Animation Video using Adobe Animate CC Application Based on Problem-based Learning

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ABSTRAK

Selama ini pembelajaran hanya menggunakan metode ceramah dan diskusi, serta belum menerapkan pembelajaran berbasis masalah. Pembelajaran belum menggunakan media pembelajaran khususnya media video animasi sehingga siswa cenderung bosan dan kurang tertarik. Berdasarkan analisis hasil belajar siswa pada materi barisan dan deret, sebanyak 56% siswa mendapat nilai di bawah KKM. Penelitian ini bertujuan mengembangkan media pembelajaran berbasis video animasi untuk meningkatkan hasil belajar siswa yang valid, layak, dan efektif. Media ini merupakan media pembelajaran matematika yang dibuat dengan menggunakan Adobe Animate yang dapat diakses melalui komputer, laptop, maupun handphone. Penelitian ini menggunakan model ADDIE yang dilakukan melalui beberapa tahapan sebagai berikut: (1) Analisis, (2) Desain, (3) Pengembangan, (4) Implementasi, dan (5) Evaluasi. Penelitian ini melibatkan siswa SMK yang terdiri dari 6 siswa kelas XI Tata Busana sebagai subjek uji kelompok kecil dan 20 siswa kelas XI Teknik Komputer dan Jaringan sebagai kelompok uji signifikan. Berdasarkan penelitian yang telah dilakukan tentang pengembangan video animasi menggunakan aplikasi Adobe Animate CC berbasis problem based learning dapat disimpulkan bahwa media dinyatakan sangat valid, sangat layak dan sangat efektif dalam meningkatkan kemampuan siswa. Video animasi menggunakan aplikasi Adobe Animate CC berbasis Problem Based Learning berdampak pada peningkatan kemampuan belajar siswa.

ABSTRACT

So far learning has only used lecture and discussion methods, and has not implemented problem-based learning. Learning has not used learning media, especially animated video media so that students tend to get bored and less interested. Based on the analysis of student learning outcomes on sequences and series material, as many as 56% of students scored below the KKM. This study aims to develop learning media based on video animation to improve student learning outcomes that are valid, feasible, and effective. This media is a mathematics learning media made using Adobe Animate which can be accessed via computers, laptops, or cellphones. This study uses the ADDIE model which is carried out through several stages as follows: (1) Analysis, (2) Design, (3) Development, (4) Implementation, and (5) Evaluation. This research involved students of vocational high school consisting of 6 students of Class XI Fashion Design as a small group test subject and 20 students of Class XI Computer and Network Engineering as a significant test group. Based on research that has been done on the development of animated videos using the Adobe Animate CC application based on problem based learning, it can be concluded that the media is stated to be very valid, very feasible and very effective in improving students' abilities. Animated videos using the Adobe Animate CC application based on Problem Based Learning have an impact on increasing student learning abilities.

1. INTRODUCTION

The development of education in the world today cannot be separated from the development of the industrial revolution 4.0 which is marked by increased connectivity, interaction and development of digital systems (Astuti et al., 2021; Shahroom & Hussin, 2018). In the era of industrial revolution 4.0, 75% of jobs involve science, technology, engineering and mathematics skills, the Internet of Things (IoT) and lifelong learning (Halili, 2019; Tri et al., 2021). The increase in human resources in the world has resulted in limitations of other resources, so that the current advances in information and communication technology

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will also have an impact on various sectors of life. One of the impacts is on the education system in Indonesia. In education 4.0, access to information is not limited by space and time and the teaching and learning process has become one unit. In the era of the industrial revolution 4.0, the world of education must prepare itself to face technological developments including the use of technology in learning media (Pujiarti et al., 2022). For this reason, the learning process that supports the 4.0 era requires IT-based learning media in order to improve students' ability to solve problems. Because the ability to solve problems is an ability that students must have in facing challenges in the revolutionary era 4.0 (Ferdiani et al., 2021; Ferdiani & Pranyata, 2022). But in fact the ability of students to solve problems is still relatively low. Likewise, the use of IT-based learning media in learning is relatively low (Faizah et al., 2013; Ferdiani, 2017). Lack of adequate technological resources, makes students less successful in following learning in the classroom.

