

The Development Animation Video MADTEX (Madura Tourism Experience) in Set Theory

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ABSTRACT

This study aims to produce a MADTEX (Madura Tourism Experience) mathematical animation video product integrated with the promotion of tourist destinations in Madura. The concept of integrating tourism into Madura's mathematical animation video media aims to export the potential of Madura's tourist destinations more deeply and broadly in the hope that students will learn more about Madura's tourist destinations and visit them. Students' interest in seeing and hearing rather than reading is maximized as they watch educational programs in the hope that it will increase their enthusiasm for learning and, of course, improve their mastery of math skills. Research on animated video media development has conducted a needs assessment for an animated video, including educational materials for collections, software for creating animated videos and introducing Madura's tourist destinations. The method of this research is the development of the 4D model that includes needs analysis, design of an integrated mathematical animation video for Madura tourism, teaching materials validated by media experts and materials experts. Of the study results, 91% came from materials experts, 93% from learning media experts, and 85% from small group experiments. On this basis, the MADTEX Animation Video learning medium is suitable for learning mathematics on set material.

Keywords: *animation, madtex, set, halal tourism*

1. INTRODUCTION

According to a recent Unesco report, the physical closure of all types of educational institutions can have serious negative effects on students, interfering with the learning process and preventing them from growing and further developing [1]. educators as pillars in the preparation of the young generation can inspire students, not as learning objects but can leave students as learning subjects [2]

A teacher's creativity and innovation in learning during a pandemic are needed to ensure that learning outcomes can be achieved by students without reducing the quality of learning. Either they were using zoom or google meet. But the student was not there, so he felt that the concept and implementation of online learning went in one direction; the teacher delivered the material with great enthusiasm while not knowing what condition the students are in receiving the material was if they listened, they listened or just put their name on it. as an alternative to overcoming problems in online learning is to use the media which is more appropriate in transmitting the material, especially mathematics, which is famous for being abstract and difficult for most students

In order for learning to attract students' attention, it is necessary to make interesting media. Learning media is

defined as anything that can be used to channel the sender's message to the recipient so that it can stimulate the thoughts, feelings of attention, and interest of students to learn [3]. The rapid development of technology can create attractive, practical, and fun learning media. During a pandemic like this, teachers must be creative in developing learning media integrated with ICT [4]. One of the innovations currently being developed in delivering learning materials is the creation of animated videos. With the media in the form of videos in learning, it is easier for teachers to deliver learning materials and more interactive so that students understand the material easily [5]. This is also in line with research [6] which states that learning by using video is more effective, which is carried out in Vocational Schools majoring in Beauty Cosmetology.

However, in the field that appears, there are still very few teachers who create and implement innovative learning media that attract students' attention; there are even some teachers who never use learning media at all [3]. Some things that cause teachers not to use the media include: (1). Preparation of media creation takes quite a long time; (2). It costs a lot of money; (3) Lack of technological development; (4) Media is considered just entertainment [6]

The use of video content, namely video-based learning strategies, is the only solution and alternative during this pandemic. However, the basic concept of using video technology for learning is not new and has been used since the popularity of MOOCs and video platforms such as YouTube [7].

One of the learning media developed by the teacher is an animated learning video. The teacher also speculates that learning media will increase students' learning motivation. Teaching media is essential when carrying out the learning process. The criteria for the media offered must be related to the material in the syllabus, which also contains audio and video so that it can increase student interest in learning. Furthermore, especially students who are young learners, learners need more and more direct attention in order to get bored quickly. Teachers should be more critical in considering learning media, which will help the learning process [8].

Almost all students consider mathematics to be a complicated subject, so that in order to increase student learning motivation, media is needed, especially in the form of videos, which are expected to increase students' understanding of mathematical concepts [9]. The trend of using learning videos is increasing rapidly [10]. Mastery of concepts is an absolute must in doing mathematics. That is, students must have a solid conceptual basis in order to be able to solve mathematical problems [11]. Making and using appropriate learning media can improve student competence and learning quality [12].

