



## The Feasibility and Practicality of Learning Multimedia Based on Whiteboard Animation of Momentum and Impulse towards First Grade of Senior High School Student Learning Motivation

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**ABSTRACT:** Physics is one of highly difficult material study, so student tend to have low study motivation. This research aims to enhance study motivation also describe the feasibility and practicality of using Whiteboard Animation to first grade of senior high school student towards impulse and momentum. Method of this study is Research and Development (R&D) with 4D models (Define, Design, Develop, and Disseminate). This research was conducted until the test of feasibility and practicality of using Whiteboard Animation towards student learning motivation. The result of this study shows that multimedia based on Whiteboard Animation of impulse and momentum material is stated very feasible to use, which is shown an average of 87% (very feasible) by material expert and 84% (very feasible) by media expert. The developed multimedia was attained high response of students on field testing, which is shown an average of 89% (very practical). The result of practicality test based on student response also stated that the developed multimedia is very interesting and potential to enhance the student learning interest. Thus, multimedia based on Whiteboard Animation of impuls and momentum material is very feasible and practical to enhance student learning motivation.

**KEYWORDS:** Feasibility, Learning Motivation, Practicality, R&D, Whiteboard Animation

### 1. BACKGROUND OF THE PROBLEM

Physics is part of natural science material, and the application is much found in daily life. Rizaldi et al. (2020) show that physics study is a part of science which is formed by fact, various phenomena, also the result of thinking and experiment. Physics material can explain the process of the occurrence of various phenomena, both theoretically and based on the description of the formula. Permata & Bhakti (2020) also show that physics is a study about nature phenomenon which is can be solved by both formula reduction and experiment to establish the process of any phenomenon in nature. The object studied in physics consist abiotic, the phenomenon of nature, or others which are have causation, so that physics study consist multiple abstract concepts (Nandyansah & Suprpto, 2019).

The abstract concept of physics involve physics become one of the highly difficult material study to understand by student (Musliman & Kasman, 2022). The high difficulty of physics study involve student learning motivation become low, so that inflict student learning outcomes also become low. Permanda & Simamora (2021) show that student learning motivation, study manner, and intelligence are in line with learning outcomes. In line with the research of Melinda et al. (2021), it shows that student learning motivation must effect student outcomes. Ugwuanyi et al. (2020) also stated that student outcomes of science material tend get low result particularly physics material. Even though, learning outcomes is one of important indicator of learning success (Ardianto et al., 2019). Thus, an effort of enhancing student learning motivation is needed to intensify student outcomes optimally, one of them is learning resource.

Gunawan et al. (2020) show that, learning resource is one of important factor which can effect the quality of learning process. This is caused by the ability of learning resource of effecting the quality of student understanding towards a material. Learning resource consist of media, method, data, people or the place of the study process, which can support and simplify learning process (Samsinar, 2019). Hadiapurwa et al. (2021) show that, learning resource consist some categories, which are print learning resource, non-print learning resource facility, activity, and environment. Print learning resource involve book, magazine, poster, and others. Non-print learning resource include video, film, slide, and others learning resource of facility consist library, auditorium, study room, and other learning facility. Learning resource of activity involve observation, interview, simulation, and others. Beside



that, learning resource of environment consist museum, garden, and other kind of area. Thus, the conclusion of these is that learning resource is everything which can support learning process.

Learning process need supported by adequate learning resource. In line with the research of Hadiapurwa et al. (2021), it shows that the developing of learning resource is need to be conformable with the growth of modern technology. This is in line with the growth of technology and science that has enhance evolution in many kinds of sectors include education, so that the application of technology in learning process is needed to optimized (Malina et al., 2021). Moreover, optimizing the using of technology in learning also in line with the needed of 21<sup>st</sup> century skills which is has encourage education sector for upgrading the using of learning media based on technology in learning process (Muzayyanah et al., 2022). Technology application optimalization as a learning media can enhance study motivation and the understanding of student towards physics material, and one of them is by optimize multimedia application. Anas (2019) shows that multimedia is learning resource which is include various kind of media for sending information or message to user based on it's puspouse and function. On the digital covered multimedia, the multimedia arrange in such a way in order to interesting and motivate user for studying. The components included in multimedia is text, image, video, animation, and audio. Multimedia has some advantages which could contribute to encourage learning proses, these are (1) resolving the limitation of verbalism; (2) resolving the difference and limitation of student capacity; (3) enhancing student learning interest; (4) enhancing curiosity of the student; also (5) flexible towards time and space (Santhalia & Sampebatu, 2020). Thus, the using of multimedia is potential to use for the learning of an abstract physics, and one of them is Whiteboard Animation.