The use of technology in learning media produces a process of activity learning becomes more interesting, effective, and increases student learning interest, so that learning objectives that have been planned (Murtikusuma et al., 2019; Oktavianingtyas et al., 2018). Making technology-based learning media can be done using various software and websites that are widely available today (Saniriati et al., 2021; Yahya et al., 2021). One of them is by using Adobe Animate software. Adobe Animate is one of many software that can produce new features to be used in the field of education by combining the concept of learning with audio-visual technology. One way to assess understanding of mathematical concepts is to identify or give examples and not examples of a concept (Gistituati & Atikah, 2022; Hidayat et al., 2020). So that learning media can provide a more effective influence on student learning, as well as generate new interest and desire to learn something that has an impact on problem solving skills. One of the learning media that can be used in the learning process is learning videos.

The use of learning videos in the classroom can be combined with the application of the Problem Based Learning model. Problem-based learning is a learning model that presents contextual problems to stimulate students to learn (Ismiati et al., 2020; Misla & Mawardi, 2020). PBL is a learning model that encourages students to try to learn independently in solving problems by developing the ability to analyze and manage information. Problem-Based Learning (PBL) describes a learning environment where problems drive the learning. That is, learning begins with a problem to be solved, and the problem is posed in such a way that students need to gain new knowledge before they can solve the problem (Suparno et al., 2019; Yew & Goh, 2016). Problem-based learning is a classroom strategy that organizes mathematics instruction around problem-solving activities and affords students more opportunities to think critically, present their creative ideas, and communicate with peers mathematically (Ali, 2019; Husnidar & Hayati, 2021). PBL is a learning approach that begins with exposing students to a math problem, then students are required to solve the problem that is rich with mathematical concepts. Based Learning (PBL) model which gives an opportunity for learners to make effective and to explore their thinking ability (Ersoy & Başer, 2014; Švecová et al., 2014). One of the characteristics of PBL is positioning students as self-directed problem solvers through collaborative activities to encourage students to be able to find the problem and plan completion trains students and familiarizes skilled serves to reflect the findings in the inquiry about the effectiveness of their way of thinking in solving the problems that faced (Mashuri et al., 2019; Widyatiningtyas et al., 2015). Previous study suggests a problem-based learning model can stimulate students' ability to think creatively, analytical, systematic, and logical in finding alternative solutions to problems through empirical data analysis in order to foster a scientific attitudeProblems in mathematics are problems that cannot be solved directly (Nahdi, 2018). Other study stated that the criteria for the problem are: if it cannot be solved by direct effort; Effort is needed to solve it, even if it fails; and requires some creative insight to solve it (Ferdiani et al., 2021; Ole et al., 2019). Problem Based Learning can be applied in learning with the help of animated video media .

Based on the results of observations that have been made by researchers at SMK Budi Utomo Kepanjen that learning so far only uses the lecture and discussion method, and has not applied problem-based learning. In addition, learning has not used learning media, especially animated video media, so students tend to be bored and less interested in Mathematics, especially in the material of sequences and series. Based on the analysis of student learning outcomes on the material of sequences and series, as many as 56% of students got scores below the KKM. Based on these problems, we need media that can support the learning process, especially to improve student learning outcomes in line and series material.

The material for arithmetic sequences and series at the vocational high school level is a continuation of the number pattern material taught at the junior high-level equivalent. Errors in calculations and completion are often found due to students' difficulties in interpreting and understanding arithmetic sequences and series (Audhiha et al., 2022; Darmayanti et al., 2022). Therefore, in instilling the concept of arithmetic sequences and series, teachers need learning media that can make it easier for teachers to transfer information and visualize material to students.