Some of the advantages of learning videos are that students are more independent in learning, communicative and can be replayed, display something in detail, can be slowed down, enlarged, and compare between two or more scenes simultaneously [9]. This is in line with [13], which revealed that the average pretest score before the application of instructional media was 57.60, while the average posttest score after the application of motion graphic learning media, an animated video, was 79.20. This means that there is an increase in learning before using animated videos and after using animated videos. To attract students' interest in learning, engaging learning media are needed. The use of digital technology as a learning medium has implications that are better and more effective than others [14].

Video content that will be used for teaching purposes in an online learning environment is an important factor, even more so, because, in the COVID-19 era, there are absolutely no physical classes. Course instructors can

take live online sessions for students or can even upload their recorded videos to online learning platforms for students to watch, followed by a discussion [7]. Animation can provide a good understanding of the concept [15].

Based on the results of observations at SMP Alharomain Sampang, teachers do not yet have learning media, especially in the form of animated videos. The teacher only uses worksheets and practice questions in learning. The mathematical animation video that will be developed is integrated with local Madura tourism, meaning that apart from the animation video, it contains mathematics education as well as a means of knowledge as well as promotion of tourism destinations in Madura.

Tourist attractions in Madura tend to be unknown to many people. Many people prefer Malang with its artificial tours to Madura, which is still original and innate in its tourist attractions. Madura itself has extraordinary tourism potential and tends to be naturally innate but is not widely exposed. Many people outside Madura don't know about Jelih Hills, Asta High, Poetry Koenang, Camplong Beach, the fire that never goes out, and so on that are no less interesting than tourist attractions in other cities. One of the promotional media is integration in the form of cartoons containing educational content on the set material.

Judging from the various facts above, it is necessary to develop MADTEX (Madura Tourism Experience) Animation Videos on Association Materials in order to support the development of halal tourism in Madura.

2. RESEARCH METHODS

This research includes research and development (Research and Development). used to produce a product and test the effectiveness of the product. The product that will be produced in this research is in the form of MADTEX (Madura Tourism Experience) Animation Video Development on Association Materials in Order to Support Madura Halal Tourism Village. The research procedure used was adapted by Thiagarajan (1974) 4D model, namely: 1) Define (defining); 2) Design (design); 3) Development (development); 4) Disseminate (dissemination). The stages of the research can be seen in Figure 1.

The research stages are based on the 4D development model developed by Thiagarajan (1974) with modifications. presented in Figure 1 as follows:

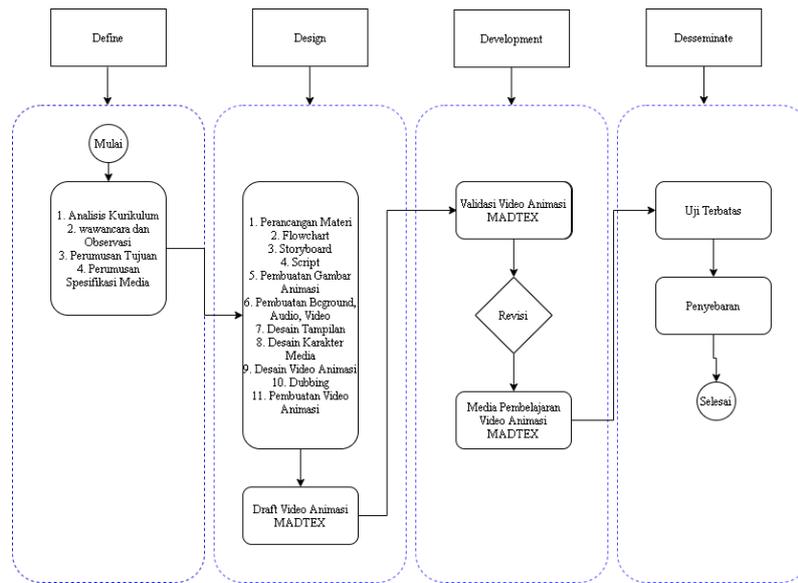


Figure 1 Research Stages of Video Animation Development

2.1. Define

Activities at the define stage are used to define and define the development requirements. The first analysis is carried out through a literature study in a curriculum used in schools. It determines the competencies to be used, the second is an analysis of student characteristics, and the third is selecting material which is carried out by identifying the primary material that needs to be taught, collecting and selecting relevant material, and systematically rearranging them. The steps taken to obtain the three things above are: the first is curriculum analysis which aims to determine basic competencies and indicators of teaching materials/books to be made and developed. The curriculum analysis stage is carried out to review the applicable curriculum and determine which competencies are used to develop animated video learning media.

Interviews and observations were used to obtain the source of the main problems in the research. The interview guide was used to dig up information on learning the set material, the media used, the integration of learning media with tourism. The interview was used semi-structured in order to get an outline of the research problem.

The next stage is the initial analysis (front end analysis), whose purpose is to determine the basic problems faced by students, thus requiring learning media. Then student analysis (learner analysis) was carried out to determine the characteristics of students and the difficulties experienced by students in the learning process. Next is the concept analysis (concept analysis) aims to determine the concepts used in the process of making learning media.

Before developing animated video learning media, the learning objectives need to be studied first in order to help researchers limit the research and not deviate from the research objectives. The objectives are divided into two: the objectives in terms of learning aspects and the objectives of the animated video media content to be developed. Learning objectives are formulated by basic competencies, which will later become the basis for making learning media. The specifications of the learning media developed are animated videos integrated with Madura tourism to learn and experience about Madura tourism through mathematics learning. Animated videos will be complemented by math learning content. Using MADTEX animation videos, students can first learn to understand the material in class, and then the teacher will reinforce the class. The development of MADTEX animation videos is also inseparable from the specifications of the software used, including adobe premiere, Coreldraw, photoshop, adobe audition.

2.2. Design

Researchers make the initial product design through the design stage. The product design needs to be validated by experts and then revised in order to get a good product. The product design will be improved according to suggestions from the validator. The activities in the design stage are: The material that will be used in the development of the MADTEX animation video is the set material. The contents of the set material are the definition of sets, types of sets, and set operations. The flowchart contains the flow that will be used to make MADTEX animation videos.

Making storyboards is used to develop MADTEX animation videos with no wrong concepts. Making a storyboard starts from the sequence of making the scene

and a description of the text on the screen and the position of the image. The storyboard was then consulted with media experts. Making animated images starts from creating characters that will be used in animated videos. Making mathematics learning materials, making Madura tourism materials, and making questions

2.3. Development

It is divided into two at this stage, it is divided into 2, namely, expert appraisal and developmental testing. Expert appraisal aims to determine the feasibility or validate the product design. Based on his observations and observations, the validator provides input and criticism of the products that have been made. Developmental testing aims to test the product design on a real sample or subject. At this trial stage, the responses and comments from users on the product design will be known. Then the product is revised, repaired, and retested

until it gets effective results according to the expectations of the product developer.

2.4. Disseminate

At the validation testing stage, the product design that has been made and validated will be implemented to the target or product user, in this case, is a class VII junior high school student. This aims to determine the level of effectiveness of the developed product. The next stage is the stage of packaging (packaging) and diffusion and adoption. The diffusion and adoption stage aims to utilize the product made by the target/user. At the dissemination stage, the product is distributed via youtube and can be seen by all students. The product trial in this study aims to collect data used as a basis for determining the feasibility of the product being developed. Product trials were carried out on media experts, material experts, individual tests, and small group tests. The test results criteria can refer to in table 1

Table 1 Qualification Criteria for Product Validation Results

No	Validity Criteria	Validity Level
1	85,01%-100%	Very Valid, or can be used without revision
2	70,01%-85%	Valid enough, or can be used but needs minor revision
3	50,01%-70%	Valid enough, or can be used but needs major revision
4	1-50 %	Invalid or should not be used

