IMPROVING STUDENTS' UNDERSTANDING AND MOTIVATION IN SCIENTIFIC THINKING WITH THE DEVELOPMENT OF A MOTION GRAPHIC ANIMATED VIDEO IN ELEMENTARY SCHOOL.

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Abstract

In the era of society 5.0, we often find several educators who are still unable to utilize existing technology into an interesting learning medium. One effort that can be made is to create learning media by utilizing the latest technology. This research aims to produce a Motion Graphic animated video media design to increase students' motivation and understanding of scientific thinking in elementary schools. This research uses the Research and Development (RnD) development method using Dick and Carey (DnC) analysis to produce products in the form of Interactive Videos. Data collection techniques use observation, instruments, documentation, pre-test and post-test. The results of this research are: 1) The level of feasibility of the Motion Graphic animated video media is said to be feasible as proven by the test results of 3 experts, namely media and design experts, language experts, and material experts. The validation results for media and design experts with a mean of 94 (very valid), validation for language experts with a mean of 94.4 (very valid) and material experts with a mean of 92.1 (very valid). 2) The level of media effectiveness from the results of the t test analysis with a sig value. (2-tailed) or t-test p-value of 0.02, which means <0.05, indicating that there is significance in the application of Motion Graphic animated video learning media which has an effect on increasing students' motivation and understanding so that students' scientific thinking abilities develop smoothly. either through the use of this animated video media.

Keywords: *Student Understanding; Student Motivation; Scientific Thinking; Motion Graphic Animation; Learning video.*

Introduction

The National Education System Law No. 20 of 2003 article 3 states that the purpose of national education is to develop skills and form the character and civilisation of a decent nation in the framework of the nation's spiritual life. (Purwati and Fauziati 2022) The learning process about the Water Cycle requires detailed explanations and examples so that students can more easily understand the process by process of the irrigation cycle. The author is interested and intends to make a Motion Graphic animation video about the Water Cycle to help the learning process. This animated video is still rarely used by educators as learning media. Basically, educators must be able to master technology in the era of society 5.0.

However, in its application, educators still cannot redevelop it into learning media that can attract students' interest in learning. With the phenomenon that the author encounters today, the Alpha generation tends to

have an interest in learning through interesting video media. Efforts that need to be made by educators in balancing student interest in learning by using the right learning media.

The changing learning system is a big problem for the world of education which causes problems with the readiness of schools, teachers and students. However, there are still some schools that are not equipped with facilities and infrastructure that support the learning process. (Adikara et al., 2022) In this sophisticated era with technological developments, it is still found that educators use media in the form of images or do not use media at all for various reasons, especially for educators who are elderly often have difficulty in operating digital media, then the reason is because to make media it requires a manufacturing process that requires a lot of tools and materials and is relatively expensive.

Even though they themselves almost 24 hours use digital media, especially Hand Phones (Hp). However, they do not know how to utilise and develop digital media into learning media that is interesting and effective, easy and saves more budget. Because at this time many video editing applications on the PlayStore have presented various features that make it easy for users to make interesting videos. As for other statements based on problems that have recently been encountered in Indonesia. There are students who do not have smart phones, experience limited internet networks (especially in 3T areas), lack of interactive students, especially when learning is done online, low attendance of students. (Nugraha et al., 2021)

This research refers to previous research conducted by (Efendi, Adi, and Sulthoni 2020) with the aim of producing Motion Graphic animation videos on single and mixed object science subjects. With the results of trials conducted on grade V students of SDN Pandanrejo 1, it was an individual trial test by getting 100%, group trials 97%, large group trials 97.3%. In addition, based on the student learning outcomes test, the number of students who reached the KKM reached 81.39%. With the conclusion that this Motion Graphic animation video media research is said to be effective and feasible to use in the learning process. Other previous research, (Rusdiansyah and Leonard 2021) conducted research with the use of Motion Graphic media in mathematics subjects, with the aim of students being more enthusiastic about learning mathematics. And measuring the level of enthusiasm for learning and student learning focus.