This research has been carried out previously by researchers who conducted research on the development of animated video media including (Chairudin & Dewi, 2021; Ramadanti et al., 2021; Suparno et al., 2019). The difference between this research and previous research is that this research is focused on developing animated videos using the Adobe Animate CC application using problem-based learning models on the subject of sequences and series which can later produce valid, feasible and effective animation learning media. So the purpose of this study was to develop and determine the validity, feasibility, and effectiveness of animated media using the Adobe Animate CC application based on problem based learning on the subject of sequences and series.

2. METHOD

The research model is used in development and research. The development used in the development of animated video-based learning media on Barisan and Sequence material is the ADDIE development model which includes 5 stages (Branch, 2010; Owens & Kadakia, 2020), namely: Analyze (The analysis stage is a preliminary activity before determining the concept of making learning media in the form of animated videos), Design (This activity is a systematic process that begins with determining the concept of the media created, Development in this research is the stage where the design is realized into a finished product with various improvements in it. Implementation animated video-based learning media that has been validated and deemed appropriate by design experts, mathematics learning experts, and material experts are then applied in the learning process in the classroom. The research design is presented in Figure 1.
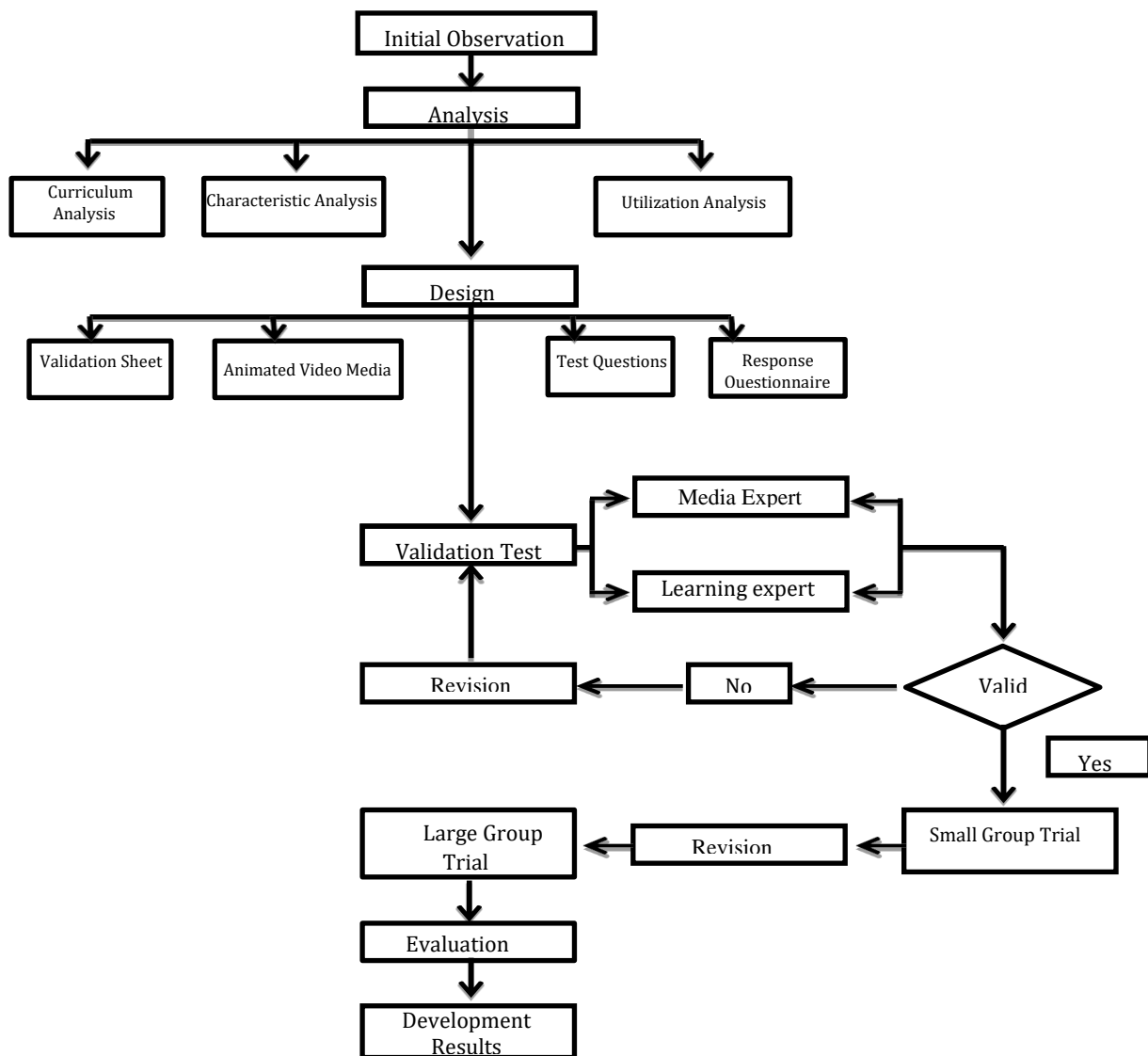