(Source: Akbar, 2016)

3. RESEARCH RESULT

The development resulted in a product in the form of an animated Madtex video. Digital teaching materials in the form of videos are the output of research and in the form of videos that have been uploaded via the youtube link: <https://youtu.be/3fpXAzV2Sz4>. This teaching material was developed using animation video technology by containing a combination of mathematics subjects on set material and an introduction to halal tourism in Madura. The development uses the 4D model described in the methods chapter. The development of an animated video of set material was developed by combining mathematics learning with the introduction of Madura halal tourism. Madura is an island located in East Java, Indonesia which has tremendous potential regarding halal tourism. The addition of Madura halal tourism is expected to make students have an insight into the knowledge of halal tourism in Madura. The results of the development of digital teaching materials in the form of animated videos can be explained as follows:

3.1. Opening video introduction to Bangkalan halal tourism

The opening of the Bangkalan halal tourism introduction video is the beginning of the animated video being developed. In the initial view, it explains about

halal tourism in Bangkalan. Halal tourism in Bangkalan which is very famous is the Suramadu bridge, Jadhil hill, Arosbaya hill, Siring Kemuning beach, Syaichona Kholil. The bridge that connects Surabaya and Madura was built since the era of President Megawati Soekarno Putri. Jaddih Hill, which is a former white limestone quarry, is currently a favorite tourist destination in Bangkalan, located in the village of Socah. Arosbaya hill is located in Arosbaya district. Arosabaya is also a former mining area but has a red-brown color which is known as "Bedel". Siring kemuning beach The location of this beach is located on the northern route of the island of Madura. Syaiahona Kholil is the grave of the founder of Nahdlatul Ulama, Sheikh KH Hasyim Ashari. The display on the opening video can be seen in Figure 2



Figure 2 Results of Bangkalan Halal Tourism Video Development.

3.2. Animated video about the concept of sets

In the first part of the Madtex learning animation video, students are presented with an understanding of the concept of sets. Overall, the first part of the animated video developed explains the concept of sets and not sets, and explains how to present sets. The synopsis of the learning scenario carried out through animated videos is that in 2020 the corona virus outbreak hit the world, including Indonesia, not only destroying the economy but also education. The unfinished corona outbreak has resulted in online learning and this requires the readiness and activity of each student. Pak Jono's family has 4 children. The first child is named Arif, class 2 of high school and 3 twins, leli, ethic and hanafi, who are still in grade 1 of junior high school. The three twins got an assignment from the teacher at the school to study the set material, then a test was held. Because Mrs. Rini, their teacher is sick, the student must study independently, and the teacher promises to give a bag as a gift for students whose test scores are above 85. Can they get the bag as a gift?. The making of the first part of the animation video can be seen from the results of the development in Figure 3-5



