Liveworksheet Interactive E-Module Effect on Equal Fractions Comprehension at 4th Grade Elementary School

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Abstract: This study seeks to investigate the impact of the liveworksheet interactive e-module on the comprehension of equal fractions among fourth-grade pupils. This study employed a quantitative methodology, utilizing a quasi-experimental design. The research design used was a post-test control-only-control group design. The sample size for this study consisted of 26 children in the 4th grade at Kejambon 2 Elementary School. The investigation employed a simple random sampling technique. The instrument comprised six descriptive questions. The data analysis was conducted using a T-test as a prerequisite test, including normality and homogeneity tests, with the assistance of SPSS software. The results obtained from the T-test analysis include a t-value of 2.311 and a significance value (2-tailed) of 0.030, which is less than 0.05. The results obtained from the T-test investigation include a t-value of 2.311 and a significance value (2-tailed) of 0.030, which is less than 0.05. The liveworksheet interactive e-module impacted the comprehension of the idea of equal fractions. Subsequently, the invalid hypothesis (H_0), "There is no significant difference in 4th-grade student mathematic comprehension, both liveworksheet interactive e-module and video-based learning", was rejected. The first hypothesis (H1), which stated, "There is a significant difference in 4th-grade student's mathematic comprehension, between liveworksheet interactive e-module and video-based learning", is considered valid.
Keywords: liveworksheet interactive e-module, mathematic concept comprehension, equal fraction

Introduction

Mathematics in the learning process is important in increasing someone's intellect. Mathematic learning is provided in all elementary to senior high school schools. This is in line with Rahayu (2013), who states that mathematics is a subject for all students from elementary school to the collegial stage as equipment for logical, analytical, systematic and critical thinking abilities and creative and collaborative skills. This aligns with the educational goals of providing direction and achieving results through all educational activities. Mulyasa (2008) states that someone's internal changes possibly increase solid function in societal living. Therefore, education must anticipate the society for the future. In this way, education will become necessary for everyone as individuals and as part of society. In line with this, schools are formal education institutions that can develop students' character as a whole and knowledge with scientific development.

Therefore, the school's learning process must encourage the student's character, knowledge, and ability development so that the relevantly applied learning model is focused on the student. At the same time, the lecturer just gives a few instructions to the students to increase their ability to think critically and develop their skills. This learning model creates effective learning, makes students happy to learn, and increases the activity and creativity of the students (Mulyasa, 2013). In line with Hudojo (1990),

mathematics is related to abstract concepts that are hierarchically organized to identify a concept by another, which is needed to know what concept is needed first.

The reality is that education in Indonesia is still experiencing various problems that impact its low quality. Education in Indonesia, especially mathematics, is low compared to other countries. According to the results of the PISA study in TIMSS in 2011 (in Widyastuti 2014), there is no change, and it even tends to decline. The TIMSS study results show that Indonesia is 38th out of 42 countries. The TIMSS assessment emphasizes mastery of concepts. Meanwhile, the PISA assessment, which highlights aspects of application in daily life, dropped to second place from the bottom, namely 64th out of 65 countries.

So, the experience of elementary school teachers is very important because it shows that mathematics learning in both lower and upper grades does not pay attention to appropriate mathematics learning media, where teachers tend to use discourse methods with textbooks or thematic books as the primary source. This situation impacts students' poor understanding of the teacher's delivery of learning material, one of which is equal fractions.

Jihad and Abdul (2012) stated that comprehension embodies the accuracy of receiving communication, presenting the result of communication in various presentations, and organization without the intention to change the meaning of understanding, knowledge, and ability to find it. In line with the opinion above, Bloom (Susanto, 2014) stated that comprehension is the ability to absorb the meaning from the learned material. Comprehending the concept itself is an important part of mathematics learning. Mathematic learning concepts are progressive, logical, structural, and systematically arranged from the easiest to the most challenging. In mathematics, essential ideas underlie another comprehension, like articulation by Zulkardi (2003), that mathematics emphasizes concepts. Therefore, the teacher must be able to deliver the accessible math material until the student understands the idea, then continue to the next concept without worrying about the possibility of misconception in the future.

