Development of Animaker-Based Animation Video Media on Momentum and Impulse Materials

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Abstract. Technological advances have been so advanced, it is no longer in place if the delivery of educational messages was still verbal. One of the information and communication technology media that can reach the general public and the most popular is the use of learning media in the form of animated videos. This study aims to develop an animated video media product design on the material "Momentum and Impulse" and to determine the quality and feasibility of the developed animated video media product. This type of research is Research and Development. The method applied in this study refers to the Borg and Gall method which consists of 10 research steps, this study only applies five research steps, and the aim was to determine the quality and feasibility of animaker-based animated video media. The product validation results are in the "Very Eligible" category with an average rating score of 4.71 and are declared eligible for testing following the suggestions for improvement from the validator.

Keywords: R&D, Animated Video, Momentum and Impulse

1 Introduction

Today's students are very knowledgeable about information technology and are active internet users. In their daily life, they get great help from Google products and are very used to interacting with smartphones. This technology allows students to use personal computers, laptops, tablets, and smartphones to access and learn from different places and times, enabling students to actively participate in learning [1].

Technological advances have progressed to the point where it is no longer applicable to the delivery of educational information that remains verbal or in mere words. Video media is one of the most popular ICT media that can reach the public. Video is also an electronic medium that can combine audio and video technologies to create dynamic and interesting programming. The main feature of this video is to provide useful and comprehensive information and knowledge, and its relevance to student assessment, thereby stimulating students' motivation and active learning [2].

Animated video is one of the learning media that can be used as a bridge to facilitate students' understanding of the material. Animated video media can be used as a teaching aid for teachers in the learning process [3]. Animation is projecting static objects into dynamic images that seem to live with their characters. It consists of several groups of images that alternate

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irregularly according to the design, which makes the videos displayed more varied, the images are interesting and colorful and can increase the attractiveness of learning for students [4].

The presence of animation can open up limitations in providing a learning experience for students learners. The material in the book can be visualized and can also be given an audio touch. Therefore, the use of animation in physics learning can be used as an alternative learning media [5]. The study of the topic of momentum and impulse includes many examples that need to be visualized. Visualization allows students to better understand and remember what material is presented. Momentum, for example, has two important variables, velocity and mass, and when two variables come into play, it is often necessary to keep one variable constant to examine the impact of the other variable. Animating this scenario requires making constant changes to the two elements and ensuring that objects move at the same speed, which is again difficult to do manually [6].

Teachers have been required to use various learning media in the teaching and learning process. But in reality, the readiness of teachers is still not as desired. Teachers are also still less than optimal in using computer technology devices, especially as a medium for teaching material. This is in line with research conducted by Semenikhina. He investigated the opinion of physics teachers (48 teachers) regarding the use of software in physics lessons and found that the ability of teachers to develop computer visual models independently was only around 48% [7].

Problems that arise must be corrected immediately. One solution to overcoming these problems is to develop learning media that can present the components of the material in a way that is clearer, more practical, and easier for students to understand. Animated videos are one of the most fun and everyday learning media. In this study, Animaker-based animated videos were developed to help teachers complete the learning materials and also help students understand the materials in collaborative learning activities and independent learning activities. Previous research has found that the use of animated videos improves learning as the material presented becomes clearer and more interesting.

This research is important because of the combination of media in explaining the material by presenting animation through object manipulation, image insertion, insertion of supporting music, sound recordings, and narration in the form of sentences. It supports a clear display of easy-to-understand animations and illustrations. Animated videos were chosen to be developed because animated videos can help students not to get bored, which can create an interesting, comfortable and humorous learning atmosphere, while still paying attention to the main aspects of learning material elements [8].

2 Research Methods

This study uses a research and development model or what we know as Research and Development (R&D) which is adapted from the Borg & Gall (1983) model aimed at developing and knowing the validity of learning video products. This study applies five steps as a research procedure. The initial stage is the process of collecting data as a basis for compiling a needs analysis and conducting product testing that can be implemented in the world of education. The product that is the result of needs analysis and implementation is animated video learning media.

This research model refers to the main objectives, namely, observing, reviewing, analyzing, and describing data and information about how the process of developing Animaker-based animated video media on the material "Momentum and Impulse" class X. The research and development approach conceptually includes ten general steps, as described by Borg & Gall, in Figure 1.

