school teachers by leveraging the flipped classroom model, thereby addressing the need for strategies that promote self-regulated learning and improve learning outcomes.

METHOD

This quantitative research uses the explanatory method. The explanatory method is suitable for this study because it seeks to identify and explain the relationships between variables, particularly the role of flipped classrooms as a moderating variable in the relationship between self-regulated learning (SLR) and students' learning outcomes. This method is ideal for testing hypotheses and determining causal or associative relationships in a structured and systematic way. Using this approach, the study can provide clear evidence about how and to what extent the flipped classroom influences the impact of SLR on academic performance, making it an appropriate choice for addressing the research objectives. This study aims to describe the effect of self-regulated learning on the learning outcomes of prospective elementary school teachers in the Basic Concepts of Mathematics course, which the flipped classroom model moderates. Data were collected through questionnaires, observations, interviews, and tests processed using multiple linear regression analysis and moderation with the help of the SPSS application. The reliability and validity of the adapted questionnaire were ensured through expert judgment, assessing clarity, relevance, and alignment with the constructs of self-regulated learning, flipped classroom practices, and learning outcomes. Reliability was confirmed through a pilot study using Cronbach's alpha, while validity was ensured through expert content review and construct validation with factor analysis. The subjects of this study were 39 students consisting of 7 male students and 32 female students aged 16-18 years. The subjects were students studying in the 1st semester of the PGSD study program at Yogyakarta State University who took the Basic Concepts of Mathematics course with the topic of number concepts.

Data collection techniques included semi-structured interviews to identify initial problems, observation of learning activities in the flipped classroom model, self-regulated learning questionnaires adapted from previous studies, and tests to measure student learning outcomes before and after treatment. Data analysis techniques involved normality tests, multicollinearity, and multiple linear regression and moderation to see the interaction between independent variables and moderation. The moderation regression analysis conducted the interaction test between the independent variables of self-regulated learning and the flipped classroom model on learning outcomes. The moderation regression model was built by assessing the regression coefficient and

the significance of the moderating variables, where the interaction coefficient indicates the direction and strength of moderation and the coefficient of determination (R^2) to measure how well the model explains the variation in learning outcomes. The research design is presented in Figure 1 below.

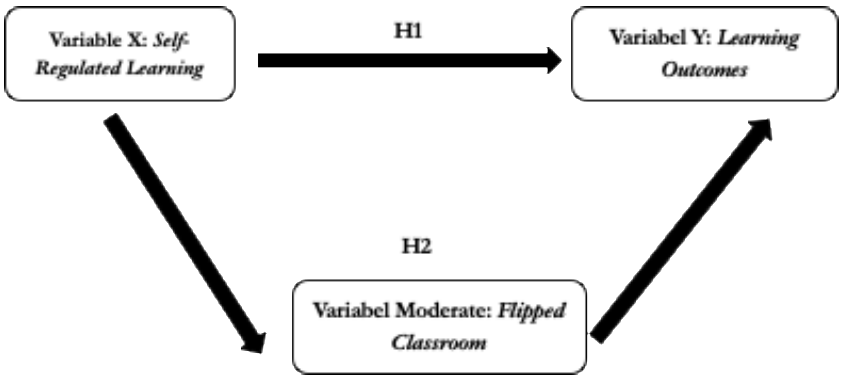

Figure 1. Research Design

FINDINGS

Normality Test

Based on the data collection and tabulation results, the researcher's first step was to analyze the normality of the data using the SPSS application to meet the requirements for parametric statistical testing. The results of the normality test analysis can be seen in table 1. below.

Table 1. Normality Test Results

		Learning Outcomes	SLR	Flipped Classroom
N		38	38	38
Normal Parameters[a,b]	Mean	67.9474	32.4211	32,3158
	Std. Deviation	11.54532	3.94990	3.8492
Most Extreme Differences	Absolute	.126	.132	.121
	Positive	.112	.125	.121
	Negative	-.126	-.132	-.114
Test Statistic		.126	.132	.121
Asymp. Sig (2-tailed)		.135[c]	.095[c]	.174[c]

Data can be categorized as generally distributed if the significance value is > 0.05. Referring to the analysis data, the significance value of the learning outcome data shows a value of 0.174; post-test data shows a value of 0.135; SRL data shows a value of 0.095; and flipped data shows a significance value of 0.174. It can be concluded that all variables have a significance value > 0.05, so all variable data are normally distributed, and we can continue testing with parametric statistics. The normal distribution of the data of these variables allows researchers to continue the analysis using parametric statistical methods, which rely on the assumption of normality to produce more accurate estimates. With this method, further study such as t-test, ANOVA, or linear regression can be performed to test the relationship or influence between variables more precisely. Parametric statistics provide the advantage of more in-depth analysis because they utilize information from the data distribution, such as the mean and standard deviation, which will provide more reliable results than non-parametric methods. Thus, the results of this normality test ensure that researchers can use more powerful parametric statistical methods to test hypotheses and draw valid conclusions about the influence of variables such as SRL and flipped classrooms on learning outcomes.

