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Development of E-Learning based Remedial Videos on Fractions in Middle School

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Abstract

The Covid-19 pandemic has opened the gates to digital learning in mathematics education and increased the use of online learning. However, teachers still rare to use digital technology as feedback and final evaluation of students. Therefore, an e-learning based remedial video is needed to developed. The research aims to produce e-learning based remedial videos on fraction that meet the criteria of valid, practical and effective. This research is development research with ADDIE models namely analysis, design, development, implementation, and evaluation. The subjects of this research were class 8 students at junior high school from three school levels in Banda Aceh, Indonesia. Data was collected using video validation sheets, students' response questionnaires, and remedial tests. The results show that e-learning based remedial videos was valid based on expert judgements, practical because students gave positive responses and effective because N-Gain of the percentage of students reached the Minimum Completeness Criteria (MCC) on diagnostic test and remedial test was 0.5 on the medium category.

Keywords: E-Learning Based Remedial, Fractions, Remedial Learning Video

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INTRODUCTION

The Covid-19 pandemic has had a major impact on education. Covid-19 opened the gates to digital learning in mathematics education and increased the use of online learning (Alabdulaziz, 2021). Along with the digitalization process, teacher skills play a key role in teaching students to understand knowledge in depth and facilitating knowledge to the environment (Turhan & Açık Demirci, 2021). Digital technology in education can be used to search for, evaluate, and use educational materials on the internet (Tsankov & Damyanov, 2017), supporting educational quality assurance, development and management of school quality assurance, student independent learning facilities, development and school resources (Perifanou et al., 2021). Therefore, the rapid development of online learning in recent years requires teachers to be able to create learning that can provide feedback and final evaluation by utilizing digital technology or e-learning. However, teachers who are generally over 30 years old show digital native characteristics, meaning that teachers are born to use digital technology, they cannot use it for learning and evaluation in the classroom (Dashtestani & Hojatpanah, 2022; Tejedor et al., 2020). Moreover, it is still rare for teachers to use digital technology as feedback and final evaluation of students, which ultimately means teachers cannot handle long-term planning, management and development (Perifanou et al., 2021).

One effort that teachers can make to utilize digital technology is to implement e- learning based remedial learning using videos. E-Learning is learning using technology, networks and computers

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(Basak et al., 2018). E-Learning is suitable for students to use because in the industrial revolution 4.0 era, students are required to be involved in technology and information-based learning activities. The use of e-learning can increase student motivation in learning (Sujiwo & A'yun, 2020). Some teachers in Greece stated that they use digital technology to edit, write and manage texts, make presentations using audio, picture, and videos, as well as conducting quizzes to develop and modify existing educational resources to improve learning (Perifanou et al., 2021).

Learning video is a moving image accompanied by sound containing material to achieve a learning goal (Hasiru et al., 2021). The use of videos can stimulate students' hearing, and vision to be more focused, videos can also convey information clearly (Siwi & Puspaningtyas, 2020). In addition, the use of videos allows students to remember the material longer, improves understanding of concepts, and interest in learning (Hasiru et al., 2021). Thus, the use of videos in remedial learning can improve learning outcomes, and achieve completeness scores (Mustofa, 2018). Remedial learning based on e-learning is effective in improving mathematics learning outcomes (Yanti et al., 2021). By applying this method, learning outcomes, and students' responses will increase and learning process more effective (Pai et al., 2021; Tampubolon et al., 2020).

Learning carried out using digital technology has been widely used and proven to be useful, as in Chou's (2017) stated that the use of videos in distance learning centered on 3D television can improve the learning outcomes of underachieving students and students provide positive responses. This is in line with the results of the study Prasetya et al. (2021) stated that animated videos in mathematics learning can explain abstract concepts, and overcome time and space limitations. The use of technology for learning is also carried out to evaluate students in a remedial learning. Research related to online remedial learning was conducted by Sriadhi et al. (2019) for higher education using virtual web effectively in improving learning outcomes. Yanti et al. (2021) conducted research to investigated the effectiveness of online remedial learning when learning from home for high school students. However, there are still very few researchers who combine the two, namely the use of videos in e-learning based remedial which is preceded by a diagnostic test for fraction topic.

