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STEM-Based Everyone is a *Teacher Here* Strategy on Metacognitive Abilities

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ABSTRAK

Rendahnya kualitas pendidikan akan berpengaruh pada kualitas bangsa. Salah satu upaya untuk meningkatkan kualitas pendidikan di Indonesia melalui kemampuan metakognitif. Komponen regulasi kognisi dalam metakognitif akan membuat pemikiran peserta didik sistematis. Penelitian ini bertujuan menganalisis strategi pembelajaran everyone is a teacher here berbasis STEM terhadap kemampuan metakognitif. Jenis penelitian ini adalah eksperimen semu (quasi eksperimental design) dengan rancangan pre-test post-test with control group design. Populasi penelitian ini berjumlah 103 peserta didik kelas V dan sampel penelitian berjumlah 55 peserta didik. Instrumen penelitian yang digunakan telah melalui uji validitas dan uji reabilitas. Analisis data yang digunakan dalam penelitian ini yaitu uji normalitas (Kolmogorov-Smirnov) dan uji hipotesis (uji Wilcoxon dan uji Mann Whitney). Hasil penelitian menunjukkan bahwa terjadi peningkatan kemampuan metakognitif yang dapat dilihat berdasarkan hasil pre-test dan post-test, kelas eksperimen dan kelas kontrol. Hal tersebut telah dibuktikan dalam pengujian hipotesis. Sehingga dapat disimpulkan bahwa pembelajaran menggunakan strategi everyone is a teacher hereberbasis STEM efektif dalam meningkatkan kemampuan metakognitif peserta didik. Melalui strategi pembelajaran everyone is a teacher here berbasis STEM kemampuan metakognitif peserta didik dapat ditingkatkan berdasarkan soft skill, hard skill, dan kreativitas dalam membangun pengetahuan dalam proses pembelajaran IPA melalui materi siklus air dan dampaknya bagi makhluk hidup dan bumi.

ABSTRACT

The low quality of education have an effect quality of the nation. One of efforts to improve quality of education in Indonesia involve metacognitive abilities. The component of cognitive regulation in metacognitive will make the students mind systematic. This study aims to analyze the STEM-based learning strategy everyone is a teacher here on metacognitive abilities. The type of this research was a quasi experimental design with a pre-test and post-test control group design. The amount of data sample of this research is 103 students of fifth grade and the research sample amount is 55 students. The research instrument used has been through validity and reliability tests. Data analysis used in this study were normality test (Kolmogorov-Smirnov) and hypothesis testing (Wilcoxon test and Mann Whitney test).The result showed an increase in metocnitive abilities outcome that can be seen based on the result of pre-test and post-test, experiment class and control class. It was proven in testing the hypothesis, which states that value Asymp. Sig (2-tailed) 0,047 < 0,05 which means Ho is accepted and Ha is rejected. So it can be conclude that learning using the STEM-based learning strategy of everyone is a teacher here is effective in incrase the metacognitive abilities of students. Through STEM-based learning strategy everyone is a teacher here, metacognitive abilities can be enhanced based on soft skill, hard skill and creativity in building knowledge in the science learning process throught the water cycle and impact on living beings.

1. INTRODUCTION

The continuity of learning in schools as a forum for transforming the knowledge, attitudes and skills of students. Educators take control as a facilitator and control the process of learning. Science learning is one of the educational problems in Indonesia(Wicaksono & Sayekti, 2020; Yusuf, 2018). A

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study conducted by the Organization for Economic Co-Operation and Development (OECD) surveyed the program for International Student Assessment (PISA)) and showed that from 2009 to 2018 Indonesia was ranked 10th from the bottom. Trends in Students Achievement in Mathematics and Science (TIMSS) also show that Indonesia is ranked 5th from the bottom from 2011 to 2015(Nugrahanto & Zuchdi, 2019; Suryana et al., 2022). The survey results illustrate that Indonesian education needs improvement(Pratiwi, 2019; Wicaksono & Sayekti, 2020). The implementation of the national education system was considered unsuccessful so the Indonesian government was under public pressure, it is based on the results of the PISA assessment since 2000.