Multicollinearity Test

The results of the multicollinearity test are shown in Table 2 below.

Table 2. Multicollinearity Test Results

Model	Un-standardized	Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	Collinearity Tolerance	Statistics VIF
(Constant)	64.84	21.40		3.03	.005		
SLR	.35	.49	.12	.72	.478	.98	1.02
Flipped_Classroom	-.25	.50	-.08	-.51	.613	.98	1.11

Good data does not show symptoms of multicollinearity with VIF <10.00 Tolerance> 0.100. The tolerance value of variable X, namely the SLR value, shows a value of 0.982, and the tolerance value of variable M, namely the Flipped value, is 0.982, meaning both show tolerance values> 0.10. In addition, data analysis reveals the VIF value of variables X and M of 1.018, which means that both variables have a VIF value of <10.00, so it can be concluded that the data does not show symptoms of multicollinearity.

Thus, these results indicate that the regression model used in this analysis is free from multicollinearity symptoms. This is important because it ensures that the relationship between independent variables is manageable, allowing for a more accurate and valid interpretation of the analysis results. Overall, these data meet the requirements to continue the regression analysis without worrying about the negative impact of multicollinearity.

Heteroscedasticity Test

The results of the heteroscedasticity test are shown in Table 3 below.

Table 3. Heteroscedasticity Test Results

Model	Un-standardized	Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	Collinearity Tolerance	Statistics VIF
(Constant)	19.473	11.626		1.68	.103		
SLR	-.299	.268	-.187	-1.11	.273	.982	1.018
Flipped_Classroom	-.012	.275	-.007	-.04	.966	.982	1.108

Good data does not show symptoms of heteroscedasticity. The test criteria are that if the significance value is> 0.05, the conclusion is that there are no symptoms of heteroscedasticity. If the significance value <0.05, the conclusion is that heteroscedasticity symptoms exist. The data from the analysis shows the significance value of the variables of each variable X and M shows a significance value of 0.273 and 0.966, which shows that all variables have a significance value > 0.05, which concludes that the data values of all variables do not experience symptoms of heteroscedasticity.

This result concludes that the analyzed data does not experience symptoms of heteroscedasticity, which is a sign that the regression model used meets the classical assumptions of linear regression. In the absence of heteroscedasticity, the regression analysis results can be better interpreted because the coefficients generated from the model tend to be more accurate and valid. Overall, the results of this test indicate that the regression model used in this study is feasible and can provide more reliable results without being influenced by inconsistent error variance.

Linear Regression Analysis of SLR Variables on Learning Outcomes

The results of the regression analysis on the SLR variable against the learning outcome variable are shown in Table 4. below.

Table 4. Linear Regression Test Results

Coefficients[a]						
Model		**Unstandardized B**	**Coefficients Std. Error**	**Standardized Coefficients Beta**	**t**	**Sig.**
1	(Constant)	57.566	15.812		3.641	.001
	SLR	.320	.484	.110	.661	.513

Linear regression analysis shows that if the significance value <0.05, the variable has an effect, but if the significance value of the regression analysis shows a value >0.05, then the variable does not have an impact. The data analysis results show that the SLR variable's significance value on learning outcomes is 0.513, which states a value >0.05, so it can be concluded that SLR has no effect on learning outcome variables.

These results indicate that, although SRL is an essential skill in independent learning, in this study, SRL was not proven to be a factor that directly influenced the learning outcomes of prospective elementary school teachers in the Basic Concepts of Mathematics course. This may indicate that other factors are more dominant or relevant in determining learning outcomes in this specific context. Researchers may consider testing other factors, such as using more structured learning methods or other pedagogical interventions, to see a more significant influence on learning outcomes.