Figure 1. The Research Design

The subject in this study is animated video-based learning media, the subject of validation involves 1 lecturer as a design expert, 1 lecturer as a material expert and 1 subject teacher as a learning expert. The Media Analysis Validity Score is show in Table 1.

Table 1. Media Analysis Validity Score

Score	Category
3,25<Y≤4,00	Very Valid
2,50<Y≤3,25	Valid
1,75<Y≤2,50	Quite Valid
1,00<Y≤1,75	Less Valid

The response subject (trial subject) involved students of class XI at SMK Budi Utomo Kepanjen in the odd semester consisting of 6 students of Fashion Design and 20 students of Computer and Network Engineering. The feasibility analysis is calculated based on the results of the student response questionnaire. The student response questionnaire to the developed media has 4 answer choices with different scores. The results of the questionnaire scores will be calculated based on questionnaire analysis feasibility criteria is show in Table 2.

Table 2. Media Analysis Feasibility Score

Score	Category
3,25<Y≤4,00	Very feasibil
2,50<Y≤3,25	feasibil
1,75<Y≤2,50	Quite feasibil
1,00<Y≤1,75	Less feasibil

The effectiveness criteria are assessed from the results of the student's ability test. Media is said to be effective if more than 80% of students achieve a score of ≥ 75 or in accordance with the Minimum Completeness Criteria (KKM). These results will be assessed based on the criteria for the effectiveness of the student's value analysis as show in Table 3.

Table 3. Media Analysis Effectiveness Score

Score	Category
80 Y ≤ 100	Very effectiv
80 <Y ≤ 60	effectiv
60 <Y ≤ 40	Quite effectiv
40 <Y ≤ 20	Less effectiv

Data collection techniques in this study were descriptive quantitative and descriptive qualitative. Qualitative data in the form of suggestions and criticisms and quantitative data in the form of assessment scores from the validation sheet. Validity test questionnaire sheet for experts or validators, student response test questionnaire sheet and student test questions.

3. RESULT AND DISCUSSION

Result
The final result of this research and development is an animated video-based learning media on the material of class XI sequences and series. This animated video-based learning media was developed with the aim that the delivery of Mathematics lessons, especially on the material of rows and series, becomes interesting so that students can make the learning process more enjoyable. Accordingly, the selection of the development model also affects the final results of the study.

Analyze stage (analysis), at this stage an analysis of the curriculum used, analysis of student characteristics and analysis of the use of learning media is carried out. The results of observations made by researchers stated that students felt bored with the conventional way of teaching teachers, the use of media that was less varied and students' lack of understanding in solving story problems. So we need animated video-based learning media that can be used in the learning process.

In the design stage (design), at this stage the first thing to do is create an animated video storyboard, then design learning materials that will be included in the animated video and finally make test

questions and design validation instruments for 1) design experts who will be assessed based on presentation techniques, language, visual and audio and ease of use, 2) learning experts who are assessed based on material aspects, learning aspects and linguistic aspects, and 3) designing student response questionnaires based on language aspects, display aspects and interaction aspects. Next, make a video animation design for learning media starting from animation, the material included as well as audio and video background. The result of developing animation media are show in Figure 2, Figure 3, and Figure 4.