Figure 3 Student Storyline for Learning Set Material



Figure 4 Opening Animated Video About Set Concept

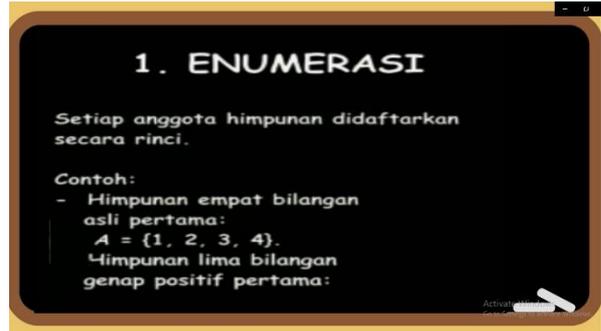


Figure 5 Animated Video Display of Set Concept Material

3.3. Video introduction to Sampang halal tourism

Sampang halal tourism is camplong beach, mandangin island, queen ebuah's grave, soul mate beach, lon poor beach. Camplong Beach has an extraordinary view so that tourists will be captivated when they visit it. Mandangin Island is a tourist attraction in Sampang. To reach this island, you have to take a traditional boat about 30 minutes from Tanglok sampan Harbor. One of the religious tours in Sampang City is the tomb of the queen mother in Mandangin Village, Polagan Village, Sampang City District, the location where Sampang Regency was originally founded. Matchmaking beaches are excellent for young people. According to history, it was given the name matchmaking beach because there used to be a powerful person named Joko Tole who proposed to a beautiful woman, but his proposal fell in that place. Lon Malang beach has lots of photo spots, games such as speed bot, banana bot, ATV motorbike accompanied by various kinds of delicious food, it feels like a beach with complete facilities. Lon Malang itself means times across.



Figure 6 Display of Sampang Halal Tourism Video.

3.4. Animated videos of types of sets

In the second sub-material there is material about mentioning the types of sets, and explaining the types of sets. The material is presented in an animated video as shown in the image below:



Figure 7 Video Opening Part Two Regarding Types of Sets



Figure 10 Pamekasan Halal Tourism Video Display

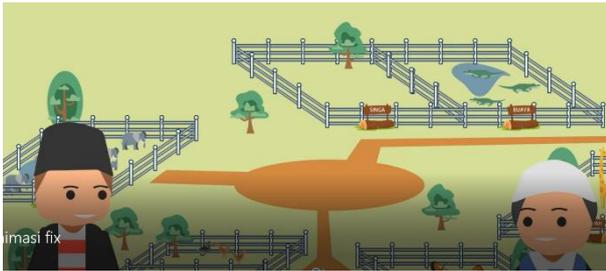


Figure 8 Animated Video Content Regarding Set Types

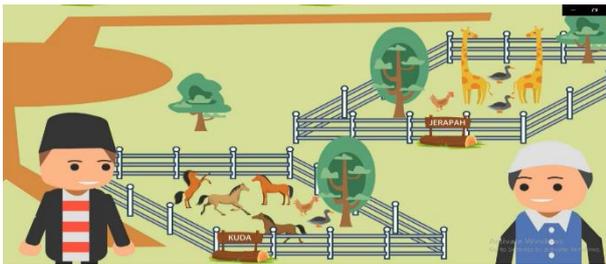


Figure 9 Examples of Understanding Sets in Daily Life

3.5. Video of the imposition of halal tourism in Pamekasan

In the final stage of the animated video, insert material is given about halal tourism in Sumenep. The halal tourism in Sumenep is Gili Liyang, Gili Labak, Asta Tinggi, Keratons Museum. Gili Liyang is an island with the second-lowest oxygen level in the world. Many tourists not only enjoy the beauty of clean white sand beaches, sunbathing on the beach, or Talang Siring Beach, Banyoto Waterfall, Love Hill, Brukoh Hill, Blaban Cave. Talang Siring Beach is located in the Prohibition District, and this beach is never empty of visitors. Banyoto waterfall, located in the village of Tonto Rajo is still natural, and the water is so fresh that it looks beautiful. Pamekasan's love hill is currently a trend for young people to visit because of its beauty and interesting photo spots. Bukit Brukoh is a new competitor that attracts attention from tourists besides Bukit Cinta because of the extraordinary beauty of the hills and unspoiled nature. Goa Blaban is one of the cave tours that are worth visiting because of the beauty of the stalactites and stalagmites on the roof of the cave.

