

Development of Video Stop Motion Graphic Animation Oriented STEAM (Science, Technology, Engineering, Arts, And Mathematics) on Global Warming Materials in Junior High School

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Abstract

Keywords:
Stop Motion Videos,
STEAM,
Global Warming

This study aims to design and produce a stop motion graphic animation video oriented to STEAM global warming material that is used as a learning medium and to determine the response of students at MTs Manbaul Huda Ngaluran Karanganyar Demak to stop motion graphic animation video oriented STEAM global warming material. The research method used is Research and Development (R&D) which refers to the Borg and Gall development procedure. This research includes 7 stages. The trial was carried out after going through a validity test by media experts and material experts. The trial was carried out at MTs Manbaul Huda Ngaluran Karanganyar Demak involving 28 students of class VII. meanwhile, the data analysis technique uses qualitative data from quantitative data for the development of STEAM-oriented video stop motion graphic animation products for global warming material in order to determine the feasibility of the developed media. The results showed that the media was feasible to use based on the percentage of media experts of 92% and material experts of 84.8%, the response of students to stop motion videos was very satisfied based on the results of small-scale trials getting an average score percentage of 96.95% and the test Field trials get an average score percentage of 85.7% which means that the stop motion graphic animation video media oriented to STEAM global warming material can be accepted by students.

To cite this article:

Puspita, I., Raida, S. A., Ayuningsih, M., Sholikhah, N.I., Handayani, N. (2021). Development of Video Stop Motion Graphic Animation Oriented STEAM (Science, Technology, Engineering, Arts, And Mathematics) on Global Warming Materials in Junior High School. *Thabiea : Journal of Natural Science Teaching*, 4(2), 198-206.

Introduction

The rapid development of Information and Communication Technology (ICT), has led to various types of media that can facilitate the activities of human life. ICT has made various types of media connected into a single unit with computer networks and even the internet. The development of new technology is increasingly affecting every field of science and life that integrates physical, digital and biological elements (Umamah, 2020). Changes in education system reform for the better are also the impact of technological developments in the field of education to deal with educational problems (Budiana et al., 2015).

The development and use of ICT at this time is also very important, coinciding with the increasingly high spread of Corona Virus Disease (Covid-19). Based on this, the demand to use online media is one of the innovations for educators to design learning media. The learning process using online media is in accordance with the Circular Letter of the Minister of Education and Culture of the Republic of Indonesia Number 4 of 2020 concerning the

Implementation of Educational Policies in the Emergency Period for the Spread of Covid-19 (Pendidikan et al., 2020). By utilizing online media, educators can ensure students to take part in learning anytime and anywhere. Educators can also provide measurable tasks in accordance with predetermined learning objectives through online media used as learning media (Herliandry et al., 2020).

One of the interesting learning media is video. Videos in the form of motion animations that contain learning materials, implementation of learning materials, sample questions to problem solving. Video learning has its own charm because it involves the senses of hearing and sight. However, the learning videos that have been circulating so far have several weaknesses, such as the existence of learning media in the form of videos that require large funds and take a long time and require special equipment in their presentation (Daryono et al., 2020). Based on this, an innovative learning video is needed using only simple tools, the material can be conveyed clearly and easily understood by students.

One of the interesting learning video innovations is using the stop motion technique. This technique is one of the most popular animation-making techniques (Husniah et al., 2020). The technique of making stop motion animation requires considerable patience, but the animation has a unique movement so that it produces a very interesting sensation. The stop motion animation video involves 2 senses (sight and hearing) of students. So that the information conveyed through stop motion graphic animation videos can be absorbed and received maximally by students (Maryanti & Kurniawan, 2018).

Stop motion animation videos are made not only display images and sound, but students can also participate in making the video because it contains procedures for making stop motion videos. In addition, the stop motion animation video also contains elements of STEAM learning. STEAM learning includes 5 disciplines, namely Science (science), Technology (technology), Engineering (engineering), Arts (arts), and Mathematics (mathematic) (Apriliana et al., 2018). In this learning, students can hone critical thinking, be able to increase mastery of understanding, can implement knowledge to solve a problem with the help of technology and creative collaborative learning strategies (Astawan & Agustiana, 2020).