Based on the principle and standard for NCTM mathematics school, the combination of "Factual, knowledge, procedural facility and concept understanding" is needed by students to use mathematics. It means the ability to understand the concept is the main needed power by students to occupy other competencies such as problem-solving, communication, and mathematical representation ability. Fraction is a form of a rational number in abstract mathematics and is tricky for students to understand. Fraction concepts are often associated with daily basic problems. Therefore, students must understand the concept of fractions well. The teacher's role is to pick learning methods and media to convey the material concept.

However, students' comprehension ability of mathematical concepts is still quite low. A relevant study held by (Elisa et al., 2018) shows that student's understanding of mathematical concepts is quite low. Most of the students have difficulty learning fractions. Many students are mistaken in determining whether a fraction has value. Students can't tell the difference between the two fractions. In delivering material, teachers have not used media to make it easier for students to be interested in learning. So that students can be skilled in solving problems and disparities, students should be able to understand the concept of fractional values. With this problem, the researcher provided a solution using several media, carried out three times.

The problem of low conceptual understanding also occurred in 4th-grade students of Kejambon 2 Elementary School. Based on offline study results at Kejambon 2 Elementary School Yogyakarta City on Friday, March 11th, 2022, about 50% of students don't understand equal fractions correctly. This was seen based on the results of student test questions on equal fractions material, where as many as 13 out of 26 students had difficulty working on equal fractions material. One of them is a slow learner student. The student only answered 2 out of 6 questions. Low conceptual understanding of equal fractions material experienced by other students, caused by the students being unable to understand the basic concept of fractions and differentiate between equal fractions and common fractions. In the test questions that have been done, a small number of students do the test by asking the teacher or friends how to solve the test. After the test, the teacher discusses the questions given in the test. The questions have been explained many times, but students still struggle to understand the material. Based on interview results with the teacher, they had no solution to the slow learner student problem in the learning. The teacher has suggested that the parents move to a special school, but there is no agreement. Another factor expressed by the teacher was that the teacher had not used concrete learning media on equivalent fraction material.

Meanwhile, the usual learning method is lectures, so learning is less interactive. In addition, learning resources that used just used the mathematical package book. During the learning process, the teacher never applied an interactive module. Some factors affect students' low conceptual understanding of mathematics with equal fractions material.

The problem of mathematic conceptual understanding of equal fractions material should be surmounted immediately because it could affect students' ability to solve mathematic problems. Therefore, to overcome the obstacle of learning source usage, we need to develop a new one adapted to students' abilities and smoothly supports independent learning. Hamdani (2011) states that the module is a learning device consisting of material, method, activity guide, exercise and appraisal media with a systematic and attractive design to achieve the desired result and be used independently.

Darmawan (2012) explains that improving science, technology, and information brings new changes and models on optimal learning materials and methods. The improvement gives new materials that can be used and accessed through computerized structures, such as electronic modules. PC-based interactive learning makes it possible to study with great inspiration caused by students' interest in media.

Thus, the researchers solve the learning problem using a liveworksheet interactive e-module. An interactive e-module is standalone learning material to achieve learning goals via a systematic preparation process in the smallest learning unit. The digital presentation consists of audio, video, and navigation to help the users interact more with the program. Nurmayanti (in Hajar and Hidayati, 2020) explained that liveworksheet is a website that helps students convert a printable traditional spreadsheet (in doc, pdf, jpg, etc. format). Liveworksheet benefits are handy for the student because it is interactive and motivational. In contrast, the live worksheet saves time and paper usage for the teacher (Andriyani et al., 2020).

Based on the description above, mathematical concept understanding can be improved at equal fraction material by using liveworksheet interactive e-module, which has several advantages, as it can be accessed anywhere by students through the devices (PC, laptop, or smartphone) they have so it can facilitate student learning activities. With the interactive module, the students' motivation to study can be increased, so their activity level also increases and attracts them to follow the learning process. It will affect the concept of understanding equal fractions material and increase learning outcomes. The e-module contains material and question sheets integrated with visual, audio, and video media and navigation, so the student can use it to study independently. The other benefit is a more interactive learning process because the student question sheet makes students involved more in the learning process, not only to listen to the explanation from the teacher. After the student finishes their reading and understanding of equal fractions material, they can fill in the question on the website online, and the answer is directly sent to the teacher. Therefore, a liveworksheet worksheet-based interactive module can reference the latest learning resources for the student, especially during the pandemic era where the learning process is still carried out by blended learning, the combination of online and offline classes. This aligns with research conducted by Fitriana et al., 2021 that this live worksheet-based interactive module can be an alternative to the limitations of distance learning that can be reapplied at any time.

