

## THE EFFECT OF DIGITAL CLASS IMPLEMENTATION ON COGNITIVE ABILITY AND SELF-REGULATED LEARNING

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### ABSTRACT

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This study aims to determine the effect of the implementation of the Learning House Digital Portal Class on cognitive abilities and self-regulated learning of students in Evolution material in class XII IPA SMA Negeri 11 Medan. This type of research is a quasi-experimental type of research. The research sample was taken by purposive sampling. The sample consisted of 2 classes, namely class XII IPA 6 and class XII IPA 5. The instruments used to collect data were tests of students' cognitive abilities in the form of multiple choice and self-regulated learning questionnaires. The results showed that the average value of students' cognitive abilities using the Digital Class was  $83.87 \pm 11.72$ , which was better than the cognitive abilities of students who did not use the Digital Class, with an average of  $77.33 \pm 10.57$ . Analysis of hypothesis testing using SPSS21 with the independent t-test method and a confidence level of  $\alpha = 0.05$  shows the significance value on the average value of cognitive ability and the average value of self-regulated learning does not differ significantly which means that in this study  $H_0$  is rejected whereas  $H_a$  is accepted. Thus it can be concluded that there is an influence on the cognitive abilities and self-regulated learning of students implemented by the Digital Home Learning Portal Class on evolution material in class XII IPA SMA Negeri 11 Medan.

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## INTRODUCTION

The development of information and communication technology (ICT) has influenced global changes in the industrial revolution 4.0 era in various aspects of people's social life. The increasing development of digital systems, artificial intelligence and virtualization mark the change in this era. (Lase, 2019). The role of ICT indirectly affects the world of education in Indonesia. One of them is to help students in learning (Budiman, 2017).

The development of ICT in education in Indonesia, especially in developing digital-based educational models or e-learning. E-learning is a form of conventional learning that is presented in a digital format through information technology (Kusnohadi, 2014). E-learning facilitates opportunities for remote and independent learning (Fisk, 2017). Several components in e-learning will enable changes, such as teachers utilising classroom facilities, learning materials, learning media and quizzes. The presence of e-learning as a learning reference is a new paradigm that makes it possible to freely study anywhere and anytime to freely open a website or portal following the demands of the world of education.

The e-learning classroom in the 21st century is technology-rich. Teachers must facilitate the learning process using pedagogical processes. The pedagogical process in question is the support of deep involvement in students. This involvement is like collaboration, cooperation and concentration together between teachers and students to produce learning outcomes that are expected (Wright, 2010). In supporting the development of e-learning, the Ministry of Education and Culture utilizes an official portal in the form of the Rumah Belajar Portal, which can be accessed at the address <http://belajar.kemdikbud.go.id>. The Rumah Belajar Portal provides Learning Resource facilities, Digital Classes, Continuing Professional Development, 2013 Curriculum, and Space Exploration that can be utilized by students, teachers and the wider community (Imanuddin, 2014). Other features available on the Rumah Belajar Portal include virtual laboratories, electronic school books (BSE), digital modules and cultural maps. The Rumah Belajar Portal, of course, can add learning resources for the world of education in Indonesia, which will make it easier for teachers to make learning more interesting (Warsihna, 2012).

The Learning Management System (LMS) is a system developed to manage and support the learning process, which can be accessed online

(Fitriani, 2020). One of the features of the Learning House that can be utilized for online learning activities as an LMS is the Digital Class. Digital Class was explicitly developed to facilitate online learning between students and educators anytime and anywhere (Setiawan, 2018). Implementing Digital Classes in the classroom will increase learning freedom, flexibility, adaptation, and the application of learning principles as learning tools that can be used throughout life (Warsita, 2019). Digital Classes provide opportunities for teachers to take advantage of online classes as an innovation to increase teacher creativity in making lesson plans, teaching materials, and practice questions that are relevant to learning activities. Research conducted by Mulyadi (2015) which states that the use of the "Kemdikbud Rumah Belajar Portal" has an effect on increasing student learning outcomes in the cognitive domain in the aspects of understanding (C2), applying (C3), and analyzing (C4). Megawaty & Helda (2016) states that optimal use of the Learning House Portal by students and teachers will impact the increasing role of ICT in education. With the Digital Class on the Learning House Portal, it is hoped that students can become more motivated to study independently outside of in-class learning activities to improve students cognitive abilities.