The material chosen in the development of this STEAM-oriented stop motion video is global warming. Students need to have literacy about the material. The importance of environmental education for sustainable living must be applied to students from an early age in order to understand natural problems and current natural conditions. So that it is expected to motivate, preserve, and foster a sense of love for the universe.

Previously, research and development that was relevant to this research by Zanderiyani Sabrinatami had been carried out on videos of making cakes from rice flour using the stop motion technique. Based on research and development to get video results that are feasible to be used as teaching media. The feasibility of the media can be seen from the results of the validation of media experts and material experts as well as student responses which indicate a very feasible category. However, this research and development has a drawback, namely there is no science learning material in it.

Another study by Muhammad Iqbal on alternative media for online learning using a STEM-based YouTube video blog channel. This research and development also gets video results that are suitable for use as teaching media. However, this research has a drawback,



namely not using stop motion techniques in making videos. Based on these two studies, it is necessary to update or differentiate this research from previous research. This research takes the theme of learning video by developing a stop motion animation video which contains STEAM elements with global warming material.

Based on the description above, research and development is carried out with the intention of carrying out further testing. Therefore, researchers are motivated to conduct research on learning videos entitled "Development of Video Stop Motion Graphic Animation Oriented STEAM (Science, Technology, Engineering, Arts, and Mathematics) on Global Warming Materials to improve students' scientific literacy".

Method

The research method used is Research and Development (R&D) which refers to the Borg and Gall development procedure (Sugiyono, 2013). This research includes 7 stages, namely 1) research and information collecting, 2) planning, 3) develop preliminary form of, 4) preliminary field testing, 5) main product revision, 6) main field testing, and 7) operational product revision (Lusiana & Lestari, 2013). The trial was carried out after going through a validity test by media experts and material experts. The trial was carried out at MTs Manbaul Huda Ngalaran Karanganyar Demak involving 28 students of class VII. Meanwhile, the data analysis technique uses qualitative data from quantitative data for the development of STEAM-oriented video stop motion graphic animation products for global warming material in order to determine the feasibility of the developed media. The research uses qualitative and quantitative data analysis techniques. Data analysis refers to filling out the Likert scale. The Likert scale is used to measure the arguments, attitudes, and views of a person or group of people about social phenomena (Sugiyono, 2013).

Results and Discussion

The research and development of stop motion video aims to produce a teaching media product in the form of a STEAM-oriented stop motion graphic animation video that is used for learning activities in class VII in the sub-theme of global warming. Stop motion video is made by applying the stop motion technique. The stop motion technique is a technique of making animation from pieces of images that are interconnected and then combined into a video to form a movement and even an animated story.

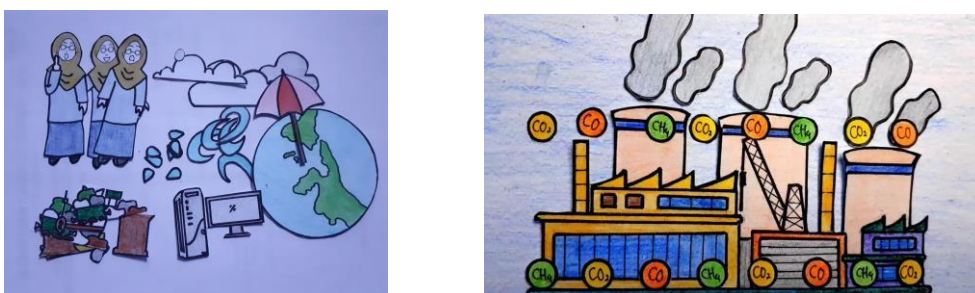


Figure 1. Animation 2D Object

Animation is created by moving 2D objects that are already available. 2D objects are moved slowly and then taken one by one image. After going through the editing process,

when the video is running, it will show a 2D animation that can move by itself (Tonni & Janner, 2020). Based on the technique, stop motion animation in this development uses cell animation type. A popular animation making technique that comes from the word "Celluloid". Each cell animation uses a separate section because a single animation is made up of sheets. For example, an object that can move on its own because the background is separate (Tonni et al., 2020).