The research goal is to know how liveworksheet interactive e-module application affects mathematical concept understanding in equal fractions material for the 4th grade at Kejambon 2 Elementary School. The research will be started by examining the test results to understand the affection. Using the liveworksheet interactive e-module is expected to affect the mathematical conceptual understanding of equal fractions and daily implementation. Therefore, the study result can be used as a more interesting alternative for equal fractions learning online for the students.

Methods

This research uses a quantitative approach with design methods like *an experiment*. The research design used a post-test-only-control group design. In this study, the first group that received treatment (experimental group) and the second group that did not receive treatment (control group) were randomized. (Purwanto & Sulistyastuti, 2011)

The form of research design was pretest-posttest. The population of this research was fourth-grade students of SDN Kejambon, which is 26 students. The sample taken randomly consists of 16 experimental class students (given action in the form of a live worksheet interactive module) and 10

control class students (not given action in the form of a live worksheet interactive module). The research was conducted from March to April 2022 at Kejambon 2 Elementary School. The details of this research activity were: 1) learning observation, 2) giving a pretest, 3) giving an action (using interactive e-module media), and 4) giving a posttest.

The data collection techniques used in this research were interviews (at the observation stage) and tests. The tool used is a descriptive question consisting of 6 questions.

The research instrument was validated first to determine the accuracy of the measuring instrument when used. The type of research validation carried out was content validation. For instruments in the form of tests, content validity can be checked by comparing the contents of the instrument with the material taught (Sugiyono, 2009). Content validity was also the validity estimated by examining the content of the test with reasonable analysis or professional judgment (Azwar, 1997). CVR and CVI or V Aiken coefficients to prove content validity with V Aiken coefficient values ranging from 1 to 1 (Srirahayu & Arty, 2018).

Apart from validity testing, the device was also tested for reliability. The reliability calculation technique used in this research was the internal consistency reliability method using the reliability coefficient alpha (α) according to Cronbach, which aligns with the test objective, namely testing consistency for research testing instrument items. The reliability value was used in the following formula.

$$R = = \frac{n}{n-1} (S - - Si)S$$

Information :
R   = Cronbach's Alpha reliability coefficient
N   = Number of items
S   = Total score variance
Si   = Variance of each item

The Cronbach's alpha (α) method is measured based on the alpha (α) scale from 0.00 to 1.00. Because this test was a hypothesis test for the average difference between the two groups, data analysis was done using the independent sample t-test. This research used SPSS 25 to analyze data to carry out normality tests (using Kolomogrov-Smirnov calculations, if the SPSS significance result is 0.05, it is declared normally distributed) and homogeneity (using One-way ANOVA, data was said to be homogeneous if it has a significance number of more than 0.05).

Results and Discussion

The effect of using the liveworksheet interactive e-module on understanding mathematical concepts regarding equivalent fractions was tested on 16 students in the experimental class and ten in the control class. The t-test is used to analyze the test results with the help of SPSS 25. The following are the results of the student's post-test.

Normality Test Result

Table 1. Kolmogorov-Smirnov Normality Test Result by Experiment and Control Group

Score	Group	
	Experiment (Liveworksheet interactive e-module)	Control (Video)
Statistic	0.201	0.159
Df	11.643	6.257
Asymp. Sig. (2-tailed)	0.085	0.200
Explanation	Normal	Normal

Based on the SPSS 25 analysis result table above, it can be concluded that Asymp. The sig value at df 11.643 is 0.085 (0.085 > 0.05). It shows that the learning result in the experiment class is equally distributed as well as the control class because the Asymp, sig value (2-tailed) is valued at 6.257 (6.257 > 0.05). Therefore, both groups had normal data.

Homogeneity Test Result

Table 2. Homogeneity Test

Variable	Sig. value	Explanation
Conceptual understanding	0.220	Homogene

Based on the SPSS 25 analysis table, both groups fulfil the homogeneity criteria, and the result shows that Sig. The result has a 0,220 (0,220 > 0,05), so the data can be assumed homogeneous.