Whiteboard Animation is a video that explain a material or theory by drawing process on the whiteboard. The drawing process is synchronized towards the audio of contents material teller directly and clearly (Angraini et al., 2018). Ki'i et al. (2022) reaveled that the view of the Whiteboard Animation consist explanation of material in teks of picture form which are drawn or written by the movement of animation, so that the material is explained become more interesting and enhance student learning motivation. Learning by using Whiteboard Animation is potential to give simplicity of understanding learning material for student. Therefore, the using of Whiteboard Animation multimedia on physics learning is potential to enhance the understanding and motivation of student effectively. Based on the research'es result of Alhidayatuddiniyah (2021) about the development of learning media based on Whiteboard Animation on Coulomb's Law material, obtained that media validity by media expert earned about 88,5% (valid). This is in line with the research'es result of Angraini et al. (2020) about the development of Whiteboard Animation multimedia on energy and work material, which is acquired high feasibility scor and practical. Consenquently, developing Whiteboard Animation multimedia also potential to enhance student learning motivation on other physics material, one of them is impulse and momentum.

Impulse and momentum is one of physics learning that have many relation with daily life (Yuberti et al., 2019). Momentum learn about tendency of an object to move by constant velocity. The change of momentum can be effected by outside force which is work at a certain time and called impulse. Impulse and momentum is one of basic concept of physics learning (Rosa et al., 2018). However, student tend have misconception on impulse and momentum material (Putranta & Supahar, 2019).

This is caused by reasoning of impulse and momentum as one of highly difficult physics learning material and have abstract property. Consenquently, the abstract property of impulse and momentum need a clearly visualization of concept. The inferior visualization will inflict student difficult to understand the material and also conduce negative effect towards student learning motivation (Triyani et al., 2019). Accordingly, developing multimedia based on Whiteboard Animation on impulse and momentum material is needed for infesting concept visualization explanation needs directly and interestingly, so that the student learning motivation also become enhanced. Learning motivation will conduce enhancing of student learning outcomes.

Based on observation and literatures review, the development of learning multimedia by using Whiteboard Animation to explain impulse and momentum material have not been found. Whereas, the using of Whiteboard Animation multimedia is potential to enhance student learning motiation in Ten'th Grade Senior High School. Therefore, this research aims to develop learning multimedia based on Whiteboard Animation on impulse and momentum material, also to describe the feasibility and practicality of product towards student learning motivation.

## 2. RESEARCH METHOD

This research is a mixed method research which is the combination of qualitative and quantitative researches (Sugiyono, 2018). This research use Research and Development (R&D) method with 4D models which is consist of Define, Design, Develop,

and Disseminate (Ikhbal & Musril, 2020). The research have some steps until feasibility and practicality testing step to find out the feasible and practical levels of product to enhance student learning motivation. The product development will be validated by material and media expert, which is implicate one material expert lecturer and one media expert lecturer. Feasibility and practicality test will be tested toward Ten'th Grade Senior High School, which are divided into small group test and big group test. In addition, the steps of Whiteboard Animation multimedia development on impulse and momentum material is shown on Figure 1.