The quality of a nation is built by education, therefore it is necessary to create quality education. Implementation of educational reforms can develop education to achieve quality education(Ainun Fauziah et al., 2019; Davidi et al., 2021). The government's efforts to develop the 2006 KTSP into the 2013 curriculum include aspects of new abilities, namely metacognitive. It is stated in the achievement of the Content Standards for Primary and Secondary Education Permendikbud No. 20 of 2016 CHAPTER II Competency Levels, students must have various abilities including factual, conceptual, procedural and metacognitive knowledge(Makaborang, 2019; Wahyu Lestari et al., 2019). As a learning approach, STEM can bind the goals and characteristics of the 2013 curriculum to direct students to develop intellectual and psychomotor abilities through curiosity, cooperation, creativity, and spiritual and social attitudes(Garza & Travis, 2019; Rizki Putri Wardani, 2021). Supported by the everyone is a *teacher here* learning strategy, it can create an active and creative learning atmosphere(Haryati, 2020; Syaiful et al., 2020).

Based on observations, it was found that the learning process was carried out conventionally with printed books and Power Point learning resources as a medium for delivering learning or information. As a result, the learning process runs passively, a way is needed to attract the attention of all students to actively participate in the learning process. The results of the study describe the impact of the everyone is a teacher here learning strategy on increasing students' learning motivation(Impianti & Jamila, 2018; Widiani et al., 2021). This is done to build and develop the thinking process of students to solve problems. In line with other research findings that state the implementation of the everyone is a teacher here strategy can improve students ' science learning outcomes(Antony, 2021; Yusuf, 2018). Furthermore, based on the results of previous research using a STEM-based approach, it can improve students' metacognitive abilities(Anggraini et al., 2021; Ting et al., 2022). Based on the results of these observations, this study aims to measure students' metacognitive abilities through the STEM-based everyone is a teacher here learning strategy. It is hoped that the implementation of the STEM-based everyone is a teacher here learning strategy will be able to improve students' metacognitive abilities.

Metacognitive is the ability to control cognitive processes associated with intelligence through executive processes including planning, evaluating and monitoring problem-solving activities. The formation of metacognitive abilities as a cognitive exercise is needed when solving problems, besides that, it can determine the intellectual intelligence of students(Erlin et al., 2021; Livingston, 1997). Metacognitive is a psychological condition through self-conscious activity regarding knowledge about cognition. Associated with metacognitive abilities, used to control, direct and control oneself. In line with previous research, metacognition becomes an individual process when thinking by building strategies to solve problems(Martinez, 2006; O'Neil Jr. & Brown, 1998). The role of metacognitive abilities is important and consequential for learning of all ages. Metacognitive development has a relationship with cognitive development at the age of 4 to 5 years(Erlin et al., 2021; Wahyu Lestari et al., 2019). At the age of 8 to 10 years, children can manage their metacognitive abilities and will continue to develop in the future(Kodri & Anisah, 2020; Septiyani et al., 2020). Metacognitive abilities are obtained based on experience and metacognitive knowledge derived from the monitoring process(Elvianasti et al., 2021; Wicaksono & Sayekti, 2020). Thus, the provision of knowledge without experience is not sufficient for developing metacognitive abilities. Educators' priority on their students' metacognitive abilities will influence students in creating new knowledge and applying it to new situations(Dirkes, 1988; Kusumaningrum, 2018; W., 2020).

The application of integrative thematics as a basis for learning in the 2013 curriculum emphasizes educators to leave an impression during the learning process. For this reason, educators are expected to create a pleasant learning atmosphere, especially in improving the quality of science learning(Aisyah & Astuti, 2021; Antony, 2021). Learning strategies that allow building a pleasant atmosphere, and learning easily to develop interactions, namely the *everyone is a teacher here* strategy. The definition of a learning strategy *everyone is a teacher here* is an active learning strategy involving all students through the application of acting as a "teacher" for their friends(Haryati, 2020; Silberman, 2013). Implementation of the *everyone is a teacher* learning strategy, focusing on learning to students (student-oriented) not (teacher oriented). Using the everyone is a teacher here learning strategy is an effective way to get all student participation both individually and in groups(Haryati, 2020; Siringo-ringo et al., 2021; Widiani et

al., 2021). The purpose of using the *everyone is a teacher here* learning strategy for students is to be able to analyze problems, the ability to find solutions, and express opinions and conclusions.

The implementation of STEM is more relevant to apply to elementary schools, that is because interdisciplinary handling and integrated learning do not change drastically at that level of education(Davidi et al., 2021; Stohlmann, 2022; W., 2020). The basis for the implementation of STEM is direct learning or learning based on the experiences of students(Seage & Türegün, 2020; Toma & Greca, 2018). There is a positive relationship for mixed outcomes between school-centred STEM learning and student engagement. STEM-based learning can encourage students' skills needed in developing the challenges of 21st-century education(Mutakinati et al., 2018; Nugroho et al., 2019; Struyf et al., 2019). Therefore, STEM can be a bridge that connects educational institutions with jobs that require problem-solving skills, systems and managing knowledge. The purpose of this study is to analyze the STEM-based everyone is a teacher here learning strategy on metacognitive abilities.