The shortcomings in this previous research are in the research conducted by Efendi, Adi and Sulthoni in 2020. Researchers only use learning outcomes tests using post tests to get the overall average results of students who are able to achieve KKM. Meanwhile, in the research conducted by Rusdiyansyah and Leonard in 2021. Researchers have not conducted large-scale tests so that follow-up is still needed to test the creativity of using the Motion Graphic video media developed.

In research conducted by Muhammad Dzulfi Muwaffaq with the title Interactive Learning Media for the Introduction of Human Digestive Tracts with Mobile Devices (Muwaffaq et al., 2020) explains about interactive learning media through games that contain images, text, sound, and animation that can be accessed by android devices to help facilitate student learning activities. However, this game application is only available in the form of a google drive link and is distributed via social media such as Facebook, WhatsApp, and Instagram. So this application is not yet available on Playstore.

The comparison in previous research and current research is that in previous research (Fauzi & Wibowo, 2021) animated video media was developed using Adobe Photoshop application editing on a laptop or computer. Whereas in current research, the media developed is edited using the CapCut application which

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can be downloaded on the playstore on a smartphone, making it easier for everyone to access and edit with applications that can be downloaded on a smartphone. And the difference lies in the content of the media. The latest media has been equipped with Al-Qur'an verses in it related to this "Water Cycle" material. The state of the art in this research is to create interactive and up-to-date learning videos, which are packaged in motion graphic animation videos to increase learning motivation and understanding of students through presenting steps in the "Water Cycle" material in a systematic and interesting way. Such learning is integrated in technology that is developed creatively and innovatively (Kusumahwardani et al., 2022). By utilising technological developments that are increasingly advanced and developing. The existence of various video editing application features on PlayStore makes it easy to make this animated video media.

Objectives

In the future, technological developments will be more advanced. Education will undergo continuous reform following the times. As is the case with learning in schools today which is centred on online-based learning. By making it easier for users to obtain any data and information obtained automatically in a short time (Student et al., 2021).

In the study (Ratmasari. 2020) stated that efforts to increase student interest in learning can be done by using image media. Meanwhile, in another statement (Gandamana & Marisa, 2022) stated that learning using image media is called monotonous because it does not involve students in learning. In addition, the learning tools that are often used by teachers are the blackboard and package books as a guide for teachers and students.

The urgency of this research is to provide convenience and solutions for the formation of students' learning motivation on water cycle material. Because learning becomes more interesting and easier to capture their understanding when learning by using media. With this research, researchers can measure the extent of students' scientific thinking when learning using media and without using media.

The ability to think Saintific students who are still low, so it needs to be trained because of the lack of planting the concept of a good composition function to students, so that the thinking ability of students is not well developed. In order for students to easily understand the basic concepts in learning, the role of the teacher is the main key in the success of the learning process. Teachers must be able to improve students' thinking skills with learning objectives will be achieved if the learning process goes well. (Wulandari et al., 2022) So that these problems can be overcome with this animated video that can help students. Besides being able to increase learning motivation, animated videos can also help students think scientifically. (Purwati, 2022) as for the application of a scientific approach in learning at school, the aim is to train students to think, behave and work in accordance with scientific rules and steps. And learning will be more important than learning outcomes. Participants feel more significant than student understanding. (Nurdyansyah H. M., 2015).

Technology and information are increasingly showing progress, with the human drive to improve efficiency and effectiveness in carrying out daily activities. Coupled with the development of information sources that are easy and can be accessed anytime, anywhere and by anyone, making it easier for users to get new information. Therefore, it can be predicted that in the future, technology will be an important part of human

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life. Not only being a tertiary item, but becoming one of the main human goods in helping and increasing the effectiveness and efficiency in human activities. All aspects of life will use technology, including education (Hapsari et al. 2019).

Through the role of technology, it is hoped that the animation about the Water Cycle can be more interesting, modern and accompanied by detailed information so that it is easily understood by students in the learning process. This animation is made using Cap Cut as one of the main applications in making with the use of Motion Graphic techniques.