Cognitive understanding is the most crucial part of learning biology. In addition to learning outcomes in the cognitive domain, an essential factor from individual circumstances that influences student learning activities is self-regulated learning (SRL). SRL also determines student success in learning and shows a positive influence on learning and achievement of cognitive abilities, which shows that SRL has a strong correlation with academic success (Schunk & Zimmerman, 1998). According to Zimmerman, independent students have cognition and metacognition and must also be motivated to use their metacognitive strategies to build their understanding of learning materials. (Schunk & Zimmerman, 1998).

In the initial observations in the field, SMA Negeri 11 Medan is currently utilizing the Learning House Portal, which is expected to facilitate teachers and students to carry out e-learning-based learning activities. The results of an interview with one of the Biology teachers in class XII stated that the broad scope of Biology material taught by the teacher was not comparable to the adequate learning time in class XII. As a result, the implementation of material learning at the beginning of the semester resulted in reduced study time in class in the even semester. Reducing study time can have an impact on delaying further

material in Evolution material. The broad scope of Evolution material, if taught only face-to-face, can cause additional material to be delayed. Thus, the implementation of Digital Classes on the Learning House Portal is expected to be a solution to the limited time during the effective study week for class XII IPA students to be able to study without having to be bound by time and place, considering that students can access Digital Classes anytime and anywhere so that learning activities continue to run effectively. Without having to meet face to face.

In implementing the Digital Class, students must have good SRL so that the learning results are excellent and optimal. Not only in learning but in daily life, a student must also be able to control himself because it can also support the good of students in learning and in getting learning results. It is necessary to research to determine students' cognitive abilities and SRL after implementing Digital Class on the Learning House Portal. SRL is a factor that needs to be owned and influences student learning outcomes (Astutik, 2016).

Based on the description above, the following hypothesis can be proposed:

H0: There is no effect of implementing Digital Class on students' cognitive abilities and self-regulated learning in Evolution material in class XII IPA SMA Negeri 11 Medan.

Ha: There is an effect of the implementation of the Digital Class on students' cognitive abilities and self-regulated learning on Evolution material in class XII IPA SMA Negeri 11 Medan.

## METHOD

This research was conducted at SMA Negeri 11 Medan Jl Pertiwi No. 99 Medan in January - March 2020. The population in this study were students of class XII IPA in the 2019-2020 Academic Year, consisting of 3 classes. The sample in this study was class XII IPA 6, with a total of 33 students as an experimental class using the Digital Class, and class XII IPA 5, with a total of 30 students as a control class that did not use the Digital Class. Determination of the sample was taken based on the purposive sampling method.

This study uses a quasi-experimental method so that learning takes place naturally and students in the research class do not feel they are being researched. The research design used the Non-Equivalent Control Group-Posttest Only Design. The data collection technique used instruments in

the form of cognitive ability tests on Evolution material and self-regulated learning questionnaires that had been adapted from Zimmerman (1989) which has been tested and validated by experts. Data analysis was carried out by calculating students' cognitive achievement in the form of multiple-choice test questions with a total of 25 questions on Evolution material using the Google form. The data is then processed to find out the final value (FV) as follows:

$$FV = \frac{\text{Number of correct answers} \times 100}{\text{Number of questions}}$$

Meanwhile, to find out the SRL of students by calculating the SRL and classifying it based on the SRL classification as follows,

$$SRL = \frac{\text{score gained} \times 100}{\text{Ideal score}}$$

The research data were analyzed using the SPSS 21 data processing application. Furthermore, the research data was tested with the normality test, homogeneity test, and hypothesis testing.

### Normality test

The normality test was carried out to see the validity of the sample and the distribution of the data obtained. The research data was tested using the Kolmogrov-Smirnov (K-S) method with a significance level ( $\alpha$ ) = 0.05. The normality test results are data that is normally distributed, namely data that has a significance value of > 5% (Asymp. Sig (2-tailed) > 0.05) and data that is not normally distributed, namely data that has a significance value of <5% (Asymp. Sig (2-tailed) < 0.05).

