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IMPROVING STUDENTS' MATHEMATICAL PROFICIENCY THROUGH SYNCHRONOUS AND ASYNCHRONOUS APPROACHES USING DIGITAL MODULES

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ABSTRACT

The covid pandemic resulted in students losing knowledge about learning that had been obtained in previous meetings. Students' mathematical prowess as a prerequisite ability to be used in subsequent learning is weakened. The purpose of this research is to know the effect of implementing synchronous and asynchronous learning assisted by digital modules on increasing students' mathematical skills by paying attention to the level of learning loss. This study used a quantitative method with a quasi-experimental nonequivalent pretest posttest control group design. The sample consisted of 48 elementary school students. The test instrument is used as the primary means of data collection. The test instrument was tested for validity and reliability before the instrument was tested on students. Paired sample t-test analysis and independent t-test were used to answer the research hypothesis. The results of the study concluded that learning using synchronous and asynchronous models assisted by digital modules has a significant effect on students' mathematical skills. Students who get asynchronous learning get a higher influence when compared to students who learn synchronously. The research findings on the use of digital modules are expected to be able to provide alternative learning models in distance learning. This research is also a recommendation for future researchers to develop digital modules at the secondary education level.

Keywords: *Mathematical Proficiency, Synchronous, Asynchronous, Digital Module*

1. INTRODUCTION

The Covid 19 pandemic that occurred in early 2020 spread throughout the world with transmission that was so fast. This forces 1.6 million students to study from home [1]–[3]. Two years into distance learning, a study revealed that during distance learning many teachers experienced stress in providing learning services. Teachers are concerned that many students are not being met with academic and social needs. Especially for mathematics, there is concern that the ability of students will gradually decrease because the distance learning process does not provide a meaningful learning experience for students [2], [4], [5]. During distance learning, students are only given explicit explanations followed by repeated practice using pre-prepared learning videos that are uploaded on the web. The distance learning system is an effort to fulfill students' opportunities to get lifelong education, with the principles of independence, flexibility, appropriateness, up-to-date, and efficient. This system is seen as learning that can facilitate students during this pandemic. In addition, distance learning has a broad reach and provides opportunities (access) in learning.

Holmberg said that distance learning is a good form of education, does not mean the physical presence of the tutor who is appointed to organize in that place, where he is accepted or where the tutor is only present on occasion or for certain tasks [6]. Distance learning is a method for teaching knowledge, skills, and attitudes by utilizing and implementing the use of information and communication technology which can mass produce high-quality learning materials so that they can be used simultaneously by students who live far from educator.

Meanwhile, the ideal conditions for learning mathematics require student-centered mathematical discussions that are built on students' learning

experiences [7]. This post-task discussion provides an opportunity for the teacher to highlight the interrelationships between mathematical ideas. One alternative way that can be done so that students are able to achieve success in learning mathematics is to increase their understanding of mathematical skills.

It is reasoned that mathematical ability is important for measuring the economic success of society [8], as well as a tool for developing science and technology [9]. Mathematical ability is the basis for understanding other disciplines, such as engineering, science, social, and arts [10], [11]. This ability can be maximized through fun mathematics learning.

Unfortunately, the results of the field analysis show that there are still students who do not like mathematics because according to them mathematics is a difficult, abstract, rigid, rigid lesson. Students often get lower grades than other subjects so that some of them avoid mathematics. The findings are in line with previous findings which state that many students do not like mathematics because mathematics is too difficult [12]. Mathematical difficulties are not only experienced by elementary school students, but also experienced by students. The findings show that many students from the Faculty of Engineering are not happy with the students' mathematical abilities [13].

In addition to mathematical characteristics, the way teachers teach also affect student interest in mathematics. This is in accordance with the assumptions put forward by Cockcroft, namely: "Mathematics is a difficult subject both to be taught and studied". The opinion above besides showing that mathematics is difficult, also confirms that there are students who have difficulty learning mathematics. For this reason, efforts are needed to overcome these learning difficulties. In this case the teaching of mathematical material needs to be designed in such a way as to achieve the teaching objectives that have been determined to be achieved.