2. METHOD

This type of research is *a quasi-experimental design* with *a pre-test and post-test design with a control group design.* The implementation of this research was at SDIT X in the Bekasi area, West Java. The population of this study were students of class V SDIT X in the Bekasi area, totalling 103 students. The sample in this study amounted to 55 students determined by *cluster random sampling* technique. There were two variables in this study, namely the independent variable and the dependent variable. The independent variable of this study is the STEM-based *everyone is teacher here* learning strategy. The STEM-based *everyone is a teacher here* learning strategy is applied to the experimental class while the control class applies the *everyone is a teacher here* learning strategy without STEM. Learning was carried out in five meetings. The dependent variable in this study is metacognitive ability which is measured through the *pre-test* and *post-test*. Metacognitive ability instrument Table 1.

Table 1. Metacognitive Ability Instrument

Indicator	Sub-Indicators	Question Number
Knowledge of cognition	Declarative knowledge	9, 11
	Procedural knowledge	12, 13
	Conditional knowledge	4, 6, 8
Regulation of cognition.	Planning	17, 16
	Strategy for managing information	5, 1, 3
	Monitoring of understanding	7, 2, 10
	Improvement strategy	19
	Evaluation	20, 18
Numbers of Question		**20**

The research data were obtained from the *pre-test* and *post-test* results of the experimental class and the control class. The research instrument is a multiple-choice test according to the 8 indicators of metacognitive ability listed in Table 1. The research instrument used has been tested for validity and reliability. The results of the validity test of the 30 questions, 20 valid questions can be used for the *pre-test* and *post-test*. The data obtained were then analyzed quantitatively. Data analysis used in this study was the normality test *(Kolmogorov-Smirnov)* and hypothesis testing (*Wilcoxon test* and Mann *Whitney test*).

3. RESULT AND DISCUSSION

Result

Data on metacognitive abilities were obtained from the results of the *pre-test* and *post-test* of students answering science learning questions adjusted for indicators of metacognitive abilities. The results of the *pre-test* of students' metacognitive abilities in the experimental class showed an average value of 54.44. Meanwhile, the results of the *pre-test* mean value of the control class was 59.29. The data was obtained from students answering 20 metacognitive ability questions before learning was carried out by applying the *everyone is a teacher here* learning strategy based on STEM or without STEM.

There is an increase in the average value of students' metacognitive ability test results after learning in the experimental class and the control class. From the results of the *post-test*, the average value of the experimental class was higher than that of the control class. The average post-test result for the

experimental class was 76.85 and the control class was 66.61. The prerequisite test is carried out before carrying out the hypothesis test. The prerequisite test consists of an analysis of the normality test and the data homogeneity test. Normality test analysis was carried out to find out whether the data is normally distributed or not normally distributed. The basis for making a decision on the normality test is from the significance level α = 5% = 0.05. If the probability (Asymp. Sig) > 0.05 then the data is normally distributed, otherwise the data is not normally distributed. The normality test is shown in Table 2.

Table 1. Normality Test

Class		Kolmogorov-Smirnov			Shapiro-Wilk		
		Statistics	Df	Sig.	Statistics	Df	Sig.
Metacognitive Ability	*Pre-Test*Experiment	0.182	27	0.021	0.948	27	0.191
	*Post-Test*Experiment	0.152	27	0.111	0.916	27	0.032
	*Pre-Test*Control	0.166	28	0.047	0.919	28	0.033
	*Post-Test*Control	0.189	28	0.012	0.872	28	0.003

Based on Table 2, shows that the normality test output of *Kolmogorov-Smirnov* and *Shapiro-Wilk* obtained a significance value of less than <0.05. So it can be concluded that the data is not normally distributed. So that the data homogeneity test was not carried out. Furthermore, a non-parametric hypothesis test was carried out using *Wilcoxon* analysis to see whether there was a significant difference in the *pre-test* and *post-test* results. The experimental class and control class before and after being given the treatment is shown in Table 3.

Table 2. Pre-test and Post-Test of Metacognitive Ability

Statistic		N	Mean Ranks	Sum of Ranks
*Post-Test*Experiment	Negative Ranks	1	5.00	5.00
*Pre-Test*Experiment	Positive Ranks	25	13.84	346.00
	ties	1		
	Total	27		
*Post-Test*Control	Negative Ranks	4	7.88	31.50
*Pre-Test*Experiment	Positive Ranks	19	12.87	244.50
	ties	5		
	Total	28		

Based on the *output* of Table 3, shows that there was an increase in the results of the *pre-test* to the *post-test* in the experimental class and the control class. It is known that there were 25 experimental class students and 19 control class students who experienced an increase after carrying out learning.