### Homogeneity Test

Homogeneity test to see the data comes from a homogeneous variant. The homogeneity test in this study used the Levene test method with a significance level ( $\alpha$ ) = 0.05.

### Hypothesis testing

Hypothesis testing was carried out using the Independent T-test method with testing qualifications with a significance level ( $\alpha$ ) = 0.05 if Sig (2-tailed) >  $\frac{1}{2} \alpha$ , then H0 is rejected, whereas if Sig (2-tailed) >  $\frac{1}{2} \alpha$ , then Haha accepted. This method compares the average value of the

variable data tested in classes that are unrelated to one another. Hypothesis testing was carried out to compare the average scores of students' cognitive abilities and SRL in the experimental and control classes.

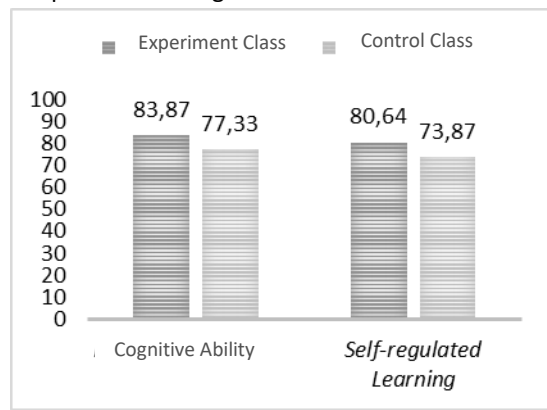
**RESULTS AND DISCUSSION**

The research data is on students' cognitive abilities and self-regulated learning in the experimental and control classes. Data on the average value of students' cognitive abilities in the experimental class was  $83.87 \pm 11.72$ ), while in the control class, it was  $(77.33 \pm 10.57)$ . The value of cognitive ability in the experimental and control classes can be seen in (Table 1).

**Table 1.** Recapitulation of Cognitive Ability (CA) and Self-regulated Learning (SRL) Score Calculations

Statistics	Experiment		Control	
	CA	SRL	CA	SRL
Mean	83,87	80,64	77,33	73,87
Std. Deviation	11,72	8,95	10,57	11,89
Min.	52	61	56	57
Max.	96	93	96	98

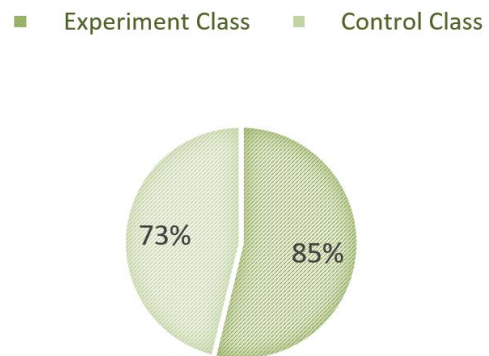
The average value of cognitive abilities and the average value of self-regulated learning in research in the experimental and control classes are presented in Figure 1.



**Figure 1.** Results of the Average Value of Cognitive Ability and SRL

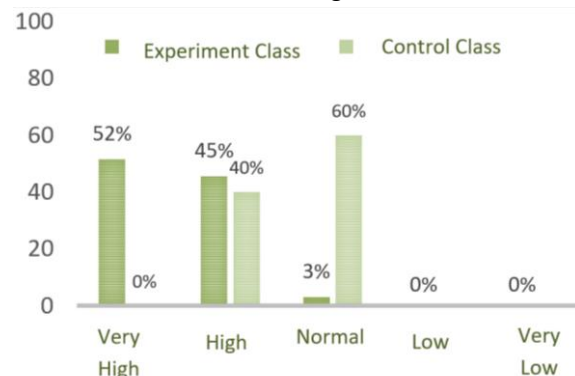
The difference in average scores in the two classes (table 1) also affects the percentage of achievement of cognitive ability results. Measuring the average value of cognitive abilities by comparing the scores of students in both classes with the Minimum Completeness Criteria (KKM). The KKM that applies in Biology subjects in class

XII IPA SMA Negeri 11 Medan is 75. Based on the data obtained on the cognitive abilities of students in the experimental class, it was found that 28 out of 33 students had scores above the KKM, while in the control class, 22 out of 30 students the number of students who have scores above the KKM. Then the percentage of achievement of cognitive abilities (Figure 2) in the experimental class is 85%, and the control class is 73%.