The reluctance of some students towards mathematics is reasonable because mathematics is indeed an abstract subject. Furthermore, according to experts, mathematics contains many symbols and formulas [14]. Sometimes, difficulties in mathematics are deliberately designed to train and familiarize students thinking and solving problems. In addition, mathematics requires students to think logically, systematically, and reflectively [15], [16]. During the learning process of mathematics, students must be tenacious, diligent, and thorough. Therefore, by studying mathematics and mastering mathematical skills, students are expected to become competitive and characterized individuals.

The problem experienced is not only in terms of students, but also in terms of teachers as teachers. The preliminary results show that there are obstacles experienced by the teacher in mathematics learning, namely: (1) the teacher lacks time in the delivery of material [17], [18]; (2) students' abilities vary so that teachers find it difficult to determine effective learning strategies and models to accommodate student diversity [19], [20]; and (3) teachers sometimes have to leave teaching tasks because of many other government demands, such as administrative demands, training, seminars, writing scientific papers, etc. that interfere with the learning process [21].

Of the many problems, it takes the right solution. One of them is to use the media as a means of delivering mathematical material. As is currently experiencing that Pandemic conditions require learning to be carried out online. So, teachers need teaching media that can be used or accessed by students independently from home. For example, the use of digital modules for elementary school students.

Module is a set of teaching materials that are presented systematically and attractively with the content of the contents of the material, methods, and evaluation. Modules or teaching materials can not only be presented in print, but can also be presented non -print or electronic -based. Electronic -Based Teaching Module is known as a digital module. This module is defined as a set of teaching materials that can be used flexibly anywhere with the help of electronic devices in the form of mobile phones or laptops [22]. This type of module requires good network access so that the module can be used.

Various types of digital modules have developed in schools. However, there is one module that is interesting and in line with the criteria or characteristics of elementary school students. The module is a flipbook. Flipbook containing animation, audio, and interactive navigation [23]. Flipbook contains several page sheets that are supported by video, animation, writing, and images.

Many previous researchers have proven that the use of digital modules is functioning well in improving students' abilities. Setiyani et al [24] has highlighted the digital module as a medium to

improve students' mathematical communication skills. The module he developed was proven to help maximize the ability of mathematical communication because its use was unlimited. Next, research on the use of digital media for several teachers in Europe is also in the spotlight for other researchers [25]. The results show the use of the media provides experience during learning.

Nopriana et al [26] has developed a digital module based on student learning barriers using Digital Didactical Design Theory (DDD). The results inform that the digital module is feasible and can be used in teaching in vocational high schools to minimize learning barriers. On a different side, there is research on the development of learning media in the form of Android -based digital modules for the history of music courses for students [27]. The results of the analysis show that the Android -based digital module can increase student learning motivation. Other researchers develop a digital module for students as a way of implementing digital practicum (practice) and integrated with the learning management system (LMS) in microbiology learning with mixed learning strategies [28].

From the various relevant literature, it can be seen that the use of digital modules is effectively used in learning. Previous studies also prove that digital modules are interesting issues to be reviewed. Aside from being a supporter of the implementation of distance learning, digital modules also have many advantages if functioned properly.

Previous findings many digital modules used at the level of higher and medium education. So, it is clearly different from this research whose purpose is to be elementary school students. In addition, this research also links synchronous and asynchronous learning approaches with the help of digital modules. Previous research only focused on the digital module. Therefore, it is interesting if this research is carried out further through quantitative testing. From this description, this study aims to determine the effect of the application of synchronous learning and asynchronous assisted by digital modules on improving students' mathematical abilities by paying attention to the level of learning loss.

2. THEORITICAL REVIEW

2.1 Mathematical Proficiency

Proficiency comes from the word capable which means (1) being able to do something; (2) intelligent and proficient; (3) have the ability and wisdom to do something. Proficiency means ability as well as ability. Mathematical prowess means a person's ability in mathematics. That mathematical prowess is all aspects of a person's ability and knowledge needed to determine success in mathematics and other fields. Singer and Stake stated that mathematical prowess intensively affects a person's math career [29].

