



Development of Musculoskeletal System Animation Videos (SkelToon) to Increase Learning Motivation

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Abstract

Biological subjects are sciences that study phenomena related to problems in the surrounding environment. Motion system material is a material that must be studied in the field of biological sciences, where the material has the characteristics of difficulty among which there are many concepts and memorization that must be mastered by learners. Therefore, the learning media of Video Animation Musculoskeletal System (SkelToon) was developed to increase learning motivation and the spirit of learning of learners, so that students are able to understand the learning materials learned easily. Based on the results of the media feasibility test by the validator showed that the animation video media designed in the category is very valid, and in this study statistical test using t-test pairs of samples that showed that the significance value obtained in this study is 0.000 which is smaller than 0.05, it can be concluded that the use of SkelToon animated video media is effective in affecting the motivation level of learners in studying on motion system material. Thus, Musculoskeletal System Animation Video (SkelToon) is quite effectively implemented in biological learning in improving students' learning outcomes.

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INTRODUCTION

The development of the globalization era has made competition between countries stronger, this is, of course, a challenge, especially for the government to realize an increase in the quality of the education system (Vegatama, 2018). The challenge of the globalization era for teachers is how teachers can design and take advantage of technological developments in learning activities (Fuad *et al.*, 2020). Technology-based learning process activities are currently being implemented throughout Indonesia due to the impact of the Covid-19 pandemic. The current covid-19 pandemic incident requires students and teachers to adapt to online learning process activities (Jundu *et al.*, 2020). Online learning must make teachers more creative and innovative in designing learning activities. Learning activities are learning using the assignment method or using modules and learning materials provided. Still, teachers also need to apply various learning process activity methods not to lose their interest and motivation to participate in learning activities.

Regarding the increase of interest, learning achievement, and students' motivation to learn, teachers need aids in the learning process, namely learning media (Fitriani *et al.*, 2013). Learning media is a tool or component in learning activities that have an important function and role in supporting learning activities that aim to help students succeed in the learning process (Atsani, 2020). Not all types of media can be applied to the implementation of learning activities, so with this problem, as teacher educators, they must be able to analyze various types of media use that are appropriate and appropriate to be applied in learning activities based on the characteristics of learning materials (Wulandari *et al.*, 2020). Biology subjects are sciences included in the science and technology group, where these subjects study natural phenomena both qualitatively and quantitatively, which are related to their application in solving problems that exist in the surrounding environment (Bahtiar & Dukolamo, 2019). The material for the motion system is a material that must be studied in the field of biology where the material is closely related to the phenomenon of the movement process that occurs in the human body (Nuriyanti, 2013), in the 2013 curriculum, especially in learning the basic competency motion system material required in the material. This is that students are expected to understand the material of human motion systems and disturbances from the motion system. Students are also required to be able to understand the names of the parts that make up the body frame (Rohmatin & Indana, 2017). The motion system material's difficult character is that there are many concepts and memorization that must be mastered by students, for example, the movement of various kinds of joints, as well as the constituent components of the motion system (Alinuha, 2018). Thus, it is necessary to have a learning media that can make students feel helped in mastering a concept or competency of the musculoskeletal system learning material. Good media is a learning media that can generate motivation and enthusiasm for student learning so that students can understand learning material that is learned easily (Yendrita & Syafitri, 2019) and can be under the learning process's objectives, material, and according to their needs. or characteristics in students (Latifah & Lazulfa, 2020). One type of effective media used in this online learning state is animated video-based learning media (Arini *et al.*, 2017; Chan, 2013; Ritonga *et al.*, 2019; Yusuf *et al.*, 2017).