Motion Graphic is a piece of animation in digital recording that creates the illusion of movement or rotation that is usually combined with audio media projects used in multimedia projects with a display that changes over time. By combining audio and images, it can provide satisfaction and affect the emotional of the audience. Motion Graphic is often used in television broadcasts or films. Motion graphics often use animation as a technique. Motion Graphic is included in one of the audio visual media. (Rusdiansyah and Leonard 2021). Audio visual is a reference to the combination of sound components and image components. Some examples of audio visual presentations include films and TV programmes.

Learning media is adapted from the characteristics and abilities of students which makes this learning media unique that is not found in other learning media. In addition, the learning model included in the media is a description of learning, learning environment, and the use of learning tools that are arranged systematically. (Safruddin & Prastowo, 2022)

Audio visual media is a Motion Graphic animation video. Audio-visual teaching materials are teaching materials that combine two materials, namely: visual material and auditive material. Visual material aims to stimulate students' sense of sight, while auditive material aims to stimulate students' sense of hearing. With the combination of the two materials, educators can create a higher quality learning process due to affective communication. (Nyiayu Fahriza Fuadiah et al. 2021). Video animation is a moving image of a set of objects that are specially arranged so that they can move according to a predetermined trajectory. What is meant is pictures and text writing. Animated videos are used to attract learners' attention if used correctly. However, animated videos can also distract learners from the content of the material presented by the educator and overwrite the content of the material. (Semara and Agung 2021).

Interactive learning media can be in the form of video, image, text and audio media that can be used for self-study or learning with the teacher. (Ernawati, 2017) The advantage of this animated video media is that it can be played repeatedly and can shorten time and help clarify something that is considered complicated. (Hulqi & Arifin, 2022)

The description above aims to develop this animated video so that students can more easily capture the learning presented in the form of interesting animated video media with detailed information. Learning by using this video media is very helpful and useful to facilitate students' understanding clearly and concretely. (Wahyuni et al., 2021) With the aim that students can be motivated and active students in constructing concepts, principles that are passed at the observation stage (finding problems), formulating problems, formulating hypotheses, and collecting data with the correct technique. So that the students' scientific thinking skills are also trained here.

Method This research was prepared using the Research and Development (RnD) development method by using the Dick and Carey (DnC) analysis as the design of the learning model developed and producing products in the form of Interactive Videos, while the stages are: (1) analysis of needs and objectives; (2) conduct instructional analysis; (3) learning analysis and contextual analysis; (4) set performance objectives; (5) develop instruments; (6) develop educational strategies; (7) development and selection of teaching materials; (8) design and conduct formative assessments; (9) revised instructions; (10) design and conduct summative evaluations. The 10th method was not continued due to cost, time and third party constraints.

 This research uses the development research model, namely Dick and Carey. Prawidalaga (2008) states that the research model is a graphical display, a systematic work procedure that contains descriptive or explanatory thoughts along with suggestions. Meanwhile, Smith (2010) explains that a research model is a mental picture of a person that helps that person understand the content of something abstract, in the sense that it cannot be seen and experienced directly. The outline is that the model means systematic, procedural, conceptual and theoretical work steps.

This research explains the Motion Graphic animation video learning design by presenting the planning stages that have been adopted from the Dick and Carey (2015) development model. The steps in the Dick and Carey model are as follows:
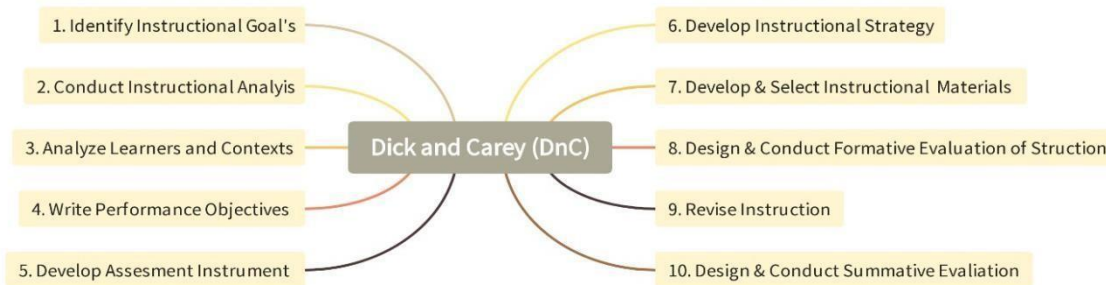