Table 5. Results of the r Value Test

Model Summary				
Model	**R**	**R Square**	**Adjusted R Square**	**STd. Error of The Estimate**
1	.110[a]	.012	-.015	11.63413

The r value in the SLR variable data shows a value of 0.012, which indicates that the value is not included in the range category between 0.60-0.79, so the SRL variable and learning outcomes do not show a strong correlation. Thus, the relationship between SRL and learning outcomes is insignificant and has a very weak correlation. This means that SRL needs to have a stronger relationship with learning outcomes in the context of this study. In other words, changes in SRL are not substantially related to changes in student learning outcomes. These results indicate that SRL is not the main factor influencing the achievement of learning outcomes of prospective elementary school teachers in the Basic Concepts of Mathematics course, or other factors may have a more significant influence on learning outcomes than SRL. Researchers can explore additional variables or test other learning models to better understand the factors contributing to student learning outcomes.

Moderate Regression of SLR Variable with Flipped Classroom on Learning Outcomes

Table 6 below shows the results of the regression test analysis of the moderate variable, SLR with the flipped model.

Table 6. Moderate Regression Test Results

Coefficients[a]						
Model		**Unstandardized B**	**Coefficients Std. Error**	**Standardized Coefficients Beta**	**t**	**Sig.**
1	(Constant)	66.760	1.448		46.114	.000
	SLR_with_Flipped	.015	.003	.658	5.242	.000

Moderate regression analysis shows that if the significance value <0.05, the variable has an effect, but if the significance value of the regression analysis shows a value >0.05, then the variable does not have an impact. The results of the data analysis show that the significance value of SRL with

the flipped classroom model shows a significance value of 0.000, which states a value <0.05 so that it can be concluded that the flipped classroom variable can moderate the effect of the SLR variable on the learning outcome variable. These results indicate that the flipped classroom not only functions as a different learning method but also plays an important role in increasing the effectiveness of SRL in supporting the achievement of learning outcomes. Without the implementation of the flipped classroom, SRL may not have a significant effect on learning outcomes. Still, with the flipped classroom, students can better utilize their SRL skills, such as time management and independent learning strategies, to improve understanding and academic performance. Therefore, the flipped classroom plays a vital role as a moderating variable that enhances the relationship between SRL and learning outcomes, making it a practical learning approach in higher education. The results of the R-value test on the summary model to show the correlation between variables are explained in Table 7 below.

Table 7. Results of the r Value Test

Model Summary				
Model	**R**	**R Square**	**Adjusted R Square**	**STd. Error of The Estimate**
1	.658[a]	.433	.417	8.815

The r value in the SLR variable data with Flipped shows a value of 0.658, which indicates the value is included in the range category between 0.60 - 0.79 so that between the SRL variable and flipped on learning outcomes shows a strong correlation with an r Square value of 0.433 which shows the contribution of the SLR variable to the learning outcome variable after the flipped classroom variable is 43.3%. Thus,, the moderation variable (flipped classroom) can strengthen the influence of the SLR variable on the learning outcome variable. From these results, the implementation of the flipped classroom has an essential role in strengthening the influence of SRL on academic achievement. With the flipped classroom, students are encouraged to be more independent in learning, prepare materials before class, and be more active during learning activities so that their SRL skills can be applied more effectively. This analysis confirms that the flipped classroom is not just an alternative learning method but also a tool that strengthens the relationship between SRL and student learning outcomes, with a significant contribution of 43.3%. This shows that the flipped classroom learning model is very effective in improving students' independent learning skills, which positively impacts learning outcomes.

DISCUSSION

The results of this study indicate that self-regulated learning (SRL) independently has no significant effect on the learning outcomes of prospective elementary school teachers in the Basic Concepts of Mathematics course. This can be seen from the significance value of 0.524 (> 0.05) and the correlation value (r) of 0.105, which indicates a very weak correlation between SRL and learning outcomes. This finding aligns with several studies stating that SRL does not always directly affect learning outcomes without being supported by an appropriate learning environment and supportive pedagogical interventions (Zimmerman, 2002). For example, students with a high level of SRL cannotimprove their learning outcomes if they are supported by an environment that allows them to apply independent learning strategies effectively.

However, when the flipped classroom moderation variable was applied, SRL showed a significant effect on learning outcomes, with a significance value of 0.000 (<0.05) and a correlation value (r) of 0.658, indicating a strong correlation. This shows that the flipped classroom can moderate and strengthen the effect of SRL on learning outcomes. Theoretically, the flipped classroom facilitates students to be more active in managing their learning process (Setyawan,

2019). In this learning model, students are allowed to study the material independently before entering the class and then apply their understanding through discussion activities, questions and answers, and problem-solving while in class (Bergmann & Sams, 2012). This provides more space for students to develop SRL strategies, such as better planning, monitoring, and reflection on their learning process.