According to math skills are what students acquire in learning mathematics and also what students need to successfully learn mathematics mathematical skills consist of 5 strands (strands) that are intertwined and interdependent [30], [31].

1. Conceptual understanding, understanding of mathematical concepts of operations and relationships
2. Procedural fluency, mastery of program skills that are flexible, accurate, efficient and precise
3. Strategic competence (strategic competence), the ability to formulate and solve mathematical problems
4. Adaptive reasoning (adaptive reasoning), the ability to think logically, reflect, explain, and defend
5. Productive disposition, the tendency that Mathematics makes sense, is useful and useful, plus belief in persistence and self-efficacy

Mathematical prowess is like a rope consisting of five strands of branches that must be in line and in sync. Apart from that, we assume that the relationship of the five strands above is a broom. If the covers are separated from each other, the stem will not be called a broom and its function cannot be used to sweep the floor. This supposition is in line with statement which shows that each component of mathematical skills is not a separate field, but the five are a series of interactive skills that can enhance one another's knowledge [32]. Asmara argues that the five components of math skills are not separate things, but skills that are interrelated, representing different aspects of a complex matter. The five aspects of mathematical ability must grow and develop in sync, so that the teacher must strive to develop aspects of mathematical ability in a balanced way. Opfer, Kim, and Qin state that in a nation the mathematical prowess of its citizens plays a major role in the nation's economic growth and

differences in mathematical proficiency predict rational personal economics and educational outcomes [33].

2.2 Digital Module

Advances in technology can change the pattern of people's lives. As Budiman argues, advances in science and technology have changed the perspective and lifestyle of the Indonesian people in carrying out their activities and activities [34]. Technological developments in the era of the industrial revolution 4.0 are currently developing rapidly and technological developments are always influenced by cultural progress. Technological sophistication is the optimal medium for delivering material/concepts and completing final assignments [35]. The learning process cannot be separated from the role of ICT (Information and Communication Technology). The use of technology used in educational activities can support the quality of education. As Budiana's opinion, the development of advances in Information and Communication Technology (ICT) today has had a major influence on all aspects of life including the world of education [36].

Teaching materials are not only in the form of books or worksheets based on print media. Non-print-based teaching materials can also be used in learning, for example in the form of electronic teaching materials. Currently electronic-based teaching materials can be easily obtained due to the presence of information technology network devices. Through this information technology network, teachers can easily use it to become teaching materials [37].

One type of teaching material that can be used by students is a learning module. Modules are structured for the benefit of students which contain a series of learning activities that are tailored to the competencies to be achieved. Modules are a set of teaching materials that are presented systematically so that students can learn without a teacher, arranged in a systematic and interesting manner that includes material content, methods and evaluations that can be used independently [38]. In line with this opinion, Prastowo suggests that a module is a teaching material that is arranged systematically in language that is easily understood by students according to their level of knowledge and age, so that they can learn independently (independently) with assistance or minimal guidance from the teacher [39].

This is in accordance with the current education paradigm where learning is more student centered (student centered learning) and the teacher acts as a learning facilitator. As science and technology develops, modules begin to transform into digital modules, namely modules that can be accessed via laptops, computers and others. This digital module is in the form of text, images, video and audio. This digital module is very suitable for use in distance learning systems (online learning) such as during the current pandemic and can help self-study.

The intended digital module is a module made digitally in the form of a flipbook as a learning medium that contains animation, audio and navigation that becomes more interactive. The use of digital flipbooks is similar to electronic books (e-books), but the advantage is that flipbooks can be opened page by sheet, supported by animations, videos, writing, and images that are relevant to the context of the book [40]. The advantages of this application are (1) being able to provide flip effect modules or flip through pages; (2) making modules with this application is very easy; (3) the appearance of the module is not only in the form of text and images, audio and video forms can be combined in presenting the material; (4) the resulting product can be published in SWF (Shock Wave Flash), HTML (Hyper Text Markup Language) format if it is to be published via a website [41].

The electronic module is a form of presenting independent teaching materials presented in an electronic format [42]. The advantages of electronic modules can present material with a combination of media such as audio, text, images and video [43].