Problems that arise in learning fraction included students assume the characteristics of fractions are the same as other numbers and apply the same rules when operated (Bush & Karp, 2013). Students incorrectly determine equivalent fractions, incorrectly simplify the form of fractions, incorrectly reduce fractions, and incorrectly adding fractions (Parwadi et al., 2020; Zalima et al., 2020). Students cannot determine the correct operation for story-shaped fraction problems (Murtiyasa & Wulandari, 2020). Therefore, the research problem is what are the results of the development of e-learning based remedial videos on fraction in junior high schools that meet the criteria of valid, practical, and effective?.

METHODS

This study was included in development research using the ADDIE model which has five stages, namely analysis, design, development, implementation, and evaluation (Branch, 2009). This study developed remedial videos. This research was carried out in 2022, one year after distance learning during the Covid-19 pandemic (2020-2021). The remedial learning designed in this research contains three packages of remedial questions, namely packages I, II, and III. Each packet consisting of 10 questions representing five attributes or indicators, namely recognizing fractions, comparing, and ordering fractions, adding, and subtracting fractions, multiplying, and dividing fractions, and percentage. These remedial questions are equivalent to diagnostic test questions for fraction material developed by Lestari et al. (2023). The remedial questions for the three packages are equivalent questions. Students who take remedial are students who do not reach the MMC, namely 70.

The subjects of this research were class VIII junior high school students in Banda Aceh, Indonesia who came from low, medium, and high category schools. This categorization is based on the average score of grade 9 students who took the final school examination. The subjects of this research for investigating the readability of video were eight students of SMP Negeri 9 Banda Aceh from medium category schools, and the subject for investigating practicality and effectiveness were 72 junior high school students; 20 students from low category, 28 students from medium category, and 24 students from high category schools.

The instruments to collect data were video validation sheets, students response questionnaire, and remedial tests. The video validation sheet aims to obtain validity data and validator suggestions for the videos. The questionnaire contains statements to collect the practicality of e-learning based remedial videos. Questionnaire adapted from Astafiria & Bayu (2021). There are two aspects in the questionnaire, namely how to use and benefits of remedial learning videos, which contains seven statements as presented in Table 1. Other instrument is the remedial test to determine students' mastery after using e-learning based remedial videos.

Table 1. Student response questionnaire

No	Aspect	Indicator	Question number
1.	How to use	1. I can use remedial learning videos easily 2. Remedial learning videos are available starting from the easiest to the most difficult material	1, 2
2.	Benefit	1. The remedial learning videos presented helped me learn 2. Remedial learning videos are interesting and motivate me to learn 3. The sound in the remedial learning video makes me enthusiastic to pay attention to the material presented. 4. Remedial learning videos improve my understanding of the material.	3, 4, 5, 6, 7

No	Aspect	Indicator	Question number
		5. I can repeat learning material that I don't understand using remedial learning videos.	

The validity test is carried out by providing a validation sheet to the validator consisting of one media expert, two material experts and one teacher. The validation sheet contains an assessment of the remedial learning video on fraction which consists of two assessment aspects, namely the video content and the video display which contains 17 statements developed by Brame (2016) as presented in Table 2. The validator was asked to give an assessment, namely 1 (not good), 2 (not good), 3 (good), 4 (very good). Data from the validation sheet was analyzed using descriptive statistics. The percentage score from the video validation sheet is calculated using the formula (Sugiyono, 2017).

$$\text{Percentage (\%)} = \frac{\text{total gained score}}{\text{total criterion score}} \text{ x } 100\% \quad (1)$$