Figure 2. Cover Media

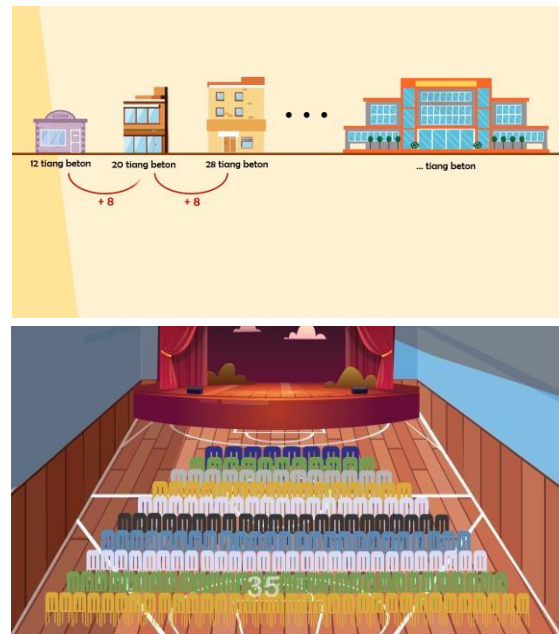**Figure 3.** Example Questions   **Figure 4.** Discussion of Sample Questions

The development stage, in the development of this research, is the stage to realize the design into a finished product. The steps in developing animated videos are validated by design experts, material experts and learning experts in the form of a questionnaire, then the results are analyzed and revised based on suggestions and input from experts. In the implementation stage, animated video-based learning media that have been validated and deemed appropriate by design experts, material experts and learning experts

are then applied in the classroom learning process. The trial was limited to a small group first, namely 6 students of XI Fashion Design to get evidence in the form of comments and suggestions for media improvement which were then analyzed and revised. The last trial, namely a wider trial, was carried out by a large group of 20 students of XI Computer and Network Engineering to determine the feasibility and effectiveness of the developed media. The evaluation stage, aims to assess the overall development stage carried out. The evaluation steps in question are after testing the students and getting the final results of research on media development based on animated videos in the form of validity, feasibility and effectiveness of the media for use in learning mathematics.

Product Validation Results

The learning media that has been developed are then tested for validity before being used for field trials. This media validity test involves several experts, namely media experts, material experts and learning experts. The validation of design experts and material experts was carried out by lecturers of the mathematics education, while material experts were carried out by mathematics teachers at SMK Budi Utomo Kepanjen Malang district. The following is a recapitulation of learning media assessments by design experts, material experts and learning experts.

Media Expert Validity

Media expert validity sheets were given to mathematics lecturers and assessed based on presentation aspects, linguistic aspects, visual and audio aspects and aspects of ease of use. The following is the result of a recapitulation of learning media assessments by design experts in Table 4.

Table 4. The Result of a Recapitulation of Learning Media Assessments by Design Experts

Aspects	Score
Presentation	8
Linguistic	8
Visual and audio	18
Aspects of ease of use	8
Total	**42**

Based on Table 4, a score of 3.50 is obtained, this score lies on the criterion scale of $3.25 < X \leq 4.00$ which indicates that the learning media design developed is in the "very valid" category. In addition to the assessment according to the design expert's validation sheet, there are several suggestions from the design expert, namely, in choosing the right color and placement of writing to make it easier for students to use the media.

Material Expert Validity

Material validity is carried out by Mathematics Education Lecturers. The validation sheet given to material experts consisted of 12 questions, which were divided into 3 question criteria which included content aspects, presentation aspects and language aspects. Based on the validation given to material experts, the following results are obtained as show in Table 5.