One application that can be used to compile electronic modules is Kvisoft Flipbook Maker Pro. Kvisoft Flipbook Maker Pro is a software designed to convert PDF files to flip page format. The advantages of this application are (1) it is able to provide flip effect modules or pages can be flipped; (2) making modules with this application is very easy; (3) the appearance of the module is not only in the form of text and images, audio and video forms can be combined in presenting the material; (4) the resulting product can be published in SWF (Shock Wave Flash) format, HTML (Hyper Text Markup Language) if it is to be published on the website.

3. RESEARCH METHODS

3.1 Research Design

This study used a quantitative method using a nonequivalent quasi-experimental design pretest

posttest control group design [44]. Quasi Experimental Design is a type of research design that has a control group and the experimental group is not chosen randomly [45]. This research includes variables. This research includes independent and dependent variables. The learning model is an independent variable, while mathematical reasoning ability is the dependent variable [46], [47].

This study involved two groups: the experimental group and the control group. In the experimental class, digital module-assisted synchronous was applied, while in the control class, digital module-assisted asynchronous was applied. The researcher first introduces the functions and features of the Digital Module. This study gave the test twice for both classes. Pre-test is the first test given before treatment, while Post-test is the second test given after treatment. The purpose of giving these two tests is to find out the increase in mathematical reasoning abilities that occur in both classes. The research was conducted online using the zoom meeting application for the learning process. Google Classroom, Google Forms and WhatsApp are used to organize assignment collection and mathematical reasoning ability test results. The selection of Google Classroom, Google Form and WhatsApp applications is based on the consideration that these applications are familiar to students and can help organize and communicate in the learning process [47].

3.2 Sample

In this study, there were 48 fifth grade students from Nagarasari State Elementary School 1 and Nagarawangi State Elementary School 1 Tasikmalaya City, Indonesia as a sample. The experimental class consists of 26 students, while the control class consists of 22 students. The sampling technique used was purposive sampling. The researcher communicated with the mathematics teacher in choosing two classes that had equal or balanced abilities and was reinforced by t-test. The independent t-test obtained the value of t (68) = 0.837 with p> 0.05 which indicates that the abilities of the experimental class and the control class are the same or equivalent. Determination of equal distribution of abilities seeks to ensure that every progress is the result of inequality in the availability of learning models.

3.3 Research Instruments

Data collection used a test of students' mathematical prowess which consisted of 15 descriptive questions. This test was designed with the aim of measuring students' mathematical prowess. Aspects that are considered in this test are (1) Conceptual Understanding of fractions, (2) Procedural Fluency regarding fractions, (3) Strategic Competence in solving problems, (4) Adaptive Reasoning in finding new problems. Before being used as a data collection tool, the instrument for testing mathematical reasoning abilities is validated and tested for reliability as an effort to ensure that the data obtained during the research process is valid and reliable.

Validity test is the accuracy or accuracy of a measuring device in measuring what you want to be measured [48]. In a sense that is easily understood, the validity test is a test that aims to assess whether a set of measuring instruments is appropriate to measure what should be measured. Validity test through the validity of the content and procedure of empirical validity. Content validity is carried out by assessment by experts [49], [50]. This study involved four experts, namely two professors and two doctors in the field of mathematics education. The results of the content validity test show that the test instrument is valid.

Empirical validity in the form of testing statistical instruments using product moment correlation analysis [51]. Product Moment correlation is to compare the test scores with certain criteria that are used as benchmarks outside the relevant test. Before being used, the mathematical reasoning capability test instrument was tested to 28 students who had learned the limit function. Empirical validity is done by correlating the values obtained by students in the mathematical reasoning ability test with the average daily test score obtained by students in the previous year.

3.4 Research Procedure

This research is divided into two stages, namely preparation, implementation, and end [52], [53]. The following is a brief explanation of the research procedure.

First is the preparation stage. The preparation stage includes field studies and literature studies to read the phenomenon of research problems to be examined. After the problem is formulated, then the researcher conducts material developed with the synchronous and asynchronous approach assisted by digital modules. Then, the researcher prepares a learning implementation plan, the researcher compiles the research instrument, conducts a test validity and empirical validity, conducts several revisions based on input from experts, trialing the

instruments to students outside the research participants, preparing and taking care of the research permit, and determining the research subject.