Table 2. Video validity criteria

Achievement rate (%)	Category	Information
80 – 100 %	Very Valid	No revision
66 – 79 %	Valid	Partial revision
56 – 65 %	Less Valid	Partial revision & reassessment
46 – 55 %	Invalid	Full revision & review of material
0 – 45 %	Very Invalid	Total revision

Source: (Sudijono, 2015)

In this research six videos were developed. A remedial learning video is said to be valid if the total score from validators is at least 66% in the valid or very valid category. Remedial learning videos that already have valid criteria are then uploaded to the GetMath platform (https://getmath.id) which was developed by the research center of Indonesian Realistic Mathematics Education (PRP-PMRI) at Universitas Syiah Kuala. The flow chart of diagnostic tests and remedial learning on the GetMath platform is presented in Figure 1.

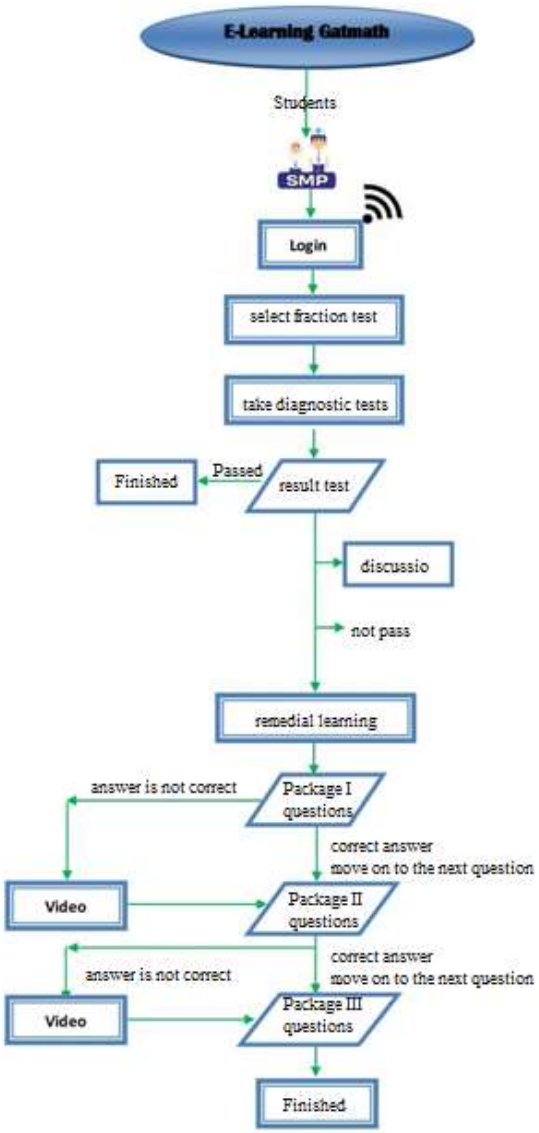

Figure 1. The flowchart of remedial process at GetMath platform

Based on Figure 1, students answer diagnostic test questions, then students who are declared not passed the diagnostic test should join remedial learning. Next, the video about introduction of fraction appeared then question number 1 in package I is appeared. If the student answer is correct then the student answer question number 2. However, if the student answer is incorrect, a remedial video will be shown according to the question indicator. After watching the video, the system will appear again question number 1 from package II which is equivalent to the previous question. If the student still fails, video appears and question number 1 from package III will be displayed. This process will continue to the question number 10. The students score appears at the end of remedial learning. The students also acquire information whether they master or not. Student response questionnaire data was analyzed using descriptive statistics. The percentage of student response questionnaire scores is calculated using the Formula 1 (Sugiyono, 2017). After getting the percentage

of student responses, the results are categorized according to the criteria of student's responses are presented in Table 3.