Figure 1: Dick and Carey Development Steps

Based on the figure above, the use of the Dick and Carey (DnC) learning model in the development of a subject intended in this study includes: (a) at the beginning and end of the learning process, students are able to know and do the material that has been learned; (b) there is a connection between each component, especially the learning strategy and the intended learning outcomes; (c) you must perform the steps included in the learning design plan described.

 Likewise, the making of this 2D video goes through pre-production, production, and post-production stages. (1) the pre-production stage becomes the initial stage in determining the theme, concept, and various preparations for making 2D animation videos. such as the use of unak devices, storyboards for 2D animations to be made; (2) the production stage becomes the stage of making 2D animation videos with

the process of compositing, editing, and rendering; (3) the post-production stage is the final stage in the implementation of making 2D animation videos. By testing and implementation.

Supported by the instrument as a measuring tool used to obtain information and research data containing characterised variables and data objectively. As a form of steps in finding the results or conclusions of the research that has been done.

Table 1. Criteria for Validity of 2D Animation Video Instrument

Intervention Score	Assessment Category	
$3,6 \leq P < 4$	Very Valid	
$2,6 \leq P < 3,5$	Valid	
$1,6 \leq P < 2,5$	Less Valid	

Description
Without revision
Minor revisions Many revisions

$1 \leq P < 1,5$	Not Valid	Not usable

The trial in this research consisted of two stages, namely media feasibility testing and design feasibility testing. The feasibility test was carried out through expert validity on motion graphic animation video media. In this research, the feasibility test was calculated using a Likert scale test. The media suitability test can be calculated using the following formula:

$$EV = \frac{SO}{MSO} \times 100\%$$

Information:
EV = Expected Value
SO = score obtained
MSO = maximum score obtained

Results

This research produces learning innovation products in the form of learning media in the form of motion graphic animation videos in elementary schools. This learning innovation product is used in schools in order to optimise learning that is valid and tested. Validity testing was conducted by media and design experts, and linguists. Media and design experts are tested by experts who are experienced in the field of media and learning design at the elementary school level. Then linguists were tested by certified school teachers. The validity test of the expert team aims to get validation presented from the product developed, so that there is an increase in pre-test and post-test results.

The results of this research are as follows:
a.   Assessing Needs to Identify Goals

At this stage the researcher made observations with the 5th grade teacher who teaches at SDM 8 Tulangan and obtained data that is the sarpras available at school supports learning by using video media. However, educators still use learning media in the form of pictures.

b.   Instructional Analysis

The end result of the instructional research process is to determine the understanding of scientific thinking of students in order to achieve the main objectives of learning. The competencies that exist in the 5th grade Natural Science subject theme 8 subtheme 1 material about Caring for Plants: (1) Learners are able to identify the Water Cycle process; (2) Learners are able to explain the Water Cycle process; (3) Learners are able to make a water cycle chart.

c.   Learning and Context Analysis

Researchers conducted an analysis of learning characteristics by conducting observations and providing instruments to determine students' understanding of learning. Then the following results were obtained:

1)   The average age of learners who are research subjects is between 10-11 years old and some of the learners have scientific thinking skills that are starting to be perfect or critical in abstraction.

2)   Learners only know about animated video media, but they rarely learn to use animated video media.