Tabel 3. Tes Peringkat Wilcoxon Signed

	***POST-TEST* EKSPERIMEN *PRE-TEST* EKSPERIMEN**	***POST-TEST* KONTROL *PRE-TEST* KONTROL**
Z	-4,340	-3,264
Asymp. Sig. (2-Tailed)	0,000	0,001

Based on Table 3, the output of the *Wilcoxon Signed Ranks Test* obtained the Asymp results. Sig. (2-tailed) is less than <0.05 in the experimental class and control class, so there is a significant difference in the results of the *pre-test* and *post-test* scores before and after being given treatment in the experimental class and the control class. The *Mann Whitney* test on *post-test* scores was carried out to determine whether there were significant differences in students' metacognitive abilities on the independent variables. The basis for decision making in the *Mann Whitney* test is if the Asymp. Sig. (2-tailed) < 0.05 then Ha is rejected. Conversely, if the Asymp. Sig. (2-tailed) > 0.05 then Ha is accepted. Thus, the testing hypothesis in this study is shown in Table 5.

Based on Table 5, the "Test Statistics" output above obtained the Asymp value. Sig. (2-tailed) 0.047 less than < 0.05. So it can be concluded that Ho is rejected then Ha is accepted. Thus there is a significant difference so that there is an effect of using the STEM-based and non-STEM-based *everyone is a teacher here* learning strategy on the metacognitive abilities of students in class V SDIT X in the Bekasi area.

Table 4. Hypothesis Test Results

Statistic	Metacognitive Ability
Mann-Whitney U	261
Wilcoxon W	667
Z	-1,982
asymp. Sig. (2-Tailed)	0.047

Discussion

Based on the results of this research analysis, it was found that the influence of the STEM-based *everyone is a teacher here* learning strategy on students' metacognitive abilities. This showed that the STEM-based *everyone is a teacher here* learning strategy can improve students' metacognitive abilities. The application of the STEM-based *everyone is a teacher here* learning strategy can direct intellectual development through a meaningful learning process that involves students' *soft skills, hard skills*, and creativity. Through the implementation of the learning strategy, *everyone is a teacher here*, it provides an opportunity for students to build and gain the concept of knowledge independently(Syaiful et al., 2020; Yusuf, 2018). The relation, through asking skills can stimulate students to encourage their thinking skills (Putri & Dafit, 2022; Widiani et al., 2021). This is an attraction for other students to maximize their ability to answer questions.

In theory, STEM education is an interdisciplinary approach that combines learning with problems in the real world. The STEM-based learning approach is connected to real-world problems so that the application of STEM is more relevant and easily integrated into science learning(Paramita et al., 2019; Syahmani et al., 2021). Understanding students after conducting experiments can build their knowledge based on experience and information that is already known, this can be meaningful knowledge for students. Learning materials and methods applied in STEM activities are important for building student interest, engagement, and learning outcomes(Ejiwale, 2012; Gyasi et al., 2021). The knowledge learned most effectively and developed to challenge learners must be applied in a school environment with support facilities.

The implication of this study was the implementation of STEM-based *everyone is a teacher here* learning strategy on water cycle learning materials and their impact on events on Earth and the sustainability of living things by the basic competencies of Class 5 theme 8 environment Sahabat Kita subtheme 3 Environmental Conservation Efforts integrated thematic book curriculum 2013 revised Edition 2017. The implementation of the STEM-based *everyone is a teacher here* learning strategy can involve all students in the learning process actively through the development of competencies owned and able to build their knowledge. The implementation of *everyone is a teacher here* the basis of STEM learning strategy on metacognitive ability requires completeness of facilities in schools and time is not short. Therefore, researchers can choose a learning strategy with a learning approach which is most effectively tailored to the needs, and characteristics of materials and facilities available in the school.

4. CONCLUSION

Based on the results of the research analysis and discussion, it can be concluded that the application of the STEM-based *everyone is a teacher* here learning strategy affects increasing students' metacognitive abilities in science learning. The implementation of the STEM-based *everyone is a teacher here* learning strategy, can help the learning process in connecting learning material with the real life of students. In addition, all students actively contributed to the learning process, practiced courage in conveying questions and opinions, and developed their abilities such as *soft skills, hard skills* and students' creativity.

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