Table 3. The criteria of students' response

No	Score Interval (%)	Category
1	81-100	Very good
2	61-80	Good
3	41-60	Enough
4	21-40	Not enough
5	0-20	Very less

Source: (Riduwan, 2012)

The practicality of e-learning based remedial videos is determined from the student's response. E-learning based remedial videos are said to be practical if the percentage of students' response is 61% or more which is in the good or very good category. The effectiveness of e-learning-based remedial videos is based on increasing the percentage of students who reach the MCC which is 70 on diagnostic test and remedial test by calculating N-Gain. The N-Gain formula from Meltzer (2002) in this research is presented as follows.

$$N_g = \frac{\text{completeness percentage of remedial test} - \text{completeness percentage of diagnostic test}}{\text{maximum completeness percentage} - \text{completeness percentage of diagnostic test}} \quad (2)$$

The N-Gain criteria are presented in Table 4. E-learning-based remedial videos are effective if the N-Gain value is at least 0.3 on medium or high criteria.

Table 4. The Criteria of N-gain

N-Gain (Ng) Value	Criteria
$Ng \geq 0.7$	High
$0.3 \leq Ng < 0.7$	Medium
$Ng < 0.3$	Low

RESULTS AND DISCUSSION

The media developed is in the form of e-learning based remedial learning videos on fractional developed through the ADDIE stages to obtain e-learning based remedial learning videos that are valid, practical, and effective. The results of this research are as follows.

Analysis

This stage was carried out to identify the needs of students and teachers regarding the learning media needed for implementing remedial learning, especially in fraction material. Based on the results of an interview with one of the junior high school mathematics teachers in Banda Aceh, it was found that: (1) Remedial learning is carried out only by giving re-exams without repeating the material

again, (2) repetition of material in remedial learning is rarely done due to limited space and time, (3) in remedial learning teachers have not used technology-based learning media.

Student analysis was carried out by looking at the results of diagnostic tests on fraction material. Based on the test results, the percentage of student completion is obtained. The percentage of diagnostic test completeness can be seen in Table 5.

Table 5. Completeness of diagnostic tests

School Level	Complete	Not Completed	Total	Completion Percentage
High	8	24	32	25%
Medium	0	28	28	0%
Low	0	20	20	0%
Average Achievement		8.3%		

Next, a curriculum analysis was carried out to determine the material used in e-learning based remedial learning videos. Analysis was carried out on Basic Competencies (BC) and Competency Achievement Indicators (CAI). After analyzing the curriculum, six videos were developed, namely video 1 about Introduction to fractional numbers, Video 2: Comparing and ordering fractions, Video 3: Adding and subtracting fractions, Video 4: Multiplication of fractions, Video 5: Division of numbers fractions, Video 6: Application of percentage.

Design

This stage involves designing the video storyboard and research instruments. The video storyboard is a visualization design for the six videos. Making a video storyboard considers the material, questions, and solutions. The video contains an explanation of the concept of fractions and provides questions and solutions to apply this concept. At this stage a research instrument was also designed which consisted of a video validation sheet, readability test interview guide, student response questionnaire and remedial tests.

Development

Producing remedial learning videos follows the learning video criteria according to Brame (2016) both in terms of content and video appearance. The process of making remedial learning videos is carried out through various stages, starting with pre-production, production, and post-production stages. In the pre-production stage, prepare the tools and applications used in making the video. Tools and applications for making remedial learning videos printed in Figure 2.

Figure 2. Tools and applications for making remedial learning videos

In the production stage, images as a animations were made using Canva and problem-solving videos using a pen tablet in the SmoothDraw application and screen recorded using the Bandicam application (see Figure 2). The worksheet's display for process of making animation and making question solving videos can be seen in Figure 3.