**Figure 2.** Percentage of Students' Cognitive Ability Achievement

SRL achievement scores in both classes are divided into Very High, High, Low, and Very Low qualifications. In the experimental class, the SRL qualifications obtained were 17 students (52%) with very high qualifications, 15 students (45%) with high qualifications, and one student (3%) with low qualifications. In contrast, the SRL qualifications in the control class were 12 students (60%) with high qualifications and 18 students (40%) with low qualifications. SRL qualifications in both classes can be seen in Figure 3.



**Figure 3.** Self-regulated learning qualification

**Normality test**

The results of the data analysis in table 2 from the normality test of the cognitive ability data of the experimental class students stated that the SRL in the two classes had a normal distribution. According to [Purnomo \(2016\)](#), if the data is normally distributed, the data obtained will represent the population in the study.

**Homogeneity test**

The homogeneity test in this study used the Levene test method with a significance level ( $\alpha$ ) = 0.05. The results of the homogeneity test are homogeneous data with a significance value. It can be stated that the data is homogeneous. Detailed

can be seen from the homogeneity test results in table 3.

**Hypothesis testing**

The results of hypothesis testing in the experimental and control class are presented in table 4. Based on table 5 presented, the results of hypothesis testing on cognitive abilities and SRL data obtained that Sig. (2-tailed)  $< \frac{1}{2} \alpha$  (0.024  $> \frac{1}{2}$  (0.05)) and SRL Sig. (2-tailed)  $< \frac{1}{2} \alpha$  (0.013  $> \frac{1}{2}$  (0.05)). So it can be concluded that there is a significant effect on students' cognitive abilities and SRL in the experimental and control classes.

**Table 2.** Normality test results

Statistics	Cognitive ability		Self-regulated Learning	
	Eksperiment class	Control class	Eksperiment class	Control class
Nilai Kolmogorov-Smirnov	1,05	1,03	0,74	0,83
Asymp. Sig. (2-tailed)	0,22	0,26	0,65	0,49

**Table 3.** Homogeneity test results

	Levene Statistic	Sig
Cognitive ability	0,28	0,59
SRL	3,32	0,73

**Tabel 4.** Hypothesis Test Results

	Class	$\bar{X}$	Sig. (2-tailed)	$\alpha$	Conclusion
Cognitive ability	Experiment	83,87	0,024	0,05	There is Influence
	Control	77,33			
Self-regulated Learning	Experiment	80,64	0,013		
	Control	78,87			

**Cognitive ability**

Student's cognitive abilities were measured after treatment in the experimental and control classes. The experimental class has an average value of cognitive ability of 83.87, while the control class has an average value of cognitive ability of 77.33. Based on these values, there was an increase in student scores after the study. The results in accordance with [Sucipto \(2017\)](#), the use of e-learning is more effective for increasing the average value of students' cognitive learning outcomes than conventional learning.

During the research, students in the experimental class tended to be more active in discussions in the Digital Class and face-to-face in class. [Liaw & Huang \(2007\)](#) shows that students studying with e-learning-based learning make these students more active in learning and sharing

knowledge with other students. Active students will affect their learning outcomes. In achieving optimal learning outcomes, it can be done by using e-learning in the classroom, increasing students' curiosity and influencing their cognitive abilities. [Panigrahi, 2018](#)). [Manullang & Djulia \(2016\)](#) states that the activity and enthusiasm of students in learning can affect learning outcomes. According to [Nguyen \(2017\)](#) learning outcomes in e-learning are influenced by online interaction factors between teachers and students, which will increase student activity and affect learning outcomes.

The students' activeness can be seen when the researcher invites them to discuss evolution in class regarding the statement that humans came from apes. The results of the discussion in the experimental class that students can answer by

analyzing the statements given with the truth that occurs in evolution. In the control class, students were less able to relate statements to evolution. Based on this, it can be used as a reference that students in the experimental class have the better analytical ability. Thus, the use of Digital Class affects cognitive abilities in the experimental class. This statement is supported by the results of Vebert's research (2014), showing that e-learning in students produces good learning outcomes.