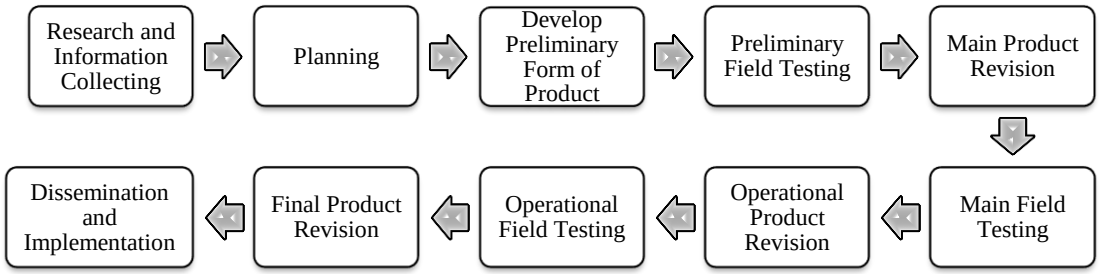

Figure 1. Schematic Procedure Development of Adapted Results of Borg & Gall Development Procedures [9]

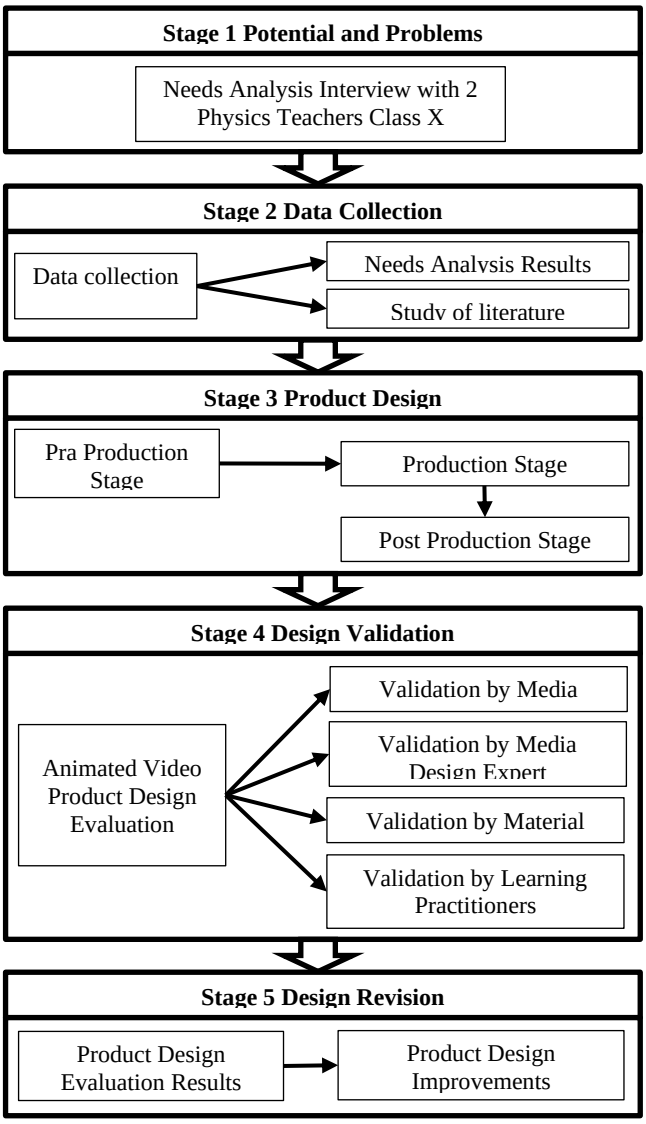

Figure 2. Animaker-Based Animation Video Media Development Procedure

Data collection techniques in this study were in the form of interviews and filling out questionnaires/questionnaires. The interview used in this study is a structured interview. The questionnaire method is in the form of a checklist in the form of five categories which will be given to media experts, media design experts, materials experts, and two educators as sources of eligibility for animated video media. Based on the data collection techniques and instruments in this development, it can be described as follows:

Table 1. Research Assessment Grid on the Quality of Learning Materials for Material Experts