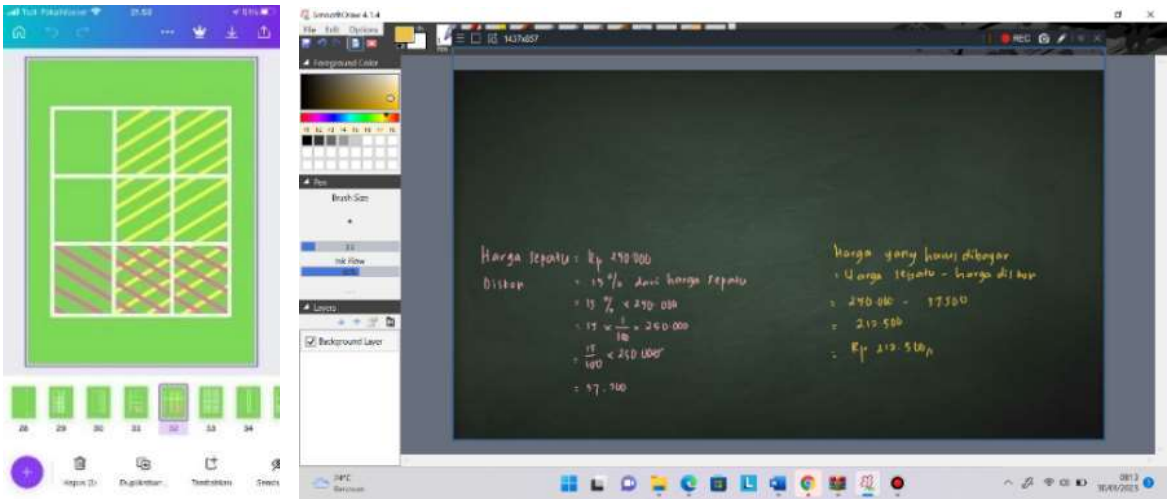

Figure 3. Process of making animations and making question solving videos

In the post-production stage, the video editing process is carried out. The video editing process includes importing, cutting, merging, inserting images, transitions, adding text, adding audio and saving video. The post production stage process display in Figure 4.