This stop motion video was also developed by applying STEAM learning elements in it. STEAM is an integration of several disciplines, namely Science, Technology, Engineering, Arts, and Mathematics. The addition of arts elements in STEAM is a development of STEM. STEAM prioritizes HOTS skills which include independent learning, collaboration, problem solving, project-based learning (PjBL) and research (Apriliana et al., 2018).

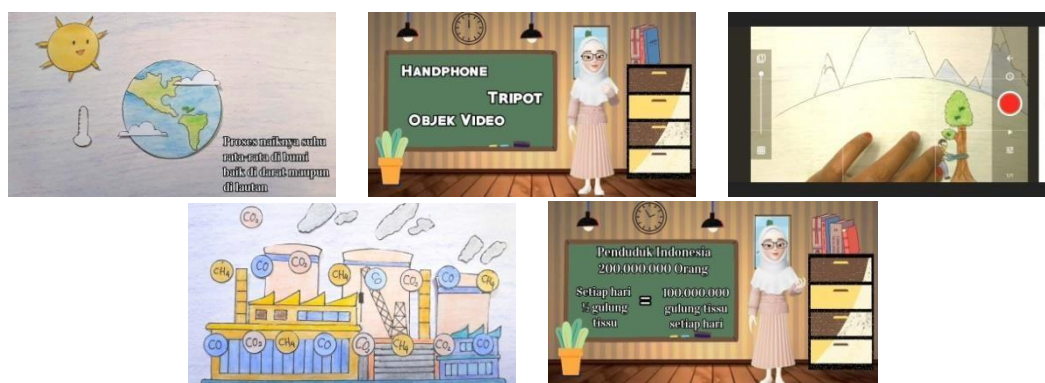


Figure 2. STEAM-Oriented Stop Motion Graphic Animation Video Media

STEAM-oriented stop motion graphic animation video media is designed to present and summarize material using various types of media, namely writing, images, and animations which are made into one clear and interesting video. Stop motion video is an alternative to save costs because now almost everyone, even students, already have smartphones that can easily install stop motion applications.

The development of STEAM-oriented stop motion videos can attract the attention of students to study global warming material. Learning is acceptable through the arts of music and energetic. "Learning is meant to be loud, musical, colorful and energetic" (Justin Reich & Thomas Daccord, 2015), meaning that learning must use high/loud volumes, use music, be colorful, and have strong power. This requires a media that can inspire students, namely using ICT (Information Communication Technology).

ICT (Information Communication Technology) helps to inspire and engage. Inspiration is the key ingredient for creativity. Second, engagement is holds the attention of a class during a lesson, with those unmistakable on task symptoms of focus, rapt listening and energetic responses to teacher instructions (Michelle D. Miller, 2014). This means that information and communication technology helps inspire and attract attention. Inspiration is a key ingredient in creativity. Second, pay attention to a class during learning, clearly on a focus, full listening and high response to the teacher's teaching.

The characteristics of the video used as a reference in the development in this study are as follows; 1) the video was developed with a class VIII global warming material, 2) the learning in the video includes elements of STEAM (Science, Technology, Engineering, Arts,

and Mathematics) learning with stop motion techniques on global warming material, 3) the video emphasizes learning that invites students to think creatively and innovatively that STEAM learning can be obtained from simple materials, 4) learning is supported by mobile media facilities that can be taken anywhere and anytime, making it easier for students to learn, and 5) the stages in product development are as follows.

Based on the assessments made by media experts and material experts, the development of STEAM-oriented stop motion graphic animation video on global warming material for SMP/MTs shows a high valid level. So it is very feasible to be used as a learning medium in teaching and learning activities in class VII MTS Manbaul Huda Ngaluran Karanganyar Demak.