Second, the implementation stage. The research implementation phase includes the implementation of pretest. Researchers provide pre-test before doing learning therapy. Furthermore, researchers gave treatment in the form of implementing the synchronous and asynchronous approaches assisted by digital modules, as well as carrying out post-test at the end of the session.

The third stage is processing research data, analyzing and discussing research results, and drawing research conclusions.

3.5 Data Analysis

Analysis of research data using quantitative statistical tests. Before carrying out statistical tests, normality and homogeneity were checked. The normality test uses the Kolmogorov-Smirnov test, while the homogeneity test uses the levene test. Normalized gain was used to assess the increase in students' mathematical reasoning abilities in both grades [54]. The normalized gain formula and criteria follow the scheme in Table 1 as follows.

Table 1: Criteria For Normalized Gain Scores (g)

Normalized Gain Score (g)	Interpretation
g 0.70	High
0.30 g < 0.70	Medium
g < 0.30	Low

The research questions posed are descriptive and hypothetical. The first research question is descriptive, where descriptive statistical analysis is used as a tool to explain the description of the criteria for improving mathematical reasoning abilities in both classes which include the mean, standard deviation, and skew-ness. The criteria for improving mathematical reasoning abilities in both classes refer to Table 1. While the second and third research questions are hypothetical in nature, where paired sample t-test and independent t-test statistical tests are used to answer the second and third research questions. The analysis process is assisted by using SPSS 25 software. The analysis procedure begins by analyzing the pre-test, post-test, and N-gain in determining the data is normal and homogeneous. Then proceed with paired sample t-test and independent t-test [34].

4. RESULTS AND DISCUSSION

4.1 Result

The purpose of this research is to find out the differences in the increase in the mathematical skills of students who receive learning with synchronous and asynchronous models assisted by digital modules. Based on these objectives, it is reduced to three research questions to be able to achieve the intended research objectives. The following is a description of the results of the descriptive statistical analysis related to the increase in mathematical skills based on the model. In the first research question, the following results were obtained. The results are shown in table 2 below:

Table 2: Descriptive Statistical Analysis

	Descriptive	Statistic	Std. Error
Score Post Test Synchronous	Mean	79.77	1.783
	95% Lower Confidence Bound	76.10	
	e Internal Upper for Mean Bound	83.44	
	5% Trimmed Mean	80.28	
	Median	80.50	
	Variance	82.665	
	Std. Deviation	9.092	
	Minimum	53	
	Maximum	95	
	Range	42	
	Interquartile Range	11	
	Skewness	-1000	.456
	Kurtosis	1.807	.887
Score Post Test Asynchronous	Mean	75.54	1.809
	95% Lower Confidence Bound	71.81	
	e Internal Upper for Mean Bound	79.26	
	5% Trimmed Mean	75.90	
	Median	75.00	
	Variance	85.058	
	Std. Deviation	9.223	
	Minimum	53	
	Maximum	90	
	Range	37	
	Interquartile Range	15	
	Skewness	-338	.456
	Kurtosis	-.0.02	.887

Based on the output above, it turns out that the average posttest mathematical prowess of students who learn synchronously with the help of digital modules and students who learn asynchronously with the help of digital modules are respectively 79.77 and 75.54 (scale 0-100).

The standard deviations of 9.092 and 9.223 respectively show that the average post-test of mathematical prowess is not much different and the standard deviations are almost the same, which means that the distribution of synchronous and asynchronous students does not differ descriptively. From the output above it is also known that the slope of the distribution of the posttest scores of the two groups has a negative slope, namely negative 1 and negative 0.338, which means that the post test scores of the two groups converge at a high score.

The next analysis relates to the differences in the effect of the implementation of Synchronous and Asynchronous learning assisted by Digital modules on the acquisition of mathematical skills. To test the research hypothesis, the t test was used with the help of SPSS software and the results are as follows.