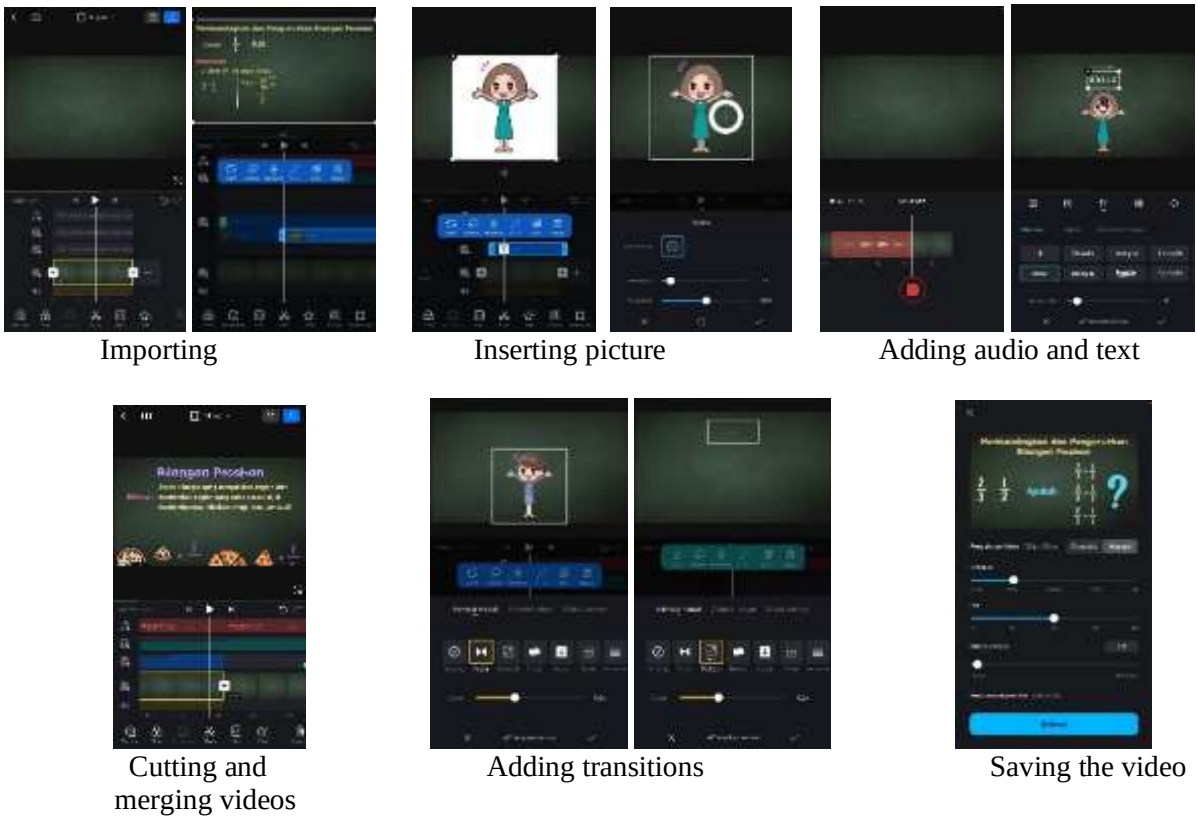

Figure 4. Post-production stage process

Validity of E-learning Based Remedial Videos

Video validation is carried out by assessing the media validation sheet by the validator or experts of. There are two assessment aspects assessed by the validator, namely the content and appearance of the video with a total of 17 indicators. The results of the validation of the remedial learning video are presented in Table 6.

Table 6. Remedial learning video validation results

Videos	Validity Percentage	Criteria
1	94.12%	Very Valid
2	95.22%	Very Valid
3	97.80%	Very Valid
4	96.33%	Very Valid
5	96.69%	Very Valid
6	96.69%	Very Valid
Validation Average	96.14%	Very Valid

The average result of the overall validity assessment of remedial learning videos is 96.14% in the very valid category, remedial learning videos meet the valid category and can be tested. The suggestions given by the validator in video 1 need to add animation, for video 2 improve the writing

which is not very clear, in video 3 it is necessary to raise subtraction questions, in video 5 replace the animation to illustrate the concept of dividing fractional numbers by whole numbers. For all videos, the voice expression is less cheerful and sounds monotonous so the audio needs to be replaced.

Implementation

Implementation is carried out by asking students to answer diagnostic test questions and then continuing with e-learning based remedial learning for students who do not complete it using valid videos. The video is uploaded to the GetMath website for practicality and effectiveness testing using student response questionnaires and remedial tests.

Figure 5. Display of GetMath website

Figure 6. Display of remedial videos on the GetMath website

The Results of Students Response

Students' response for e-learning based remedial videos from questionnaire to assess the practicality is presented in Table 7.

Table 7. Practicality of e-learning based remedial videos

Indicator	School Level			Practicality	Criteria
	High	Currently	Low	Average	
Indicator 1	85.83%	82.86%	86.00%	84.90%	Very good
Indicator 2	85.00%	84.29%	82.00%	83.76%	Very good
Indicator 3	87.50%	86.43%	90.00%	87.98%	Very good
Indicator 4	86.67%	82.86%	87.00%	85.51%	Very good
Indicator 5	86.67%	82.14%	91.00%	86.60%	Very good
Indicator 6	87.50%	83.57%	85.00%	85.36%	Very good
Indicator 7	81.67%	82.86%	89.00%	84.51%	Very good
Practicality Average	85.83%	83.87%	87.14%	85.61%	Very good

All statements achieved a practicality percentage of more than 61% with a very good category at each school level as seen in Table 8. This shows that e-learning based remedial learning videos are easy to use, the easiest to the most difficult material is available, help students learn, are interesting and motivate students to learn, the sound of the video provides enthusiasm for students to pay attention to the material presented, increases students' understanding of fraction material, and students can repeat material that they have not yet understood using remedial learning videos.