The assessment carried out by media experts in this case stated that it was very good with a very worthy category for use as a learning medium. The percentage of two aspects, namely the display aspect of 90.7%, and the audio aspect of 96%. The average obtained for all aspects is 92%. The details of scores from several aspects are as follows.

Table 1. Media Expert Assment Resultsses

No.	Aspect	Total score	Percentage	Average	Criteria
1	Display aspects	68	90.7%	4.53	Very good
2	Audio aspect	24	96%	4.8	Very good
	Total	92	92%	4.6	Very good

The details of the display aspect and the audio aspect that must be considered are first, the display aspect (Yuwanita, 2016) includes text that can be read well, background graphic selection, text size and typeface, accuracy of color and graphic selection, quality of supporting images, animation presentation, video presentation, clarity of video sequence, clarity of instructions, typography, well-organized video media design, accuracy of font selection, accuracy of media ordering, and placement and use of buttons, and ease of use of media. Second, the audio aspect (Yuwanita, 2016) includes voice clarity and clarity, soundtrack quality, music instrument sound does not interfere with students' concentration, music instrument stipulation, and music instrument sound gives effects according to the material.

The development of stop motion videos can also streamline learning time by only taking one hour of theory learning. Apart from this, comments and suggestions were obtained to improve the stop motion video visually. Then do no further related to the improvement and refinement of the learning media. The researcher then revised the product according to the comments and suggestions given by the validator before the product was tested for use to students.

In addition to assessments from media experts, assessments were also carried out by material experts in this case stating very good with a very worthy category for use as a learning medium. The percentages of the three aspects are 83.6% content and material aspects, 80% language aspects, and 96% STEAM learning aspects. The average obtained for all aspects is 84.8%. The details of scores from several aspects are as follows.

Table 2. Material Expert Assessment Results

No.	Aspect	Total score	Percentage	Average	Criteria
1	Content and material aspects	46	83.6%	4.18	Very good
2	Language aspect	36	80%	4	Well
3	Aspects of STEAM learning	24	96%	4.8	Very good
Total		106	84.8%	4.24	Very good

The details of the content and material aspects, language aspects, and STEAM learning aspects that must be considered are first, the content and material aspects (Yuwanita, 2016) include the relevance of the material to the basic competencies, the material presented is systematic, the material is clear and specific, the material is in accordance with the formulated , accuracy of sentence structure and easy to understand language, material according to the level of ability of students, coverage of material related to the sub-themes discussed, clarity of description of global warming material, images used in accordance with the material, and the order of material presented according to the needs of students , as well as the examples given in accordance with the material

Second, the language aspect (Yuwanita, 2016) includes the language used appropriately, the language used is communicative, the writing is in accordance with the EYD that has been refined, the language is easy to understand, and does not cause double meaning, the grammar used is easy to understand and shows semicolons, use good and correct Indonesian, standard and official language, and show capital letters. Third, aspects of STEAM learning (syukri et al., 2013) include science, technology, engineering, arts, and mathematics.

After validation by media experts and material experts, the next process is to improve the product before testing the product. The trial process was carried out to measure the satisfaction and response given by students to stop motion videos. The product trial process was carried out twice using small-scale trials and field trials.

A small-scale trial was conducted by 7 seventh grade students at MTs Manbaul Huda Ngaluran Karanganyar Demak. The results obtained from small-scale trials obtained an average percentage of 96.95% with a very satisfied category. Details of the percentage of satisfaction can be seen from several aspects, namely the display aspect of 96.33%, the content and material aspect of 98.57%, the usefulness aspect of 98.3%, and the language aspect of 91.4%. While the results obtained from field trials obtained an average percentage of 85.7% with a very satisfied category. Details of the percentage of satisfaction can be seen from several aspects, namely the display aspect of 86.63%, the content and material aspect of 89.28%, the usefulness aspect of 83%, and the language aspect of 85.7%. The details of scores from several aspects are as follows.