Animated video media is a learning medium in which there is a combination of image, text, audio, and video components containing learning material information (Furoidah, 2019). One of the development software used to design learning media in the form of animated videos is Powtoon. Powtoon is the software's name (online) that facilitates cartoon animation videos concisely and free of charge (Ernalida *et al.*, 2018). The advantages of this Powtoon software are the availability of various complete features such as cartoon character animation, handwritten animation, and transition effects that make the display more lively (Deliviana, 2017). So with the advantages and ease of making animated videos, the teacher can design the desired media according to the learning material's competence. The use of attractive animated videos can make students easily master a concept. The application of the media also helps in understanding difficult material, especially in motion system learning material, because the animated media video that is presented will be made concisely coupled with text and audio that makes students are more relaxed in learning activities (Fakhri *et al.*, 2019; Kwasu & EmaEma, 2015; Ridwan *et al.*, 2013; Semaan & Ismail, 2018), then the use of animated video media can also affect increasing motivation and learning outcomes in

students (Febriani, 2017). This is also proven by the existence of several research findings, including research conducted by Oktarini et al. (2014), where the application of animated video media in learning activities effectively increases student learning outcomes compared to learning media in the form of images. Then, Noviyanto et al. (2015) also show that the use of animated video learning media for the respiratory system can increase the learning process results.

Motivation is encouragement in each individual, with a person's character having a desire to change behavior according to his goal (Uno, 2016). The position of motivation in the learning process is very important where motivation affects students in the learning activity process (Ningsih et al., 2019) because this motivation it will cause students to have feelings of desire and encouragement that make students more interested or enthusiastic about learn and achieve its goals (Jamaris, 2013). Each student certainly has a different level of motivation in terms of learning, so the task of an educator must be able to generate motivation to learn in themselves from each student so that with the emergence of this motivation, it is hoped that students can have enthusiasm in participating in the implementation of the learning process. Based on the explanation described above, this study aims to develop learning media, especially in animation videos, using Powtoon software on musculoskeletal system material. By developing this media, is expected to produce appropriate media and generate student learning motivation.

RESEARCH METHOD

Research Design

This study uses a research design type One Group Pretest - Posttest Design. The research design was an experimental research design in which this study used one group for pretest and posttest treatment (Arikunto, 2007). The type of research method developed is the Research and Development (R & D) method. This Research and Development research method is a method that aims to develop or produce a product and test its effectiveness (Sugiyono, 2009), which is the development in this study is a Powtoon-based animation learning video on motion system material. This research method refers to the 4D (four D) model proposed by Thiagarajan, which has four stages: definition, design or arrangement, development, and dissemination (Thiagarajan et al., 1974).

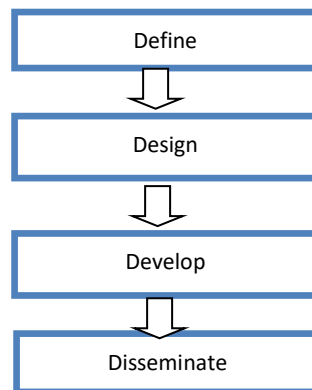


Figure 1. Stages of the model flow

Research Subject

This research was conducted in November 2020 at SMAN 30 Tangerang district, and the research subjects consisted of 21 students from class XI MIPA II.

Research Instruments

The independent variable in this study is animated video media, and the dependent variable is learning motivation. The instrument used in assessing learning motivation was an instrument in the form of a learning motivation questionnaire using the Likert scale measurement type. Likert scale is a scale measurement to assess or measure an opinion, attitude, and perception of a person or group of people related to social phenomena (Sugiyono, 2015). The questionnaire instrument statement items were developed into 25 statement items, and before being used for research, the instrument was tested first to see

the validity of the questionnaire instrument statement. After the validity test was carried out, six items of the questionnaire instrument statement were invalid. Then these six statements are not used in testing the learning motivation questionnaire instrument. Test the validity of the learning motivation questionnaire instrument using testing through the Product Moment correlation formula. The following is a related grid from the development of a learning motivation questionnaire:

Table 1. Indicators Regarding Learning Motivation

Indicator	Statement Number		Sum of Statement	
	Positive	Negative	Valid	Invalid
Desire and passion for learning	9, 11, 16,	1, 13*	4	1
Readiness in the learning process	19, 22	2, 24	-	-
Interest in the learning process	5*, 10,	6, 12,	3	1
Seriousness in following the learning process	3*, 4, 20	18*	2	1
Participate in the learning process	7,8, 15, 17, 21, 23	14*, 25*	6	2

Source : Uno (2016)

Research Procedure

The 4D development stages are as follows: the definition stage is the 4D development model stage, which aims to analyze media needs in learning activities by interviewing teachers and students, then conducting literature studies related to media making and the use of learning media to be designed. The design stage is the stage of compiling or designing motion system learning materials according to the curriculum's application and the competency demands that students must achieve, designing instruments for media validity, designing instruments in the form of questionnaires to measure students' learning motivation. The next stage is the development stage, where the animation video media of learning motion system material is made. After the animation video media has been made, an expert validator will then validate the media. There is input from expert validators, namely related to this animated video media, including the display of text too fast, which causes students to stop the video from reading the information on the animated video media.

Furthermore, after improvements are made by expert advice, the media can be tested on students. Before being tested, students are first given a learning motivation questionnaire to validate the learning motivation questionnaire instrument. The final stage is dissemination. At this stage, students are given a validated learning motivation questionnaire before being treated with animated video media. After being applied with learning media in the form of animated videos, students are also given a learning motivation questionnaire that aims to see students' level of motivation after being treated with instructional animation video media. The following is an explanation of the stages of this research:

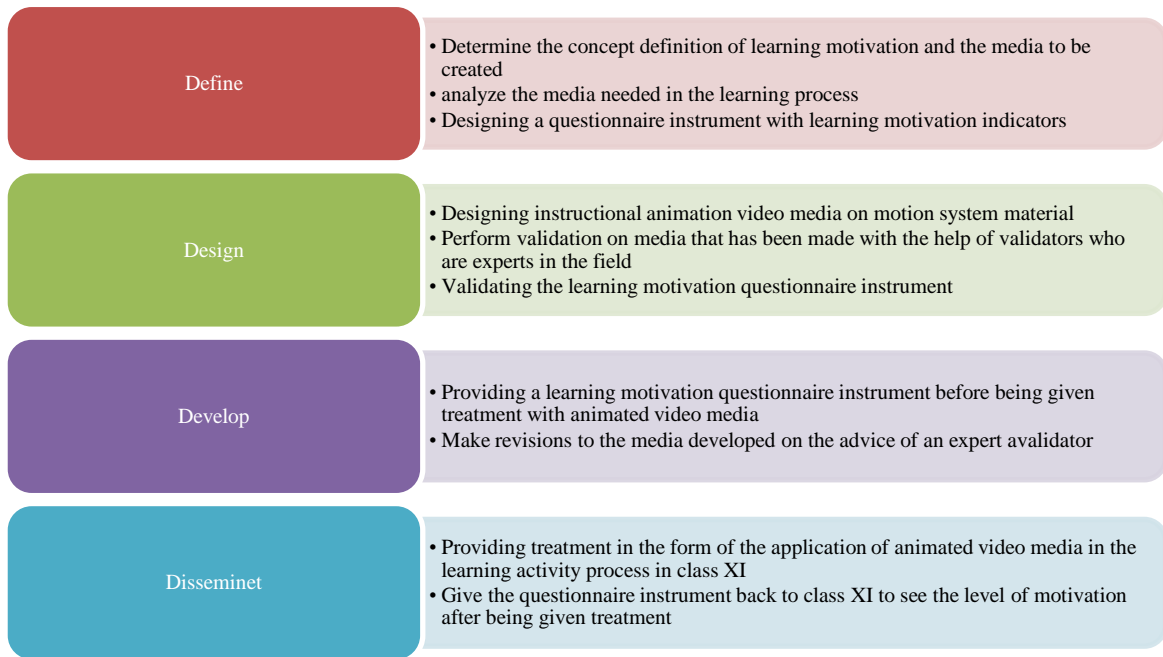


Figure 2. Description of the 4D stages in media development

Data Analysis

The data analysis in this study used descriptive statistical testing and inferential statistical testing. Descriptive testing aims to determine the value of students' learning motivation. In contrast, inferential statistical testing aims to determine how the application of animated video media affects learning motivation. The questionnaire instrument on learning motivation aims to see how it affects the increase in students' learning motivation before being given treatment with animated video media and after being given treatment. The pretest-posttest score calculation data is then analyzed with N-Gain, which aims to see how the increase in learning motivation before the experiment and after. The statistical analysis test used the prerequisite test, namely the Kolmogorov-Smirnov normality test. Testing the analysis using the SPSS 25 application with alpha (0.05), the data obtained in this study were usually distributed. After the normality test was carried out, the next step was to test the hypothesis using the paired sample test and continue with the N-gain calculation.

Table 2. Criteria for measuring the N-gain test

Interval	Category
$(\langle g \rangle) \geq 0,70$	High effectiveness
$0,30 \leq (\langle g \rangle) < 0,70$	Moderate effectiveness
$(\langle g \rangle) < 0,30$	Low Effectiveness

Source: Hake (1998)

RESULTS AND DISCUSSION

Animated video media is learning media containing audio, video, and image media containing learning material (Warsita, 2011). The development of animated video media made by the researcher is the Powtoon animation video media named the SkelToon animation video. The results of the media made by researchers are as Figure 3.