3.6. Set operation animation video

In the third sub-material, we discuss the subject of set operations. Set operations explain set operations, solving contextual problems related to binary operations on sets. The results of making a video of set operation animation material can be seen in the picture



Figure 11 Characters Discussing How to Operate Sets



Figure 12 Results of Discussion Regarding Set Operations



Figure 13 The Closing Result of the Animation Video From the Overall Material

3.7. Video introduction to halal tourism in Sumenep

In the final stage of the animated video, insert material is given about halal tourism in Sumenep. The halal tourism in Sumenep is Gili Liyang, Gili Labak, Asta Tinggi, Keratons Museum. Gili Liyang is an island with the second-lowest oxygen level in the world. Many tourists not only enjoy the beauty of clean white sand beaches, sunbathing on the beach, or snorkeling but also for health healing, especially those who have respiratory or lung problems. Gili Labak has very clean water with beautiful and beautiful coral reefs, so it is perfect for snorkeling, but you have to prepare a large enough fund to enjoy the extraordinary scenery. Asta Tinggi is located in the village of Kebon Agung, where this is the final resting place for the kings and noble families of the Sumenep Palace, which is located on the hills of Madura. The Kraton Museum is a very old museum that describes the genealogy of the kings/regents in Sumenep. Starting from Arya Wiraraja, Prince Djoko Tole, until now. In the museum, there is an Arya Wiraraja chariot which is estimated to be more than 1000 years old. The final result of the introduction of halal tourism in Sumenep can be seen in the picture

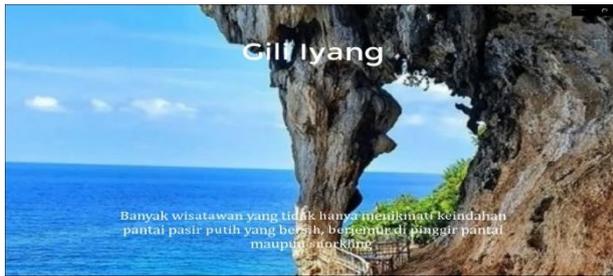


Figure 14 Results of Introduction to Halal Tourism in Sumenep.

The material validation test is carried out by an expert who has the ability and knowledge of mathematics subjects, and media experts are carried out by experts in learning media. The media expert in this study was a lecturer at the Department of Information Technology, State Polytechnic of Malang, namely Rokhimatul Wachidah, S.Pd., M.T. Validation was carried out related to aspects of content feasibility and feasibility of presentation and graphics on Madtex Animation Videos which were developed with a rating scale range of 1-4. Validation, The material expert in this study was a lecturer in the Informatics Engineering Education Study Program, State University of Malang, Wahyu Nur Hidayat, M.Pd. Validation was carried out related to aspects of content feasibility and linguistic feasibility in Madtex Animation Videos which were developed with a rating scale of 1-4. The results obtained from media validation are suggestions and the level of validity of the product. The level of validity obtained a percentage of 91.84% with very valid criteria. The average results of the media experts are in the valid category and do not need revision. But there is input from the validator about the use of fonts; there are insertions in every section, video animations are too fast, and voice dubbing is clarified again. Details of the results of media expert validation can be seen in table 2.

Table 2 Media Expert Validation Results

No	assessment aspect	assessment		V (%)	criteria
		Tse	Tsh		
1	Contents	15	16	93,75	Very valid
2	Presentatio n	29	32	90,62	Very valid
3	Graphics	31	34	91,17	Very valid

The results obtained from the validation of the material in the form of suggestions and the level of validity of the product. The results of the material expert validation obtained a percentage of 93.04% with very valid criteria.

The average results of the media experts are in the valid category and do not need revision. Details of the results of material expert validation can be seen in table.

Table 3 Material Expert Validation Results

No	assessment aspect	assessment		V (%)	Kriteria
		Tse	Tsh		
1	Purpose	20	20	100	Very valid
2	Contents	36	38	94,73	Very valid
3	Theory	32	34	94,11	Very valid
4	Language	20	24	83,33	Very valid

Individual trials were carried out by 3 students who were taken in grade 7 of SMP Alharomain Sampang. The trial was carried out using the attached respondent's trial questionnaire. The data collected is in the form of

quantitative data with a total of 20 questions. The results of individual testing have results of 89.25% in the very valid category. The following data on the results of small group trials are presented in Table 4.