Table 3: Post-Test Score Acquisition

Group Statistics					
	Learni-ng group	N	Mean	Std. Deviation	Std. Error Mean
Score Posttest	Synchronous	48	75.60	10.0120	1.445
	Asynchronous	48	80.65	10.124	1.461

Table 4: Independent Sample Results

Independent Samples Test						
		Levene Test for Equality of Variances				
		F	Sig.	t	df	Sig. (2-tailed)
Score Posttest	Equal variances assumed	.036	.850	-2.453	94	.016
	Equal variance not assumed			-2.453	93.988	.016

Based on the output above, it turns out that the sig (2-tailed) value is 0.016, and this value is less than 0.05 (α), which means that the research hypothesis states that there are differences in the effect of the implementation of synchronous learning assisted by digital modules and asynchronous learning assisted by digital modules on the acquisition of skills. accepted mathematics. Furthermore, because the average score of the acquisition of mathematical skills of students who study using the asynchronous model assisted by digital modules is 80.65 higher than the average value of students' acquisition of mathematical skills using the synchronous model assisted by digital modules (75.60), it can be concluded that the implementation of asynchronous learning assisted by digital modules has a higher effect on acquisition than students who learn using a synchronous model assisted by digital modules.

The next analysis related to the normality and homogeneity tests of the data is fulfilled, paired sample t tests and independent t tests can be carried out. The results of the analysis using SPSS software, the output of the Paired sample t-test is obtained in the following table.

Table 5: Paired Sample-T-Test Results

Paired Sample Correlations				
Pair 1	Pretes_X1 & Posttest_X2	26	.410	.037

From the output of the paired-sample-t-test, there are two important things that can be concluded, because in the output:

Paired sample correlation, the significance value is 0.037 and this value is less than 0.05 (α) which means that there is a significant positive correlation between the pretest and posttest scores of students who receive synchronous learning assisted by digital modules.

Paired sample test, the significance value is 0.000 and this value is less than 0.050 (α) which means that the implementation of learning with the synchronous model assisted by digital modules has a significant effect on mathematical proficiency.

Table 6: Paired Sample-T-Test Results

		N	Correlation	Sig.
Pair 1	Pretest_X1 & Posttest_X2	22	.189	.401

From the output of the paired-sample-t-test, there are two important things that can be concluded, because in the output:

Paired sample correlation, the significance value is 0.401 and this value is greater than 0.05 (α) which means that there is a positive but not significant correlation between the pretest and posttest scores of students who receive synchronous learning assisted by digital modules.

Paired sample test, the significance value is 0.000 and this value is less than 0.050 (α) which means that the implementation of learning with the synchronous model assisted by digital modules has a significant effect on mathematical proficiency.

The next analysis relates to the differences in the effect of the implementation of synchronous and asynchronous learning assisted by digital modules on improving mathematical skills. To test the hypothesis above, the t test (double mean) was used and with the help of SPSS software the following results were obtained.

Table 7: Group Statistical Test Results

Group Statistics					
	Pembelajaran	N	Mean	Std. Deviation	Std. Error Mean
Score Gain	Synchronous	48	.6644	.13591	.01962
	Asynchronous	48	.7394	.12295	.01775

Table 8: Independent Sample Results

Independent Samples Test						
		Levene Test for Equality of Variances				
		F	Sig.	t	df	Sig. (2-tailed)
Score Gain	Equal variances assumed	.974	.326	-2.835	94	.006
	Equal variance not assumed			-2.835	93.071	.006

By paying attention to the SPSS output (result) above, it turns out that the sig (2 tailed) value is 0.006, and this value is less than 0.05 (α), which means that the research hypothesis states that there are differences in the effect of implementing synchronous and asynchronous learning assisted by digital modules on increased mathematical proficiency received. Based on the average, it can be concluded that the implementation of the effect of learning using the digital module-assisted asynchronous model (0.74) is higher than using the digital module-assisted synchronous model (0.66) on improving mathematical skills.