Criteria	Assessment Aspect	No. Item
Material Relevance	Conformity of objectives with curriculum	1
	Suitability of the material with the purpose	2
	Ease of understanding terms and formulas	3
	Animation accuracy in explaining the material	4
	Concept or theory description	5
	The suitability of the scope of the material with the objectives	6
	The suitability of the depth of the material with the purpose	7
	Providing examples or illustrations for material support	8
	The suitability of the duration of the time with the material of the dish	9
	Use of spelling and grammar in presenting material	10

Table 2. Research Assessment Grid on Design Quality for Learning Design Experts

Criteria	Assessment Aspect	No. Item
Content Eligibility	Topic selection accuracy	1
	The suitability of the material with the indicators	2
Presentation	Giving motivation	1
	Clarity of material description	2
	Explanation of the examples provided	3
	Maximizing the learning process	4
	Use different text to mark the important part	5
Graphics	Color composition	1
	Graphic use	2
	Selection of font type and size	3
	Image and animation quality	4
	Use of music	5

Table 3. Animated Video Quality Research Assessment Grid for Media Experts

Criteria	Assessment Aspect	No. Item
Media Systematics	Acceleration of letters, numbers and symbols	1
Media Aesthetics	Visual quality (resolution) of graphics or images	2
	Color composition and resolution on the screen	3
	Text color match with background	4
	Text, visual, audio and animation acceleration	5
Narration and Audio Quality	Narrator's voice clarity	6
	Ease of understanding language in narrative	7
	Noise-free narration	8
	Narrative is communicative	9
	The suitability of the background with the presentation material	10
Video and Animation Quality	Use of video/animation resolution (pixels)	11
	The suitability of the object/video/animation with the material	12

Criteria	Assessment Aspect	No. Item
	Visualization of objects on the concept/abstract material	13
	Ability to reduce misperception of objects	14

Data analysis in this study was obtained in the form of qualitative data and quantitative data. The feasibility data for the animated video learning media product is in the form of qualitative data from the tabulation of all validity results and assessment items available on the product assessment sheet by media experts, learning design experts, and material experts. The data obtained through the assessment instrument at the time of the trial were analyzed using qualitative descriptive statistics. Qualitative data in the form of very good, good, moderate, poor, and not good statements are converted into quantitative data with a scale of 1 to 5. The results will be averaged using a Likert Scale which is analyzed descriptively by percentage with the following equation:

Table 4. Criteria for Evaluation of Video Animation Expert Validation

No	Interval	Criteria
1.	85%≤ X 100%	Very Good
2.	75%≤ X 84%	Good
3.	65%≤ X 74%	Acceptable
4.	55%≤ X 64%	Poor
5.	0 %≤ X 54%	Very Poor

Note: X = Meets the ideal criteria [10]

Calculating the average score of answers from each aspect assessed by the formula:

$$x = \frac{\sum x}{n} \quad (1)$$

For eligibility assessment media learning animated videos overall is done in the same way by involving all item scores on each aspect of the assessment with the formula:

$$X_t = \frac{\sum x_i}{N} \quad (2)$$

Furthermore, the level of eligibility is divided into four groups with the ideal average (2.50) as the limit of the feasibility score. Therefore, the average score less than the ideal average is interpreted in the "not feasible" category, while the average score in the "decent" category is divided into three levels, namely "less feasible", "decent" and "very feasible", such as stated in the table as follows:

Table 5. Feasibility Interpretation of Animated Video Media

No	Mean Score Interval	Interpretation
1.	1.00 - 2.49	Not feasible
2.	2.50 - 3.32	less worthy
3.	3.33 - 4.16	Worthy
4.	4.17 - 5.00	Very Worthy

3 Result and Discussion

The initial description of the animaker-based animated video product that has been developed by the researcher has several steps, namely: determining concept maps and learning tools; determination of media components; determination of animaker-based animated video storyboards; and initial product design for animaker-based animated video media.