Table 4 Individual Trial Results

No	assessment aspect	assessment		V (%)	criteria
		Tse	Tsh		
1	attractiveness	52	60	87	Very valid
2	Benefit	54	60	90	Very valid
3	Quality	64	72	89	Very valid
4	Contents	44	48	91	Very valid

The small group trial was carried out by six students taken in grade 7 of SMP Alharomain Sampang. The trial was carried out using the attached respondent's test questionnaire. The data collected is in the form of

quantitative data with a total of 20 questions. The results of the small group test have a result of 85.2% in the very valid category. The details of the data on the results of the small group trial are presented in Table 5.

Table 5 Small Group Trial Results

No	assessment aspect	assessment		V (%)	Kriteria
		Tse	Tsh		
1	attractiveness	96	120	80	Very valid
2	Benefit	106	120	88	Very valid
3	Quality	123	144	85,4	Very valid
4	Contents	84	96	87,5	Very valid

4. CONCLUSION

The product produced in this research and development is an animated MADTEX video with a competition between a mathematics learning video and an introduction to Madura halal tourism for junior high school students at Alharomain SMP, Sampang Madura. The contents of the animated video are:

1. Opening video introduction to halal tourism in Bangkalan
2. Animated videos about the concept of sets
3. Video introduction to halal tourism in Sampang
4. Animated videos of the types of sets
5. Video of the imposition of halal tourism in Pamekasan
6. Set operation animation video
7. Video introduction to Sumenep halal tourism

The Madtex Animation learning video has been tested through four stages of testing, namely: the validation stage by material experts, the validation stage by media experts, individual trials, and small group trials with very feasible results to be used as teaching materials for mathematics subjects on set material and the introduction of halal tourism. Madura. The results of media expert validation obtained a percentage of 91.84% with very valid criteria. The results of material expert validation obtained a percentage of 93.04% with very valid criteria. The results of individual trials obtained a percentage of 89.25% in the very valid category. The results of the small group trial obtained a percentage of 85.2% in the very valid category.

This is in line with research [16], which states that there is a significant difference in students' thematic learning outcomes between before and after using learning animation videos. This is also in accordance with research [17]. This is in line with research [5] which states that before the learning media is used, the teacher must first check both the sound and the image so that the implementation of learning can be as expected. The teacher, as a facilitator in teaching and learning, directs students according to the learning objectives, and an evaluation is carried out at the end of the lesson to find out deficiencies in learning and check students' understanding.

AUTHORS' CONTRIBUTIONS

The Development Animation Video MADTEX (Madura Tourism Experience) in Set Theory It can be used by students and teachers in understanding abstract mathematical material as well as one of the effective learning media in developing students' competencies. In addition, it can also introduce Madura tourism destinations so that they can be better known in Indonesia

which in turn increases economic growth, especially in the tourism sector in Madura.

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3. Validator of materials and learning media
4. Students and parties assisting research