T-test Result

Table 3. T-test Result

		F	Sig.	t	df	Sig. (2-tailed)
Mathematical Concept Understanding Result	Identical variant result	1.585	0.220	2.311	24	0.030
	Identical variant result			2.639	23.650	0.014

Based on the table above, the T-test result was done on the research, with a t value of 2.311, and it gained Sig. (2-tailed) value is 0.030 at df < 0,05. It can be assumed that there is an effect from liveworksheet Interactive e-module usage on conceptual understanding of equal fractions material.

Effective and efficient learning will lead the student to achieve good educational goals. So, as in mathematic learning, effective learning will increase the student's concept understanding so that they can master other abilities, such as problem-solving (NCTM, 2014), defining conceptual understanding as comprehending the mathematical concept as well. It means that students not only remember the calculation but also define and summarize the mathematical concept according to the formation of the knowledge (Fauziah et al., 2021). The student mainly needs concept understanding to finish their mathematical problem. Concept understanding refers to the ability to combine recently added information with information they already have, possibly giving the student a good conceptual understanding and developing their skill in every learning material (Adawiyah et al., 2020). Mathematical learning concepts are comprehended when the lecturer and student are directly involved in classical learning activity. Teachers transfer their knowledge to the students not only because students remember the theoretical learning by the teacher but also because students remember it (Radiusman). The student understands this concept when they can classify, describe, formulate, calculate and redefine the concept more simplified, accurate and concisely to make it easier to understand. Syarifah (in Fauziah et al., 2021). Indicators can be used to determine whether the student already understands the concept or not by classifying objects based on conformity to the requirements that make up the concept, redefining the studied concept, giving examples or non-examples from the studied concept, linking various concepts, presenting the concept in various mathematical representation and developing necessary or sufficient conditions of a concept (Kilpatrick, 2001). The six indicators are used in this study.

For the mathematical concept, understanding is in redefining a concept. The experiment class's student average score is 12.6, while the control class's is 12.2, with a maximum score of 15. This shows that students in both groups also have an excellent understanding of picture-based equal fractions. In this research, the experiment group got a liveworksheet interactive e-module that asks the students to explain the equal fractions based on pictures. The study results in the experiment class align with Adawiyah et al. (2020) research, which gained a 25% pretest average score, while the post-test gained an 89% average score. The higher score in the post-test means that students have a better conceptual understanding when using the e-module than when the students have not used it. E-module usage during the learning process can increase the participation of the students and make them understand the actual material concept. Control class testing results are also in line with the study from Damayanti (2020), which shows that video-based learning affects students' learning results by 82.23%. Therefore, the experiment and control class showed the same result when testing the concept. It happened because the experience of the two groups encouraged students to understand the mathematical concept well.

The next mathematic concept understanding indicator is part of the student's ability to classify subjects based on whether they fulfil the concept condition. In this study, the indicator is that students

can classify an object by determining an equal fraction by conditional fulfilment from the correct equal fractions concept. Based on this indicator, the average score from the question was 15 for the experiment class and 14.7 for the control class, while the maximum score was 15. The result shows that the experiment class with liveworksheet interactive e-module is more understanding of the concept of equal fraction because they can precisely describe the equal fraction object on their answer. In the experiment class, a student was asked to investigate an object by observing fraction objects so they could classify other items based on their research. Thus, the results of learning the object classification in the experimental class reached a high level. Therefore, it is in line with the research conducted by Prabakaran and Saravanakumar (2020) that interactive e-content modules are very powerful teaching and learning methods for students, especially for mathematics learning. But this E-Content is also used to complement effective teaching by a teacher. In addition, e-content usage makes students learn independently.

The third indicator is mathematic concept understanding by students, giving examples or non-examples from the studied concept. In this case, students can precisely mention examples and non-examples from the equal fraction concept, besides mentioning examples of pictures of equivalent fractions and not equivalent fractions. Students will explain why they chose the picture. The average score of students on questions that reflect this indicator is 18.2 in the experimental class and 17.8 in the control class, with a maximum score of 20. These results indicate that the experimental class can provide examples of equivalent and non-equivalent fractions based on pictures and reasons. Most of the students in the experimental class with interactive e-module live worksheets mentioned examples of equivalent and non-equivalent fractions and the reasons that fit the concept of equivalent fractions. This study's results align with Maniq et al. (2022), who developed an e-module for learning mathematics on fraction material for fourth-grade students and stated that all student responses reached 84.2% with a very decent category. This shows that the E-Module is very good when applied in the learning process, where it can help students achieve competency indicators such as giving examples and non-examples so that students can master the concept of fractional material at a good value. This is in line with research conducted by Haji and Yumiati (2019) that understanding teaching mathematics will provide opportunities for students to express opinions. Thus, it can improve students' conceptual understanding. These teaching principles can develop the ability to understand mathematical concepts by defining concepts, fighting between examples and non-examples of concepts, applying concepts to new situations, etc.