3)   Learners currently use digital technology more often.

d. Formulating Learning Objectives

Learning objectives in this stage are formulated based on the competencies contained in the 2013 curriculum. So, after carrying out learning activities, it is expected that students can understand the material easily and apply it in various forms and contexts of diverse learning environments independently and responsibly. e. Developing the Instrument

Table 2. Learning Outcomes Assessment Grid

Subject Matter	Objective Test Cognitive Level						Number of Questions
	C1	C2	C3	C4	C5	C6	
Understand the water cycle	1	2, 3	-	-	-	-	3
Practise the water cycle sequence correctly	-	-	10	-	-	-	1
Utilisation of water for human life	4,5	-	-	-	-	-	2
What happens if water is absent/extinct	6,8	7	-	-	-	-	3
The importance of protecting the environment	-	9	-	-	-	-	1
Total	**5**	**4**	**1**	**-**	**-**	**-**	**10**

To measure the level of understanding and scientific thinking of students, a pre-test and post-test were conducted on a small group of 5 students of grade 5 SD Muhammadiyah 8 Tulangan. The data from the pre-test and post-test can be seen in Figure 2 below.
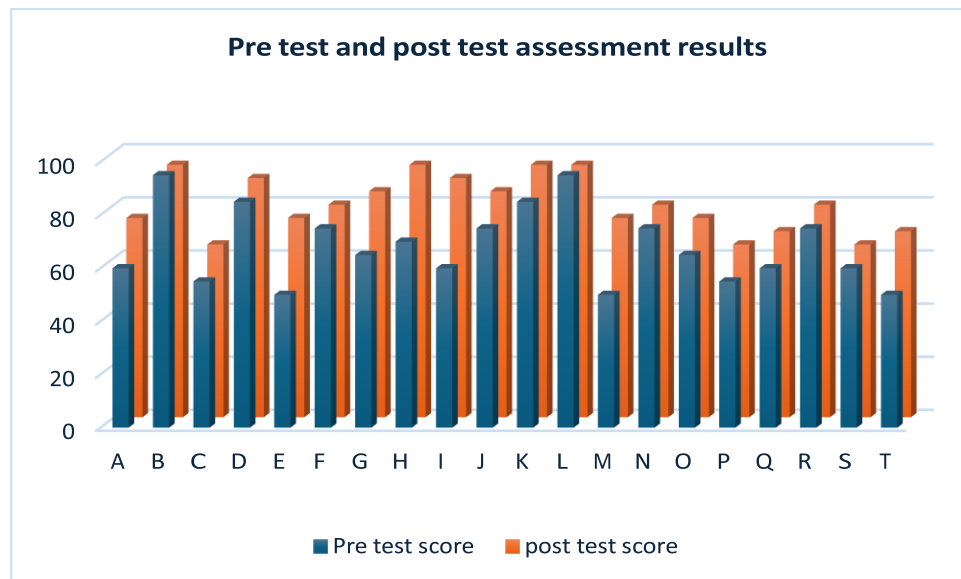
Based on the picture above, the average pre-test result score is 68, while the average post-test result score is 80.25, there is an increase of 12.25 points. In general, it can be concluded that there has been an increase in students' understanding of learning from the results of pre-tests and post-tests which have been tested without using Motion Graphic animation video media and after learning using Motion Graphic animation videos.

Discussion

Stage of Developing Learning Strategies, The learning strategy and model used in this research in learning activities is a mix method (lecture and assignment method) which includes learning objectives and activities.
Stage of Developing and Selecting Teaching Materials. The stages for developing animated video learning media, researchers create stryboards and products to develop animated video learning media tailored to the material that will be presented during implementation in class.
Formative Evaluation Stage. This evaluation stage is carried out by distributing feasibility test questionnaires to individual experts. the results are as follows:

Table 3. Media and Design Expert Test

No	Aspects Assessed	Validators	Criteria
1.	Clarity of video title	95	Very Valid
2.	Animation layout suitability	90	Very Valid 3. Ease of use of videos 100 Very Valid 4. Text layout on images 90 Very Valid
5.	The colors used in the video are comfortable to look at	95	Very Valid

6.   Suitability of background selection   85   Valid
7.   Consistency in color use   98   Very Valid
8.   Accuracy in selecting the type of text and fonts presented   95   Very Valid 9.   Accuracy in selecting the font size presented 96   Very Valid
10.   Animation is easy to understand   100   Very Valid
11.   Appropriateness of the animation used in the material   99   Very Valid 12.   Suitability of images used in the material   99   Very Valid 13.   Accuracy of sound presentation 90   Very Valid 14.   Sound/audio quality   90   Very Valid
15.   Video display quality   90   Very Valid
16.   Appropriateness of the use of video to the material   96   Very Valid
17.   Use of words, images, sounds and videos that are related   87   Valid
to each other
18.   Presentation of material using interesting videos and   95   Very Valid
narratives