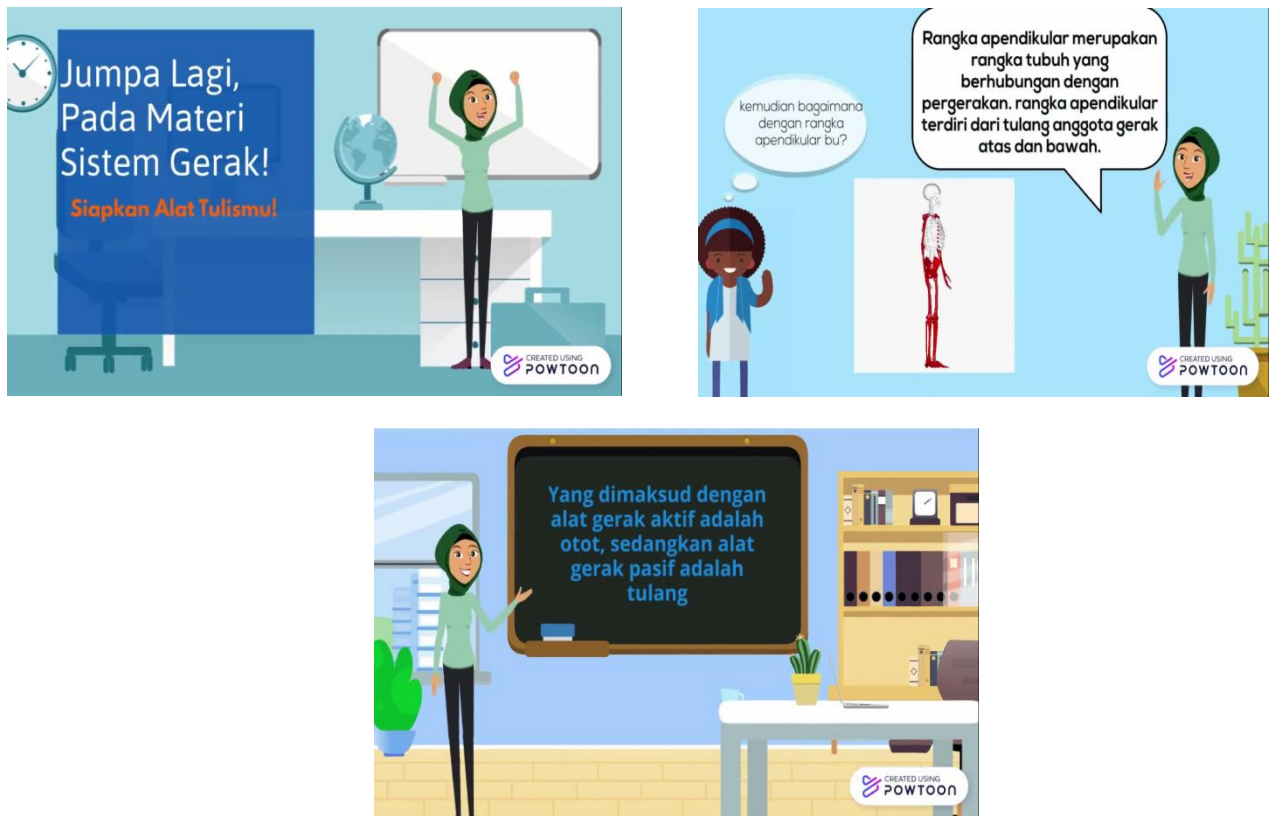


Figure 3. Display of SkelToon Animation Video Media

The development of this musculoskeletal system animation video media named SkelToon where the word Skel- is taken from the word skeleton means the human body frame. In contrast, the word toon is taken from the word animation video media development software, namely Powtoon, which means SkelToon is the development of video animation systems. powtoon based motion.

Media Validation Test Results

After the animated video media has been completed, the next step is to evaluate the SkelToon animation video media development, which is validated by the validator. Two validators in this study are competent in biology education, while the results of the assessment of the two validators can be seen from the Table 2.

Table 3. Validator Assessment Results

Assessment Aspects	Indicator	Validator I	Validator II	Average
Presentation Aspects	The use of text color in the video contrasts with the background display so that the writing can be read properly	4	4	4
	The selection of fonts or letters in the video display is correct	4	4	4
	The font size used in the video is not too big, but it is still legible	3	4	3.5
	Image and animation settings or compatibility in this video is appropriate	4	3	3,5
	The image displayed on the video can be seen clearly	4	4	4

	The selection of the accompanying music used in the video is appropriate	3	3	3
	The illustration of the music used in the video supports the learning process	4	4	4
	The use of SkelToon animated video media is easy to use	4	4	4
	This SkelToon animated video media can be used together or individually	4	4	4
Aspects of Media Usage	This SkelToon animated video media is very light, so it doesn't burden the storage space on student gadgets	4	3	3.5
	This SkelToon animated video media is easy to save	4	4	4
	The material presented is in accordance with the learning objectives.	4	4	4
	The material presented in the instructional animation video media is correct.	4	4	4
	The material in the instructional animation video media has been arranged systematically	4	4	4
	The material presented in the instructional animation video media is clear and easy to understand.	4	4	4
	The language used in presenting the material is clear, communicative, and easy to understand	4	4	4
Aspects of Learning Materials	The presentation of images in the instructional animation video media is in accordance with the material	4	4	4
	The presentation of images in the instructional animation video media can clarify the material	4	3	3.5
	The process of learning activities with this video becomes more interesting and fun	4	4	4
	The use of the SkelToon animated video media makes it easier for teachers to provide material to students	4	4	4
Benefit Aspects of Media	SkelToon animation video media makes it easier for teachers to deliver material to students	4	4	4
	Average	3.9	3.8	3.8
	Category	Very Valid	Very Valid	Very Valid

Table 4. Expert Validation Criteria

<i>Interval Category</i>	<i>Criteria</i>
$3.25 < x \leq 4.00$	Very Valid
$2.50 < x \leq 3.25$	Valid
$1.75 < x < 2.50$	Less Valid
$1.00 < x < 1.75$	Not Valid

Source: Ratumanan & Laurens (2006)