The next indicator of understanding mathematical concepts is to provide concepts in various forms of mathematical representation. Simbolon (2018) argues that representation is an indicator for measuring students' abilities when providing the concept of mathematical operations with variables in the form of pictures in a mathematical sequence. Types of student depictions can be in the form of words or action words, text styles, pictures, tables, charts, substantial articles, numerical images and so on. This is in line with the opinion of Jungkary and Johar (2018), who explain that representation can be interpreted as a process of modelling concrete things in real problems into abstract concepts or symbols. Mathematical representations are used to design, review, and guide the mathematical problem-solving process.

This study assessed the ability to understand mathematical concepts, namely the ability to rearrange a fraction equivalent to solving a problem into an image in the right steps following daily life. The average score obtained by students in the experimental class was 14.7, and in the control class was 13.2, with a maximum score of 15. These results indicated that the experimental class could better express concepts in mathematical terms. In this case, draw equivalent fractions from narrative questions.

The fifth indicator is linking various concepts. The skills assessed in this study were students' ability to conceptualize the relationship between equivalent fractions and daily living correctly. The average obtained by students in questions with this indicator was 14.5 in the experimental class, while in the control class, it was 13.1, with a maximum score of 15. These results indicate that the experimental class can more conceptualize the relationship between the concept of equivalent fractions and daily life from story questions and pictures set according to the right concept. The presentation in the liveworksheet interactive is in line with NCTM (Bartell et al., 2013), which states that understanding concepts is the most basic goal in learning mathematics. Once students can understand mathematical concepts, it will be easier to solve mathematical problems.

The last indicator is developing the necessary and sufficient conditions for a concept. The ability in this study is how students can correctly complete a concept of equivalent fractions. Students solve

word problems about equivalent fractions, namely determining the parts with the same size. The average score obtained by students in the questions that reflect this indicator is 13.5 in the experimental class and 13.2 in the control class. These results indicate that the experimental class can be more able to grow the necessary and or sufficient requirements for a concept in equivalent fraction material. This follows the principles of mathematics learning in schools at NCTM (2000) in Jazim et al. (2017), emphasising that students can actively build new knowledge and skills in understanding mathematics learning material. An effective mathematics learning process requires students to understand what needs to be learned and then encourage and support them to learn more.

The analysis results examining the effect of using the liveworksheet interactive e-module with the help of SPSS show that the use of the liveworksheet interactive e-module has an effect on student learning outcomes on equivalent fractional material. A T-test carried out the analysis with a t-value of 2.311 and a Sig. (2-tailed) is 0.030 <0.05. Therefore, the null hypothesis (H_0), that "There is no significant difference in the mathematical understanding of 4th-grade students between the use of liveworksheet interactive e-modules and learning videos," is rejected. Hypothesis one (H_1) states that "There is a significant difference in the mathematical understanding of 4th-grade students significantly between using liveworksheet interactive e-modules and learning videos" is accepted.

Conclusion

Based on the research results and discussions that have been carried out, it can be concluded that this live worksheet interactive e-module is an alternative learning medium, especially on equivalent fraction material, to improve understanding of class IV concepts at Elementary School. This can be seen from the results of the t-test analysis showing significant differences between the use of interactive E-modules liveworksheet and learning videos with a t value of 2.311 and a sig value. 0.030. This research found an influence on liveworksheet interactive e-module towards understanding the concept of equivalent fraction material. Therefore, the null hypothesis (H_0) that "no significant difference in fourth-grade students' mathematical understanding between the use of interactive e-modules liveworksheet and learning videos" is rejected. Hypothesis one (H_1) stated that "there is a significant difference in fourth-grade students' mathematical understanding between the use of interactive e-modules liveworksheet and learning videos" is accepted.

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