With the flipped classroom, students can manage their study time more flexibly outside the school and be more involved in meaningful learning activities in the classroom (Rosa, 2024). This study supports the findings of Baas et al. (2015), which showed that implementing the flipped classroom can improve students' independent learning management skills, which positively impacts learning outcomes. The flipped classroom allows students to use SRL more effectively and have more control over their learning process (Baas et al., 2015). This is also consistent with constructivist learning theory, which emphasizes the importance of students' active role in the learning process, where the flipped classroom allows them to construct knowledge through exploration and collaboration (Vygotsky, 1978).

In addition, the results of the moderation regression showed that the flipped classroom not only strengthened the relationship between SRL and learning outcomes but also substantially contributed to improving overall learning outcomes. The R^2 value of 0.433 showed that the flipped classroom contributed 43.3% to the influence of SRL on learning outcomes. The R^2 value of 0.433 indicates that the flipped classroom model accounted for 43.3% of the influence of self-regulated learning (SRL) on learning outcomes, suggesting a moderate to substantial contribution. This finding is consistent with research examining flipped classrooms' impact on student performance and SRL. For example, McLaughlin et al. (2014) found that flipped classrooms enhanced student engagement and improved learning outcomes, with similar moderate effect sizes. These findings support the idea that flipped classrooms, by fostering active learning and promoting SRL, can have a meaningful impact on learning outcomes, particularly in subjects like mathematics for prospective elementary school teachers. The flipped classroom not only acted as a facilitator but also had a direct impact on increasing the effectiveness of SRL (Blair, 2016). Thus, this study found that combining self-regulated learning abilities with the flipped classroom learning model can provide more optimal results in improving the learning outcomes of prospective elementary school teachers, especially in the number concept material of the introductory mathematics concept course.

Overall, this study provides an essential contribution to the literature on higher education, especially in developing effective learning methods. The results of this study underline the importance of creating a learning environment that supports the implementation of SRL to the fullest, where flipped classrooms act as one of the effective strategies for improving learning outcomes. Flipped classrooms provide space for students to take greater control over their learning process, which aligns with the SRL concept, which emphasizes the importance of planning, monitoring, and reflection (Zimmerman, 2002). The findings of this study can be implemented in broader educational settings by introducing the flipped classroom model in other teacher training programs, such as science or language arts courses for prospective teachers. In these programs, students could engage in pre-class activities like watching video lectures or reading materials, followed by in-class activities such as problem-solving discussions or group projects reinforcing self-regulated learning (SRL) strategies. Additionally, the flipped classroom approach could be expanded to K-12 education, particularly in mathematics and science, where students could first explore new topics through instructional videos at home and use class time for interactive activities. To support these efforts, teacher training programs could offer workshops on designing and implementing flipped classroom strategies, fostering active learning, enhancing SRL skills, and improving student outcomes across various educational levels.

CONCLUSION

Based on the results of the regression analysis, self-regulated learning (SRL) independently does not have a significant effect on the learning outcomes of prospective elementary school teachers in the Basic Concepts of Mathematics course, with a significance value of 0.524 (>0.05). In addition, the correlation value (r) of 0.105 also shows that there is no strong relationship between SRL and learning outcomes. However, after being moderated by the flipped classroom model, the SRL variable significantly affected learning outcomes, with a significance value of 0.000 (<0.05). The correlation value (r) between SRL and flipped classroom on learning outcomes reached 0.658, which is included in the strong correlation category, and the R^2 value of 0.433 shows that flipped classroom increases the influence of SRL on learning outcomes by 43.3%. Thus, flipped classroom plays a role in strengthening the impact of SRL on student learning outcomes.

Based on the research results, it is suggested that the flipped classroom model be widely applied, especially in courses that require active student involvement, such as Basic Concepts of Mathematics. This model has been shown to strengthen the influence of self-regulated learning (SRL) on learning outcomes, indicating that the flipped classroom creates an environment that supports the development of students' independent skills. With the flipped classroom, students are more actively involved in the learning process and can utilize SRL skills more optimally, especially in preparing materials before class sessions and participating in interactive activities in the classroom.

In addition, instructors need to develop learning strategies integrated with the flipped classroom model to strengthen students' SRL skills. Although SRL alone does not have a significant effect, it highlights the importance of creating an environment that supports SRL development. Instructors can design learning materials encouraging students to learn independently by providing guidance, time management, and self-reflection. With this approach, students can more effectively manage their learning, improving their learning outcomes.

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