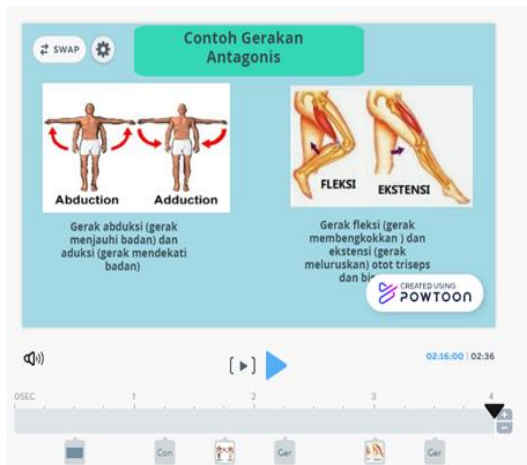
Based on the evaluation of the validator regarding the feasibility of the SkelToon animation video media from the aspect of presentation display, media use, learning material and media benefits, it was found that the powtoon animation video media was included in the very valid category. In making the animated video media SkelToon also has suggestions for improvement from the validator, namely related to the display of text that is too fast so that before being tested, this SkelToon animated video media must be improved. The following are the results of the improvements based on the validator's expert advice:



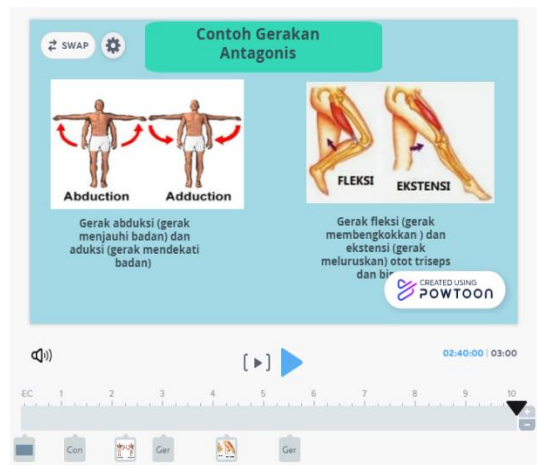
Before



After



Before



After

After making improvements to the text display on the animated video media SkelToon based on the validator's suggestions, the researchers then carried out the SkelToon animated video media's effectiveness stages to increase the learning motivation of students.

Motivation to learn

Measuring students' level of motivation in learning is measured by using a non-test instrument in the form of a questionnaire. The questionnaire instrument was given before applying the SkelToon animation video media and after it was applied. As for knowing the value of the descriptive data obtained regarding the comparison of the results of the maximum and minimum values, the mean and standard deviation of the pretest and posttest can be seen in Table 4 below:

Table 5. Table Description of Learning Motivation data Before Experiment and After Experiment

	N	Minimum	Maximum	Mean	Standard Deviation
Students' motivation to learn before doing experiments	21	40	54	48.86	3.306
Students' motivation to learn after the experiment	21	57	65	61.43	2.399

Based on the data description table, it can be seen that the minimum score of students' learning motivation before implementing the SkelToon animation video media is 40, while the highest score of students' learning motivation is 54 with an average of 48.86 and the standard deviation is 3.306. Meanwhile, the minimum score of students' learning motivation after applying the SkelToon animation video media was 57, and the highest score was 65, with an average of 61.43 and a standard deviation of 2.3999. After the description data is known, the researcher then performs the normality calculation test, which is used to test the prerequisites in conducting hypothesis testing. The results of the normality calculation test can be seen in Table 5.

Table 6. Test Results for the Calculation of Normality Prerequisites

	Asymp. Sig (2-tailed)	Explanation
Before the experiment was applied	0.200	Normal
After the experiment was implemented	0.104	Normal

The calculation normality test was tested with the Kolmogorov-Smirnov calculation through the SPSS 25 application. Based on the related table, the normality test results show that the value of the data obtained before the experiment is 0.200. After the experiment was applied, the value was 0.104. Because the significance value of the two students' learning motivation is greater than the value of 0.05, the data obtained in this study are normally distributed. After calculating this value, the data is normally distributed. At this stage hypothesis testing is carried out, where this test uses paired sample t-test. as for the results of these calculations are obtained a significance (Sig. (2-tailed)) with a result of 0.00, which means that in the research conducted by the researcher, there was a significant difference between the motivation before and after the treatment was applied using the media SkelToon animation videos.