	97	Very Valid
Average	**94**	**Very Valid**
Percentage	**89%**	19.

Presentation of material is not excessive

Based on the table above, it can be seen the results of consultations with media and design experts in the first and second stages regarding Motion Graphic animated video media on water cycle material to increase students' motivation and understanding of scientific thinking. As stated in the table above. At this stage it is 89%. The percentage results are obtained from the total score times the weight of the highest component divided by the number of statements times the weight of the highest component multiplied by 100% as formulated in the Ridwan formula.

$$\text{Precentag} = \frac{\sum \square score \ x \ component \ weight}{n \ x \ highest \ score} \ x \ 100\%$$

$$\text{Precentag} = \frac{17 \ x \ 4}{19 \ x \ 4} \ x \ 100\% = 89\%$$

Table 4. Language Expert Test

No	Aspects Assessed	Validators	Criteria
1.	The effectiveness of the sentences used in the video on the water cycle	98	Very Valid
2.	Suitability of language used in water cycle material videos	93	Very Valid
3.	Accuracy of punctuation used in water cycle video material	89	Valid
4.	The language used is in accordance with EYD	95	Very Valid
5.	The language used is formal	97	Very Valid
	Average	**94,4**	**Very Valid**

	Percentage	80%

Based on the table above, it can be seen the results of consultations with linguists regarding Motion Graphic animated video media on the water cycle material to increase students' motivation and understanding of scientific thinking. In the first stage, the percentage of media and design experts was 80%. The percentage results are obtained from the total score times the weight of the highest component divided by the number of statements times the weight of the highest component multiplied by 100%. These results identify that the Motion Graphic animated video media product is linguistically very valid.

The following are the results of material expert tests to see the validity of Motion Graphic animated video media products:

Table 5. Material Expert Test

No	Aspects Assessed	Validators	Criteria
1.	The material is in accordance with the curriculum	96	Very Valid
2.	The material is in accordance with competencies, indicators and learning objectives	95	Very Valid
3.	Clarity of learning outcomes	92	Very Valid
4.	Consistency of content/description of material	98	Very Valid
5.	Clarity of example questions accompanied by discussion	97	Very Valid
6.	Suitability of material to purpose	96	Very Valid
7.	Conformity of material content with standard concepts	90	Very Valid
8.	Clarity of instructions for working on questions	93	Very Valid
9.	The series of questions presented	95	Very Valid
10.	Difficulty level of questions	85	Valid
11.	Suitability of practice questions to learning outcomes	96	Very Valid
12.	Clarity of summary	95	Very Valid
13.	Presentation of a bibliography/reference list	70	Valid
	Average	92,1	Very Valid
	Percentage	84,4%	

According to the results of the table above, it can be seen the results of consultations with material experts regarding Motion Graphic animated video media on the water cycle material to increase students' motivation and understanding of scientific thinking. As stated in the table above. In the first stage, the percentage of media and design experts was 84.4% (Very valid). The percentage results are obtained from:

$$Precentag = \frac{\sum \square score \; x \; component \; weight}{n \; x \; highest \; score} \; x \; 100\%$$

$$Precentag = \frac{11 \; x \; 4}{13 \; x \; 4} \; x \; 100\% = 84,4 \; \%$$

After completing the expert test stage, a small group trial was carried out on 5 students. Based on good, medium and low levels of ability, the results of the assessment are the feasibility of expert trials and the

effectiveness of media use. It is necessary to carry out a comparison test using the following Paired Sample T test:

Table 6. Paired Sample Statistic

		Mean	**N**	**Std. Deviation**	**Std. Error Mean**
Pair 1	Pre Test	78.00	5	13.038	5.831
	Post Test	92.00	5	8.367	3.742

Paired samples, namely Pre Test and Post Test samples, carried out media tests on students. The data shows an average test score of 78.00 from the 5 amounts of data used. With a standard deviation of 13,038 and a mean standard error of 5,831, the data obtained after carrying out the test shows an average value of 92.00 with a total of 5 students' data. It has a standard deviation of 8.367 and a mean standard error of 3.742.