Table 5. Recapitulation of Learning Media Assessments by Material Experts

Aspects	Score
Content	15
Presentation	15
Language	13
Total	**43**

Based on Table 5, a score of 3.58 is obtained, this score lies on the criterion scale of $3.25 < X \leq 4.00$ which indicates that the material in the developed learning media is in the "very valid" category. In addition to the assessment according to the media expert's validation sheet, there are several suggestions from media experts, namely, the addition of making sample questions using fractional numbers adjusted to the ability level of students. The addition of this example problem is after the example problem of arithmetic sequences.

Learning Expert Validity

The validity of the learning was carried out by a mathematics teacher at Budi Utomo Kepanjen Vocational School, Malang Regency. The validation sheet given to learning experts consisted of 12 questions which were divided into 3 question criteria covering material aspects, presentation aspects, and language aspects. Based on the validation given to mathematics learning experts, the results are obtained as show in Table 6.

Table 6. Recapitulation of Learning Media Assessments by Learning Experts

Aspects	Score
Material	15
Presentation	16
Language	15
Total	**46**

Based on Table 6, a score of 3.83 is obtained. This score lies in the criterion $3.25 < X \leq 4.00$ which indicates that the material in the developed learning media obtains the criteria of "very valid". In addition to the assessment according to the learning expert validation sheet, there are several suggestions from learning experts, namely, the use of lesson plans should follow the latest format. These evaluations and suggestions will be used to revise the product so that the learning media can be used for research.

Test Results I

Animated video-based learning media that have been validated by design experts, material experts and learning experts are said to be "very valid". The next step is to be tested on groups that have been previously divided to determine the feasibility and effectiveness of the media. Eligibility is known from filling out a response questionnaire consisting of 10 questions consisting of aspects of language, appearance and interaction. As for the effectiveness, it is known from the students' completeness in filling out the test. Limited field trials were conducted on six students of class XI SMK Budi Utomo Kepanjen.

Based on the data obtained from the assessment of six students, the student response questionnaire scores were 83.33% in the 3.25 interval < ‾X4.00 and 16.67% at the 2.50 interval < ‾X3.25 in the limited field trial (small group) which showed that learning media obtained the "very feasible" category. Based on Assessment of Student Response Questionnaires in Limited Trials, the student's completeness score is 83.33% reaching a score of 75 or above the KKM (Minimum Completeness Criteria) at Budi Utomo Kepanjen Vocational School. This percentage lies on the criteria scale $80\% < X^- \leq 100\%$ so the test results show that the media developed is in the "very effective" category. Based on the description above, it can be concluded that the learning media in a limited field trial (small group) can be declared suitable for use in learning mathematics.

Test Results II

After the animated video-based learning media was tested in a limited field trial and said to be very feasible and very effective, it could be further tested in a wide field trial. The level of feasibility and effectiveness of animated video-based learning media online and series material for Computer and Network Engineering students at Budi Utomo Kepanjen Vocational School is the same, which is measured based on the results of student response questionnaires and student completeness. Based on the data obtained from extensive field trials, it was obtained that the student response questionnaire score was 80% at intervals of $3.25 < \overline{X}4.00$ and 20% at intervals of $2.50 < \overline{X}3.25$ in a wider field trial which showed that this learning media obtained the criteria of "very feasible" to be used in learning mathematics.

The test results in Assessment of Student Response Questionnaires on Broad Field Trials show that the student's completeness score is 85%. This percentage is on a criterion scale of $80\% < \overline{X}100\%$ which indicates that the learning media developed has the criteria of "very effective" to improve students' abilities in line and series material at Budi Utomo Kepanjen Vocational School. Based on the description of the data above, it can be concluded that the media in the wide field trial can be declared very suitable for use in learning mathematics and very effective for improving students' mathematical abilities.

Discussion

This development research produces math learning media products with problem-based learning animation videos that are valid, feasible, and effective. This media really supports the implementation of learning in the era of the industrial revolution 4.0, because I use this animated video technology which can be accessed anywhere and anytime. This development will be very useful to improve students' ability to

solve problems. This is in line with the thinking of which states that the Video Assisted Problem-Based Learning Model in LKS is effective in increasing students' mathematical problem solving abilities (Haqiqi & Syarifa, 2021). Meanwhile video-based learning media is very effective, especially in learning (Chan, 2015; Mustofa Yusuf & Amin, 2017; Ritonga et al., 2020).