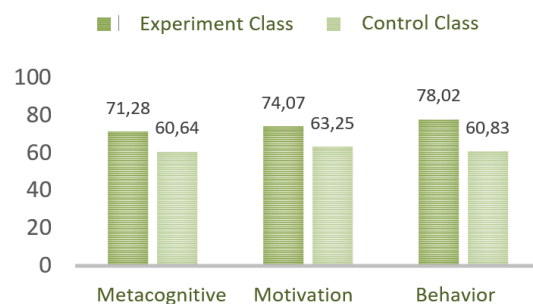
Based on the findings in the study, implementing Digital Classes positively affects students' cognitive abilities in Evolution material.

### **Self-regulated Learning (SRL)**

SRL achievement scores in both classes are divided into Very High, High, Low, and Very Low qualifications. In the experimental class, the SRL qualifications obtained were 17 students (52%) with very high qualifications, 15 students (45%) with high qualifications, and one student (3%) with low qualifications. In contrast, the SRL qualifications in the control class were 12 students (60%) with high qualifications and 18 students (40%) with low qualifications. SRL qualifications in both classes can be seen in Figure 4.

Differences in SRL values also affect differences in values for each indicator. This can be seen in table 5.

In the metacognition indicator, the average value of the experimental class was 71.28 with high qualifications, while in the control class, the average value was 60.64 with low qualifications. In the motivational indicator, the average value of the experimental class was 74.07 with high qualifications, while in the control class, it was 63.52 with high qualifications. In the behavioural indicators, the average value of the experimental class was 78.02 with high qualifications, while in the control class, it was 60.83 with low qualifications. The difference in the average value of the SRL indicator can be seen in Figure 4.



**Figure 4.** SRL Average Score Difference

**Tabel 5.** SRL Score Differences

Indicators	Experiment Class			Control Class		
	n	$\bar{X}$	Qualification	n	$\bar{X}$	Qualification
Metacognition	927	71.28	Tinggi	788	60.64	Rendah
Motivation	667	74.07	Tinggi	572	63.52	Tinggi
Behaviour	624	78.02	Tinggi	487	60.83	Rendah

SRL in this study was measured through a questionnaire filled in by students via Google form after learning using the Digital Class. Self-regulated learning has three indicators, namely metacognition, motivation, and behavior ([Zimmerman, 1989](#)). These three indicators were measured in the experimental class and the control class.

The metacognition indicator students have in the experimental class has an average value of 71.28 with high qualifications. In contrast, the control class has an average value of 60.64 with low qualifications. According to [Winne \(2013\)](#), Students with good metacognitive skills are actively involved in thinking about their learning.

The motivational indicator of students in the experimental class had an average score of 74.07 with high qualifications, while in the control class, it was 63.52 with high qualifications. According to [Paechter \(2010\)](#) states that students who do learning with e-learning can motivate students and improve self-regulated learning rather than classroom learning.

Behaviour indicators in the experimental class have an average value of 78.02 with high qualifications, while those in the control class have an average value of 60.83 with low qualifications. According to [Artiono \(2012\)](#), students who use e-learning make students more adaptive and behave in good independent learning. In general, the SRL value of students in the experimental class had an average of 80.64, while those in the control class had an average of 73.87. This is also in accordance with the results of research by [El-Senuousy and Alquda \(2017\)](#), which shows that the average SRL score among students who use e-learning differs significantly from students who learn using traditional methods.

[Jansen et al \(2017\)](#) states that e-learning is necessary to improve students' SRL. Implementation of Digital Classes makes students more responsible than face-to-face learning systems. Digital Classes change students from passive learners to become active and able to self-manage for independent learning. [Delen \(2014\)](#) states that e-learning will have a positive effect and support SRL students. Students in the form of increased student activity obtain positive effects. According to [You \(2014\)](#), students with high SRL are active and participate in doing assignments.

The results of [Paechter \(2010\)](#) results, state that students with SRL prefer e-learning-based learning. Zimmerman emphasizes that students with high SRL use specific strategies during

learning to achieve the desired learning outcomes ([Zimmerman, 1989](#)). Based on the findings in the study, implementing the Digital Class positively affects students' SRL in Evolution material.