Table 7. Paired Samples Correlation

		N	**Correlation**	**Sig.**
Pair 1	**Pre Test & Post Test**	5	963	.009

From the results of the second output, it is known that the correlation value is 0.963 with a significance of 0.009, because the significance result is 0.009 <0.05, it can be concluded that there is a significant relationship between the test scores before and after. And the relationship that occurs is strong because the correlation value is 0.963 (close to 1).

Table 8. Paired Sample Test

		Paired Difference					**t**	**df**	**Sig. (2tailed)**
		Mean	**Std. Deviation**	**Std. Error Mean**	**Lower**	**Upper**			
Pair 1	**Pre Test – Post Test**	-22.000	13.038	5.831	-38.189	-5.811	-3.773	4	.020

In table 8, it is known that the significance value (Sig. 2-teiled) is 0.020. This states that the 2-tailed Sig < 0.05. So it can be concluded that there is a difference in the test scores obtained between before and after the Motion Graphic animated video media test.
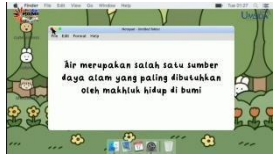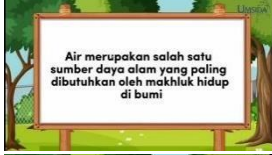
Revision stage. At this revision stage, researchers receive various input from experts and make improvements to the validated product. The input for validated products is as follows:

Table 9. Product Revision

No	Field	Suggestion	Follow-up
1.	Media and Design Expert	1) The font size and type need to be adjusted from the start of the video to the end; 2) the stickers used in the video should be changed to Islamic stickers; 3) Greetings should be in Arabic, not Indonesian.	Everything has been corrected and consulted on, starting from changes to fonts, stickers and the use of greetings.
2	Material Expert	1) Al-Qur'an verses related to the material presented are added so that there are special characteristics as the character of the Islamic study program, 2) the material needs to be integrated with one another so that students have a complete understanding.	1) Al-Qur'an verses have been added according to the material covered, 2) integration of one material with each other has been added so that they are related

3 Linguist 1) There is a small part of the language used It has been corrected in terms of that has not been adapted to the KBBI and 2) KBBI suitability and vocal the voice intonation in the video needs to be intonation and has been emphasized so that it is easy for students to revalidated by linguists. understand.

Table 10. Follow-up by Design & Media Experts

No	Sebelum	Sesudah
1		
2		
3		
4		
5	There are no verses from the Koran yet	
6		

From the table above you can see the changes that have been made and have been verified by experts so that this product can be implemented in schools as a new innovation in developing the learning media being taught.

Recommendation

The level of feasibility of this Motion Graphic animated video media is said to be feasible as proven by the test results of 3 experts. To find out whether a product is suitable or not, researchers need to carry out expert trials. These include media and design experts, language experts, and material experts. The validation results of media and design experts with an average of 94 (very valid), validation of language experts with an average of 94.4 (very valid) and material experts with an average of 92.1 (very valid).

The level of effectiveness of the Motion Graphic animated video media was obtained from the results of the pre-test and post-test of students using SPSS 25 analysis. The results of the t-test analysis of the Water Cycle material showed an average pre-test score of 68.00 and post-test 80. .25. Because the sig value. (2-tailed) or the p-value of the t test is 0.02, which means <0.05, so it can be concluded that Ho is rejected and Ha is accepted. This shows the significance of the application of Motion Graphic animated video learning media which influences the average pre-test and post-test scores.

Thus, the Motion Graphic animated video media product on the Water Cycle material can be said to be suitable and effective to use and has good quality to increase students' motivation and understanding in scientific thinking.

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