This research has been carried out previously by researchers who conducted research on the development of video animation media (Suparno et al., 2019; Zhafirah et al., 2020). The difference between this research and previous research is that this research is focused on developing animated videos using the Adobe Animate CC application based on problem based learning on the subject of sequences and series. This research is applied at the SMK level, especially in mathematics and the video is designed in the form of an animated video using the Adobe Premiere Pro application which is then exported in mp4 format. This video is also given an interesting animation using simpler language to facilitate the intent of the animated video, so that students can easily understand the content and intent of the video. Current presence animated video learning media is really needed by students to make it easier for students to absorb knowledge, by using animated videos, students can see explanations of sequence and series material along with solving questions repeatedly without time constraints, so they can be used at any time, because the sequence material and series is mathematical material that has little theory, but does more calculations to find the value of the nth term or the sum up to the nth term in a sequence and series of numbers. For this reason, educators must have learning media that can explain the concept of sequences and series so that it is more easily understood by students.

Based on the recapitalization results of the design experts, the criterion scale is $3.25 < X \le 4.00$ which indicates that the learning media design developed is in the "very valid" category. Based on the recapitulation of media experts, a score of 3.58 was obtained, this score lies on the criterion scale of $3.25 < X \le 4.00$ which indicates that the material in the learning media developed is in the "very valid" category. Based on the recapitulation of learning experts, a score of 3.83 was obtained. The score lies in the criterion $3.25 < X \le 4.00$ which indicates that the material in the developed learning media obtains the criteria of "very valid". Student response questionnaire scores of 80% at intervals of 3.25 <4.00 and 20% at intervals of 2.50 <3.25 in a wider field trial indicate that this learning media obtains the criteria of "very feasible" for use in learning mathematics. Based on the results of the study, it showed that the student's completeness score was 85%. This percentage is on a criterion scale of 80% < 100% which indicates that the learning media developed has the criteria of "very effective" to improve students' abilities on sequences and series material at SMK Budi Utomo Kepanjen. Based on the description of the data above, it can be concluded that the wide field trial media can be stated to be very suitable for use in learning mathematics and is very effective for improving students' mathematical abilities. While the novelty of this research is the production of development animation videos using the Adobe Animate CC application based on problem based learning on the subject of valid, feasible and effective sequences and series for class XI students of Computer and Network Engineering.

Based on the results of these studies it can be concluded that the research objectives have been achieved. The purpose of this study is to determine the validity, feasibility and effectiveness of animated media using the Adobe Animate CC application based on problem based learning on the subject of sequences and series. Research on the development of video animation based on video animation is limited to line and series material as well as learning objectives, so it is necessary to develop material and develop broader test questions at various levels to make it easier for students to learn. all math material and solve various types of problems.

4. CONCLUSION

Based on the research that has been done on the development of animated videos using the problem-based learning-based Adobe Animate CC application, it can be concluded that the media developed by the researchers was declared "very valid" by the experts. The media developed by the researcher obtained a student response questionnaire score of 80% at intervals of 3.25 < ⁻X4.00 and 20% at intervals of 2.50 < ⁻X3.25 in a wider field trial which showed that this learning media met the criteria "very feasible" is used in learning mathematics. The media developed by the researcher obtained a student completeness score of 85%. This percentage is on a criterion scale of 80% < X100% which indicates that the learning media developed has the criteria of "very effective" to improve students' abilities in sequences and series material at Budi Utomo Kepanjen Vocational School. Based on the description of the data above, it can be concluded that the media is in a trial The broad field can be expressed very well. used in learning mathematics and is very effective in improving students' mathematical abilities. The development of video animation using the Adobe Animate CC application based on problem based learning has an impact on improving student learning abilities.

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