Table 3. Results of Student Responses on Small-Scale Trials

No.	Aspect	Total score	Percentage	Average	Criteria
1	Display aspect	236	96.33%	4.82	Very good
2	Content and material aspects	69	98.57%	4.93	Very good
3	Aspects of benefit	172	98.3%	4.91	Very good
4	Language aspect	32	91.4%	4.47	Very good
	Total	509	96.95%	4.85	Very satisfied

Table 4. Results of Student Response Field Trials

No.	Aspect	Total score	Percentage	Average	Criteria
1	Display aspect	849	86.63%	4.33	Very good
2	Content and material aspects	250	89.28%	4.46	Very good
3	Aspects of benefit	581	83%	4.15	Very good
4	Language aspect	120	85.7%	4.28	Very good
	Total	1800	85.7%	4.28	Very good

In addition to student responses, responses from educators or teachers are also needed to determine the feasibility and usefulness of video as a learning medium. The results of the teacher's assessment of the stop motion video with details of the display aspect of 88.3%, the content and material aspects of 95%, the usefulness aspect of 100%, the language aspect of 95%, the audio aspect of 96%, and the STEAM learning aspect of 88%. The average obtained for all aspects is 92.5% in the very good category. The details of scores from several aspects are as follows.

Table 5. Teacher Response Results

No.	Aspect	Total score	Percentage	Average	Criteria
1	Display aspect	53	88.3%	4.42	Very good
2	Content and material aspects	38	95%	4.75	Very good
3	Aspects of benefit	10	100%	5	Very good
4	Language aspect	38	95%	4.75	Very good
5	Audio aspect	24	96%	4.8	Very good
6	Aspects of STEAM learning	22	88%	4.4	Very good
	Total	185	92.5%	4,625	Very good

At this stage, there was a good response from the teacher that the stop motion video product was very interesting and made students understand science material. After several stages of product development, the final result of the learning video product is a stop motion graphic animation video oriented to STEAM on global warming material at the SMP/MTs level. The development of stop motion video produces one video with a duration of 12 minutes 38 seconds. The technique used in making the video is a stop motion technique. This video is 260 MB in size with MP4 format. The video editing process uses the stop motion

studio application and the kinemaster application. Distributed in the form of a google drive link to teachers and students at MTs Manbaul Huda Ngaluran Karanganyar Demak so that it can be used anytime and anywhere.

The advantages of the STEAM-oriented stop motion graphic animation video media on global warming material at the SMP/MTs level that have been developed include; 1) students are greatly helped to understand the material with the stop motion video about global warming class VII, 2) does not require an internet network in its use so it can be accessed offline, 3) stop motion video media is not boring because of the writing, pictures, audio, and the presence of prominent artistic elements, 4) the combination of 2D animation with stop motion animation can make learning media more interesting, 5) stop motion video media uses, unique technique, namely the stop motion technique, 6) the stop motion technique requires high patience and patience in its manufacture so that it can help students to have these characteristics, and 7) stop motion videos are also STEAM learning oriented.

The shortcomings of the STEAM-oriented stop motion graphic animation video on global warming material at the SMP/MTs level that have been developed include; 1) stop motion video media takes a long time to make, 2) stop motion animation can't be said as a whole stop motion, there are still some adaptations from other animations in the opening and explanation sections, 3) stop motion video media only has 1 video.

Conclusion

Based on the results of research and development that has been carried out, it can be concluded that the process of developing a STEAM-oriented stop motion graphic animation video on global warming material is carried out through several stages, namely making a story board, preparing the tools and materials needed followed by making videos, editing videos with stop motion applications. studio and kinemaster. In addition, stop motion video media based on the assessment of media experts obtained the category of "very good" with a percentage of 92%, while the assessment of material experts obtained the category of "very good" with a percentage of 84.8%. The response of students to the satisfaction of learning media in the form of stop motion videos is very satisfied. The results of trials on a small scale get an average score percentage of 96.95% and field trials get an average score percentage of 85.7%.

Acknowledgment

Thanks to also parties who have succeeded in carrying out research activities that we cannot mention one by one.

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