### Digital Class Implementation

The Digital Class is designed to be independent of place and time. Researchers act as facilitators, providers and supporters of the learning process using Digital Classes.

Before the research, the researcher helped students register accounts as students in the Digital Class. Then students were asked to choose a class according to the direction of the researcher. Besides, researchers have prepared Digital Classes by adding Evolution material content, as shown in Figure 5. Classes are presented with six learning activities accompanied by assignments as learning supports. Material content is prepared as attractive as possible so that students are interested in accessing Digital Classes at home and face-to-face learning activities at school. Digital Classes are also designed constructively, encouraging students to be more active in learning the material presented. This can be seen when the teacher provides content in the Digital Class. Students play an active role in completing the task and take advantage of the discussion forum features. There is material content, learning videos, and images relevant to the Evolution material. [Paechter \(2010\)](#) states that interesting material content can make students study independently at home.

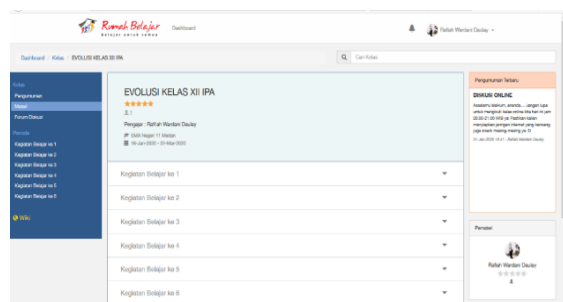
In the early stages of learning, students in groups were asked to log in to the Digital Class and carry out the learning process according to the directions of the researcher and the learning scenario. After the learning process is complete, the researcher asks students to work on assignments that can be downloaded in each learning activity. Class assignments are also collected through the Digital Class by way of re-uploading according to learning activities before a predetermined deadline. This can motivate students to study the learning material provided in each learning activity in the Digital Class.

In addition to presenting material content, interactive activities used by researchers and students in the Digital Class are discussion forums (Figure 6). These will stimulate students to be more active when learning in the Digital Class. The discussion forum aims to encourage students to be active in learning and not only rely on the material

content presented in the Digital Class. The interaction that occurs between teachers and students online is a factor that can increase student activity and affect students' cognitive abilities. According to [Nguyen \(2017\)](#) The use of e-learning can influence online interaction factors between teachers and students, increasing student activity during learning.

The experimental class's use of discussion forums in the Digital Class is carried out online outside school hours. The discussion forum was opened by discussing material regarding fossilized buffalo horns found in Central Java. Before starting the discussion, the researcher asked students to fill in the attendance sheet provided in the discussion forum as a sign that the student was present during the online discussion.

The results obtained in the discussion forum were good responses from students seen from the activeness of students answering questions during the discussion. This is in accordance with the research [Panigrahi \(2018\)](#) which states that discussion activities between teachers and students by utilizing e-learning will produce suitable student activities. Research result [Salamat \(2018\)](#) states that students become more active while using e-learning. [Ali et al \(2015\)](#) also argues that e-learning will involve students actively. According to [Zimmerman dan Moylan \(2009\)](#) by utilizing discussion as a learning activity, students can deepen their understanding of the subject matter, making them more actively involved in learning. It also supports student SRLs.



Gambar 5. Tampilan Kelas Digital



Figure 6. Discussion Forum

## CONCLUSION

Based on the results of the research that has been done, there are differences in the cognitive abilities of students in the experimental class and control classes. The difference in cognitive ability was obtained from the average value in the experimental class, 83.87, while the average cognitive ability in the control class was 77.33. This difference can be seen from the Sig (2-tailed) value on the independent t-test of 0.24. Based on the analysis above, there is an effect of implementing Digital Class on cognitive abilities in Evolution material in Class XII SMA Negeri 11 Medan. In addition to cognitive abilities, there are differences in students' self-regulated learning in the experimental and control classes. The difference in self-regulated learning is obtained from the average value in the experimental class, which is 80.64. in comparison, the average value of self-regulated learning in the control class is 73.87. This difference can be seen from the Sig (2-tailed) value on the independent t-test, which is 0.13. Based on the analysis above, there is an effect of implementing Digital Class on self-regulated learning in Evolution material in Class XII SMA Negeri 11 Medan.

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