3.1 Animated video media

Animated video learning media is an Information Technology or Digital-based learning media that has been designed in such a way in the form of video pieces which are then combined into a complete animated video media. Packaged in the form of a youtube link and equipped with a variety of attractive designs, each link contains sub-chapters of different materials and is divided into 3 parts**.**

3.2 Product Validation Results

a. Media Validation

Learning media in the form of animated videos have been validated by media experts with the aim of testing the feasibility of the products that have been developed. The following are the results of the recapitulation of media expert validation data based on assessment points which are described as follows:

Table 6. Results of Data Validation Recapitulation from Media Experts in Animated Video Media

No	Criteria	Score Result
1	Media Systematics	4
2	Media Aesthetics	20
3	Narration and Audio Quality	22
4	Video and Animation Quality	25
5	Ease and Flexibility in Access	38
Overall score		109
Total number of items		23
Average= $\frac{\sum \text{overall score}}{\sum \text{number of item}}$		4.73
Criteria		**Very Worthy**

The results of media expert validation have shown that the product in the form of animation is classified in the "Very Eligible" category with an average score of 4.73. The animated video media is said to be "Eligible" to be tested on a limited scale based on the revised results of the validator's suggestions and comments.

b. Media Design Validation

Table 7. Results of Data Validation Recapitulation from Learning Design Experts in Animated Video Media

No	Criteria	Score Result
1	Content Eligibility	10
2	Presentation	23
3	Graphics	25
Overall score		58
Total number of items		12
Average= $\frac{\sum \text{overall score}}{\sum \text{number of item}}$		4.83
Criteria		**Very Worthy**

The results of the validation of media design experts have shown that the development of animation products is classified in the "Very Eligible" category with an average score of 4.83. The animated video media is said to be "Eligible" to be tested on a limited scale based on the revised results of the validator's suggestions and comments.

c. Material Validation

Table 8. Results of Data Validation Recapitulation from Material Experts in Animated Video Media

No	Criteria	Score Result
1	Material Relevance	10
2	Contents	38
Overall score		48
Total number of items		11
Average= $\frac{\sum \text{overall score}}{\sum \text{number of item}}$		4.36
Criteria		**Very Worthy**

The results of material expert validation show that the development of animation products on "Momentum and Impulse" material for class X is included in the "Very Eligible" category with an average score of 4.36. The animated video media is said to be "Eligible" to be tested on a limited scale based on the revised results of the validator's suggestions and comments.

d. Expert Practitioner Validation

Table 9. Results of Data Recapitulation of Product Validation Results by Learning Practitioners

No	Criteria	Validator I	Validator II	Average
1	Media Material	39	39	39
2	Media Design and Facilities	39	38	38.5
3	Pedagogic Aspect	24	24	24

No	Criteria	Validator I	Validator II	Average
Overall score		102	101	101.5
Total number of items		21		21
Average= $\frac{\sum \text{overall score}}{\sum \text{number of item}}$		4.85	4.80	4.82
Criteria		**Very Worthy**	**Very Worthy**	**Very Worthy**

Based on product validation data by learning practitioners, it was found that the animated video media on Momentum and Impulse material was in the "Very Eligible" category with an average score of 4.82 and said to be "Eligible" to be tested on a limited scale based on the revised results of suggestions and comments. validator.

Based on the data from the validation results of the five validators that have been averaged to determine the criteria for the animated video product being developed. The following data recapitulation can be described in Table 10.

Table 10. Data Recapitulation of Validation Results from the Five Validators

No	Validator	Score
1	Media Expert	4.73
2	Media Design Expert	4.83
3	Material Expert	4.36
4	Learning Practitioner Expert I	4.85
5	Learning Practitioner Expert II	4.80
Total score		23.57
Average= $\frac{\sum \text{score}}{\sum \text{validator}}$		4.71
Criteria		**Very Worthy**

Animated video media is one of the digital media developed on the material "Momentum and Impulse". Therefore, the overall assessment of the product scored 4.71 with the criteria of "Very Eligible" and said to be "Eligible" to be tested on a limited scale.

3.3 Product Revision

a. Media Expert Revision

The results of the validation of animated video media products by media experts have shown the level of media feasibility to be applied in the world of education. The aim is to find out the weaknesses and shortcomings of animated video media on aspects of appearance, quality, and product results. Based on the results of media expert validation, there are several suggestions and comments for improvement, which can be seen in Table 11.