4.2 Discussion

The results of descriptive analysis show that the increase in students' mathematical abilities in both learning classes is in the medium category. The condition explains that the synchronous and asynchronous learning model assisted by digital modules can make it easier for students to improve their mathematical abilities. The results are in line with the findings of Ryan V. Dio [55] that the Asynchronous Module has been proven to strengthen student experience. Also, with other research that the combination of synchronous learning and asynchronous has balanced the education process in schools [56].

Then, the results of the research analysis showed differences in students' mathematical abilities before and after using the model. The results showed that the posttest value of students' mathematical ability after applying the synchronous BMD model (M = 75.60) and Asynchronous BMD (M = 80.62) was higher than the pretest value before applying the Synchronous BMD model (M = 23.52) and Asynchrous BMD. (29.35). That is, there is a significant positive relationship between the mathematical abilities of students and posttest students in each synchronous class assisted by a digital module (R = 0.41) and asynchronous assisted by digital modules (R = 0.189). The results of the calculation are also similar to the previous findings that the Synchronous and Asynchronous approach is effective in improving student learning outcomes and skills [57], [58]. Next, other findings inform you that there is a significant effect of the application of the online learning model synchronous versus Asynchronous Learning on the cognitive results of students [59].

When viewed in more detail, it is known that the asynchronous model gets a higher score compared to using the ASINCRON model assisted by a digital module to improve mathematical capabilities. This is in accordance with the theory of asynchronous learning. Asynchronous learning is a learning method that allows students to learn where and at any time according to their will [60]–[62]. This learning emphasizes students who must learn independently. Asynchronous learning has several advantages, namely flexible and

maximizing student independence. The reason is also in line with the expert opinion that the asynchronous model is very easy and flexible [63], [64].

Unlike the case with a synchronous model. This model has shortcomings in the form of learning must be within a time frame and requires a technical system that must be done, such as the use of internet networks. Synchronous learning requires everyone to listen at the same time, the whole class must be online at the same time. Similar to Zhang's findings that the synchronous model requires a lot of experience and skills in their training process [65].

The application of a digital module can help students to recognize and understand the concept of fractional count operations. This Finding is in line with Jiahua Zhao's opinion that the gamified interactive e-book in the mathematical flipped classroom (the GIEBFL group) is effective in maximizing learning motivation and students' metacognitive abilities after being used in learning [66]. In addition, this digital module can also help students in mastering other mathematical skills such as procedural fluency, strategic competence, adaptive reasoning, and productive dispositions. This is because this digital module is very easy to use. Digital modules are an alternative to improving students' abilities and independence in learning because their use is not limited to the classroom [24].

Presenting a model that attracts and motivates students can focus students on the observation process, such as the visualization displayed in the digital module. Listening to the teacher delivering material, peers expressing opinions in solving problems and observing problem-solving schemes presented in teaching materials, helps students understand the learning behavior displayed during the learning process [67]. In this situation, cognitive factors play a role in observing, considering, and absorbing the learning behavior displayed by the model. It is different from the learning conditions in the classroom that study with Digital Modules. In this class, students are faced with problems related to the concepts to be studied. Contextual problems are used to stimulate and attract students' attention so they can focus on the topic of the material being studied. The successful implementation of problem-based learning reported by Aslan concludes that mathematical skills can be developed through this model. Students' initial abilities are very important in the process of implementing this model, this is because students must be able to learn, and reason about the problems given at the beginning of learning [68], [69].

5. CONCLUSION

The results showed that the criteria for increasing students' mathematical skills in the two models tested were in the medium category. The application of synchronous and asynchronous learning models assisted by digital modules each gives moderate and low scores. The application of synchronous and synchronous learning models assisted by digital modules each has a significant influence on students' mathematical skills. Where students who get learning using asynchronous models assisted by digital modules get a higher improvement than students who learn using synchronous models assisted by digital modules.

This research has limitations, namely the research subjects only 4th grade students at Nagarasari 1 Elementary School and Nagarawangi State Elementary School 1 Tasikmalaya City so that researchers feel the need for further research that uses development in things that are considered lacking. The upcoming researchers can also test similar models at a higher level of education. Based on research findings and limitations of this research, subsequent research can develop synchronous learning models and asynchronous assisted by digital modules as an alternative learning model in online learning situations.

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