REFERENCES

- [1] J. Tumwesige, "COVID-19 Educational Disruption and Response: Rethinking e-Learning in Uganda," no. May, pp. 1–14, 2020.
- [2] E. Mulyadi, "Penerapan Model Project Based Learning untuk Meningkatkan Kinerja dan Prestasi Belajar Fisika Siswa SMK," *J. Pendidik. Teknol. dan Kejuru.*, vol. 22, no. 4, p. 385, 2016, doi: 10.21831/jptk.v22i4.7836.
- [3] T. Talizaro, "PERANAN MEDIA PEMBELAJARAN DALAM MENINGKATKAN THE ROLE OF INSTRUCTIONAL MEDIA TO IMPROVING," vol. 2, no. 2, 2018.
- [4] S. Maryanti and D. T. Kurniawan, "PENGEMBANGAN MEDIA PEMBELAJARAN VIDEO ANIMASI STOP MOTION UNTUK PEMBELAJARAN BIOLOGI DENGAN APLIKASI PICPAC," vol. 0417, no. 1, 2017.
- [5] D. Kuniawan, "PENGEMBANGAN MEDIA VIDEO PEMBELAJARAN PADA MATA PELAJARAN IPA TENTANG SIFAT DAN PERUBAHAN WUJUD BENDA KELAS IV SDN MERJOSARI 5 MALANG Dicky Candra Kurniawan 1 , Dedi Kuswandi 2 , Arafah Husna 3," pp. 119–125, 2010.
- [6] I. Nurhayati, M. Khumaedi, and H. Yudiono, "The Effectiveness of the Use of Video Media on Learning on the Competence of Scalp and Hair Care of Vocational High School Students of Beauty Department," *J. Vocat. Career Educ.*, vol. 3, no. 1, pp. 66–72, 2018, doi: 10.15294/jvce.v3i1.15388.
- [7] D. Pal and S. Patra, "University Students' Perception of Video-Based Learning in Times of COVID-19: A TAM/TTF Perspective," *Int. J. Hum. Comput. Interact.*, vol. 37, no. 10, pp. 903–921, 2021, doi: 10.1080/10447318.2020.1848164.
- [8] N. K. P. Laksmi, K. A. Yasa, and K. A. M. Mirayani, "the Use of Animation Video As Learning Media for Young," pp. 42–52.

- [9] E. Nurdin, A. Ma'aruf, Z. Amir, R. Risnawati, N. Noviarni, and M. P. Azmi, "Pemanfaatan video pembelajaran berbasis Geogebra untuk meningkatkan kemampuan pemahaman konsep matematis siswa SMK," *J. Ris. Pendidik. Mat.*, vol. 6, no. 1, pp. 87–98, 2019, doi: 10.21831/jrpm.v6i1.18421.
- [10] M. N. Giannakos, "Exploring the video-based learning research: A review of the literature," *Br. J. Educ. Technol.*, vol. 44, no. 6, 2013, doi: 10.1111/bjet.12070.
- [11] Annajmi, "PENINGKATAN KEMAMPUAN PEMAHAMAN KONSEP MATEMATIK SISWA SMP MELALUI METODE PENEMUAN TERBIMBING BERBANTUAN SOFTWARE GEOGEBRA," *J. Math. Educ. Sci.*, vol. 2 No 1 Okt, pp. 1–10.
- [12] I. Baharuddin, "Efektivitas Penggunaan Media Video Tutorial Sebagai Pendukung Pembelajaran Matematika Terhadap Minat Dan Hasil Belajar Peserta Didik Sma Negeri 1 Bajo Kabupaten Luwu Sulawesi Selatan," *J. Nalar Pendidik.*, vol. 2, no. 2, pp. 247–255, 2014.
- [13] L. N. Amali, N. Zees, and S. Suhada, "Motion Graphic Animation Video As Alternative Learning Media," *Jambura J. Informatics*, vol. 2, no. 1, 2020, doi: 10.37905/jji.v2i1.4640.
- [14] F. Adnan, B. Prasetyo, and N. Nuriman, "Usability testing analysis on the Bana game as education game design references on junior high school," *J. Pendidik. IPA Indones.*, vol. 6, no. 1, pp. 88–94, 2017, doi: 10.15294/jpii.v6i1.9597.
- [15] I. Hwang, M. Tam, S. L. Lam, and P. Lam, "Use of animation as a supplementary learning material of physiology content," *Proc. Eur. Conf. e-Government, ECEG*, pp. 141–149, 2012.
- [16] P. J. R. Ponza, I. N. Jampel, and I. K. Sudarma, "Pengembangan Media Video Animasi Pada Pembelajaran Siswa Kelas Iv Di Sekolah Dasar," *J. EDUTECH Univ. Pendidik. Ganesha*, vol. 6, no. 1, pp. 9–19, 2018.
- [17] J. Nouri, "The flipped classroom: for active , effective and increased learning – especially for low achievers," *Int. J. Educ. Technol. High. Educ.*, 2016, doi: 10.1186/s41239-016-0032-z.