Based on the decision-making on the hypothesis test, if the significance value obtained is lower than the value of 0.05, it means that H_a is accepted and H_o is rejected in this study. In this study, the significance was lower than 0.05 ($0.00 < 0.05$), so it can be concluded indirectly that the SkelToon animation video media was effective in influencing the level of motivation of students in studying the motion system material. Measurement of the increase in learning motivation is carried out by calculating the N-gain. The n-gain aims to determine how much influence the learning media has in increasing students' learning motivation before and after the implementation of the SkelToon animation video media. The results of these measurements can be seen in the table below:

Table 7. Calculation Results of the N-gain Test

	Average	Gain Score	Category
Before the experiment was applied	48.86	0.45	Moderate
After the experiment	61.43		

Based on the results of the calculation of the N-gain test in the table, it was found that the increase in the learning motivation of students in this study obtained a value of 0.45 and included if it was included in the criteria for the N-gain test category, the value was included in the moderate category. In research conducted by researchers, it was found that there was an increase in learning motivation, this was due to the use of learning media in the form of a SkelToon animation video which was able to attract attention, participation, and curiosity of students in the learning process.

Regarding the increase in learning motivation obtained, a study states that animated video media can increase understanding of science learning material and student motivation (Rosen, 2009). And this is also the same as the research findings, which argue that students who carry out learning activities using animation, there is a high increase in motivation in learning science learning compared to conventional learning (Barak et al., 2010). The use of media in the learning process is proven to affect students' level of motivation to learn. The emergence of this motivation is determined by the interest in what is seen by the senses. Students' interest in learning process activities can be generated if there is the use of interesting learning media (Lidi & Dau, 2019).

Animated video as a learning media has a function to explain the concept of complicated or complex learning material to be simpler with the help of images and text to be easily understood by students (Noviyanto et al., 2015). This animated video's advantages are very suitable for use in biology learning material that cannot be seen directly by the eye. With the help of the animated video, the concept of the material can be more depicted through a visual form. The use of animated video media in explaining the explanation of learning materials related to the work system of the human body, for example, the motion system, can help students understand information related to the concept of learning material. The benefits of using animated video media are that students feel a sense of interest in participating in learning activities. This interest will later provide new experiences where students experience a high sense of interest and motivation in learning (Tafonao, 2018). Motivation to learn; namely, feelings related to the desire and urge to change behavior towards students' learning intensity and learning success (Pintrich, 2003). Motivation to learn is very important for the learning success of students. Therefore, as educators, teachers must build students' motivation in the learning process (Wenning, 2015).

The advantages of the learning process using the powtoon animation media are that students have a deeper sense of interest in learning activities and other advantages, namely how the animated video media can help students understand various learning material concepts because these learning activities can be visualized. This animated video learning media also makes students feel motivated. This can be seen in the average acquisition of motivation values before being applied with the media. Meanwhile, the obstacle of implementing the learning activity process using this Powtoon animation video media is that the video size is included in the large category, and it takes up enough storage space on students' smartphones.

CONCLUSION

Based on the results of the study, it can be concluded that the development of the Musculoskeletal System (SkelToon) animated video media is very suitable to be used as a learning support medium. This can be seen from the average acquisition of expert validator test scores, which are 3,9 and 3.8 which are categorized as very feasible. - The development of the Motion System (SkelToon) animation video media is also able to increase students' learning motivation, this can be seen by the acquisition of an N-gain value of 0.45 which means that the Motion System (SkelToon) animation video media is moderately effective in increasing student learning motivation.

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