Table 11. Media Expert Revision

No	Revision	Follow-up
1	Narrator's voice on KD slides and Indicators for each video need to be present	The narrator's voice on KD and indicators already exist

No	Revision	Follow-up
2	Learning Objectives for each video need to be made	Learning Objectives for each video have been created
3	The explanation at the beginning of video 1 (motorcycles and trucks) at 00.25 seconds is too long	Fixed the explanation at the beginning of the video to be more focused and clear
4	The narrator's voice is not strong enough	Improved the narrator's voice so that it is clearer and clearer to hear
5	Sentences are not clear at 02.20 seconds. If we … (why end in a period)?	Fixed sentences at 02.20 seconds so they are clearer and unambiguous
6	The narrator explains the material on the video too fast	Fixed how the narrator explains material in the video to be quieter and less fast
7	Directional arrows on the 03.21 seconds slide don't need to exist	Removed the directional arrows
8	Is the mass of the motorcycle 1/2 of the mass of the truck? We recommend that the mass be made 1/6 or 1/8 at 04.10	Fixed the mass of the motorcycle to 1/6
9	The narrator's voice is cut off "In a ..." condition at 06.12 seconds	Fixed the narrator's voice at 06.11 seconds so that it is clearly heard
10	In the video 3 learning indicators are too many	Fixed the learning indicator in video 3 so it's not too long

Based on the results of media validation by media experts, improvements were made based on the suggestions and comments of the validator before the animated video media was applied in general to students.

b. Media Design Expert Revision

The results of the validation of animated video media products by media design experts aim to find out the weaknesses and shortcomings of animated video media on aspects of appearance, quality, product results, and make it easier for students to understand the content of the material. Based on the results of the validation of media design experts, there are several suggestions and comments for improvement, which can be seen in Table 12.

Table 12. Media Design Expert Revision

No	Revision	Follow-up
1	The display (made with animaker) is too big, it should be reduced	Improve the writing on the video so that it is clearly legible
2	The picture of the book on the video 1 second 04:57, if there is no function, it should be removed	Already removed the book image at 04.57 seconds
3	Video 1 at 06.12 seconds the narrator's voice is cut off	Fixed the narrator's voice at 06.12 seconds so that it is clearly heard
4	The baseball picture in the 1 second 08:54 video is not clear. It's a good idea to contrast the color with the background of the image so that the theory is achieved	Improved the appearance of the background on the video so that the images and text of the material on the video are clearly visible

Based on the results of media validation by media design experts, improvements were made based on the validator's suggestions and comments before the animated video media was applied in general to students.

c. Material Expert Revision

The product developed in the form of an animated video has been validated by a material expert with the aim of knowing the weaknesses and shortcomings in aspects of the content of the material contained in the animated video media. Based on the results of material expert validation, suggestions and comments for improvement can be found in Table 13.

Table 13. Material Expert Revision

No	Revision	Follow-up
1	In video 3 it is better to make additional animations for perfect elastic collisions	In video 3 has added animation on a perfectly elastic collision
2	Animations on sample questions are adjusted to the information provided	Have adjusted the animation on the sample questions according to the information provided
3	The symbols in the picture are complete	Already added symbols to the image
4	It's better to make practice questions	Added practice questions

Based on the results of product validation on the material aspect by material experts, improvements were made according to the validator's suggestions and comments before the media was generally applied to students.

3.4 Final Product Review

The development of Animaker-based animated video media helps students understand the material taught by the teacher. The process of operating animated video media is very easy and does not require special skills because the steps taken are no different from playing videos on the YouTube application using a computer or laptop in general. The final product that has been produced is a final product revised by media experts, media designs, materials, and two Physics teachers for class X. The product revision process has been carried out based on the results of comments and input from the validators relating to the initial product. Based on the revised data, there are several changes in the animated video media, namely changes to aspects of presentation, quality of narration and audio, aspects of learning material content.

4 Conclusion

Based on the results of the development of animated video media and the results of product validation that have been developed by researchers, the conclusions of this study are: 1) The product developed is in the form of Animaker-based animated video media on the material "Momentum and Impulse" equipped with elements of images, writing, sound, movement, background, and background, which are varied and interesting; 2) The animated video media on the material "Momentum and Impulse" class X has quality and feasibility in the "Very Eligible" category with an average of 4.71 so it is feasible to be tested.

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