Table 8. Practical results of remedial learning videos

School Level	Practical Value	Criteria
High	85.83%	Very good
Currently	83.87%	Very good
Low	87.14%	Very good
Mean Practicality Value	85.61%	Very good

The average overall practicality results of e-learning based remedial learning videos at the three school levels reached a percentage of 85.61% with very good criteria. E-learning based remedial videos meet practical criteria.

The Results of Remedial Test

Remedial tests are carried out after students take part in e-learning based remedial learning using videos. The test results are presented in Table 9.

Table 9. Remedial test results

School Level	Complete	Not Completed	Total	Completion Percentage
High	19	5	24	79.16%
Medium	15	13	28	53.57%
Low	6	14	20	30%
Average Completion			54.23%	

Based on Table 9, it can be concluded that there are differences in student test results between high, medium and low school levels. Overall, the average completion rate for the three school levels

reached a percentage of 54.23%. N-Gain's diagnostic test completion percentage is 8.3% and remedial test completion percentage is 54.23%. Therefore, an N-Gain value is 0.50, in medium criteria. Therefore, it can be concluded that e-learning based remedial learning videos meet the effective category with moderate criteria.

Evaluation

E-learning based remedial learning videos is carried out after going through the development and implementation stages. The videos developed have been tested, applied in class, and evaluated for several shortcomings. Based on the results of validity, practicality, and effectiveness tests, it was concluded that e-learning based remedial learning videos met the criteria of validity, practicality, and effectiveness.

The remedial learning video meets the valid criteria because it follows the criteria for a good learning video (Brame, 2016). However, there are still several parts that need to be improved, especially the voice expression is less cheerful and too monotonous. It is feared that a voice that is less cheerful and monotonous will have a boring effect on students. This statement is in accordance with the findings of Priyantini et al.(2021) which stated that the sound in the video is expected to attract students' interest in learning.

E-learning based remedial learning videos obtained a practicality percentage of 85.61% with very good criteria. This means that e-learning based remedial learning videos are easy to use, in agreement with Firdaus & Hamdu (2020) who stated that e-learning based learning videos are easy to access and help students learn. E-learning based remedial learning videos help students understand the material and help with learning difficulties. This was also found by Marsandi & Kusairi (2016) who stated that remedial videos can be used because they help students learn related to the learning indicators presented.

Overall student remedial test results achieved a completion percentage of 54.23%. Students from high level schools achieved a completion percentage of 79% or out of 24 students only 5 students did not reach the MCC score. This situation is clearly inversely proportional to low level schools which only achieve a completion percentage of 30%. Of the 20 students, only 6 students achieved the MCC score. Meanwhile, for students from medium school levels, the number of students who completed and did not complete was almost the same. There was an increase in the percentage of student completion with an N-Gain value of 0.5. Therefore, e-learning based remedial learning using videos is effective in the medium category.

E-learning-based remedial videos on fraction meet the criteria for validity, practical and effective. Videos are suitable for use, can be operated easily, useful for students in overcoming learning difficulties that result in incomplete learning, and help students achieve completion scores. This statement is in accordance with the findings of Mustofa (2018) that the use of interactive media

in the form of learning videos in remedial learning can be used to help students understand the material and achieve completion scores.

CONCLUSION

E-learning based remedial videos on fraction in junior high schools meet valid, practical and effective criteria. The remedial learning video meets the valid criteria because it has an average validity of 96.14%. The practicality results of e-learning based remedial learning videos at the three school levels reached a percentage of 85.61% with very good criteria. Based on the test, the student's completeness percentage of remedial test was 54.23% with an N-Gain value was 0.5 thus e-learning based remedial videos meet the effective criteria. Therefore, e-learning based remedial videos can be used as an alternative to overcome students' difficulty in learning fraction. This study only focus on students score before and after remedial, the next researcher is expected to investigate the relationship between students score and students motivation or students anxiety.

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