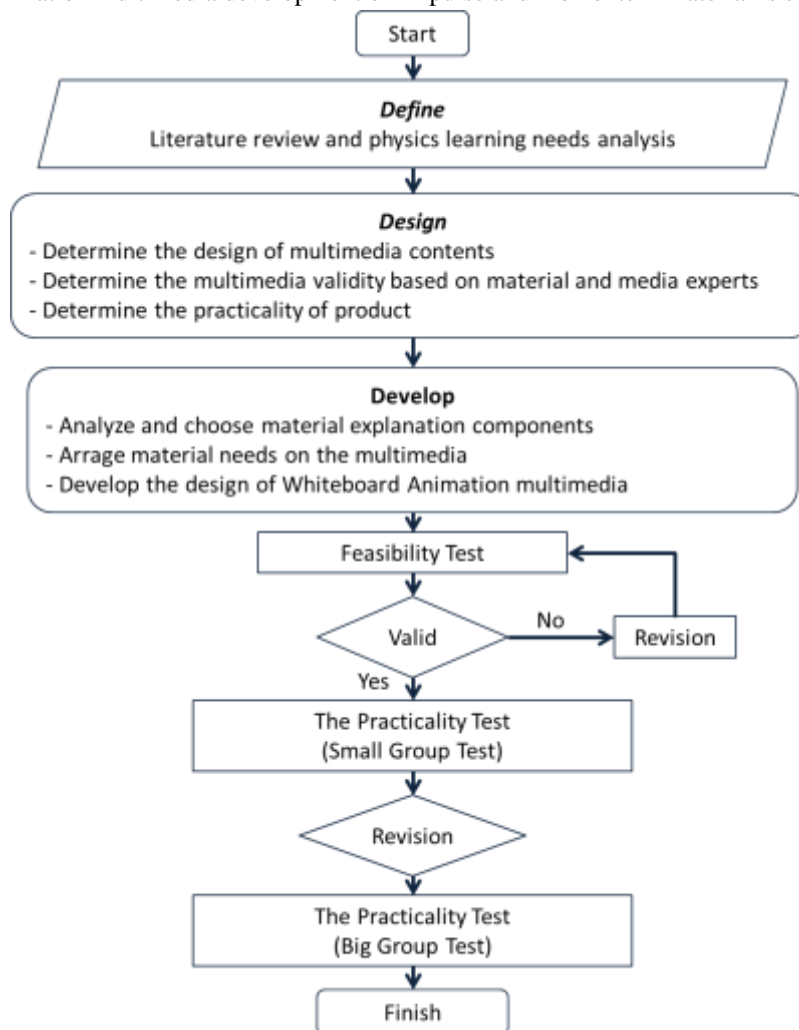


Figure 1. The Development Research Design

Defining step is done through preliminary study and development need analysis based on various literatures and observation. Design is done by, (1) determinating the design of multimedia contents; (2) determinating the multimedia validity based on material and media expert; and (3) determinating the feasibility and practicality of product. Furthermore, development step consist, (1) analyzing and choosing material explanation components; (2) arranging material needs on multimedia; also (3) developing the design of whiteboard animation multimedia. The compiled product will be validated by material and media expert to find out the feasibility of product. On the disseminate stage, the product validation result will be developed and then tested to Ten'th Senior High School for finding out the practicality of product towards student learning motivation.

This research's instruments consist expert validation questionnaire of material and media, also student response questionnaire for small and big group test. In addition, research's results data will be analyzed by using qualitative and quantitative technique. The research's questionnaire of validation test is arranged by using likert scale based on Sugioyo (2018). Beside that, the questionnaire of practicality use Guttman scale based on Sugioyo (2018). The qualitative analyze is done towards research's



results data in opinion form by validator. The quantitative analyze is done towards research'es results data in quantitave form, which are include the validity and practicality form.

The result of material and media experts validation will be analyzed by counting the rate of every aspect of assessment using formula (1). The result of analysis of expert validation is interpreted based on Table 1.

$$Ps = \frac{\sum S_j}{n} 100 \% \tag{1}$$

Keterangan:

Ps = Score percentage

$\sum S_j$  = Skoce item of j aspect

n = Indicator quantity of j aspect

**Table 1.** The Interpretation of Material and Media Expert Result

The Feasibility Percentage	The Feasibility Classification	Description
81 – 100 %	Very feasible	Can be used without revision
61 – 80 %	Feasible	Can be used without revision
41 – 60 %	Adequate feasible	Can be used with little revision
21 - 40 %	Less feasible	Can be used with many revision
0 – 20 %	Not feasible	Can not be used with total revision

The practicality test result based on student response is analized by counting the rate of every indicator by using formula (2). The practicality test analysis result is interpreted based on Table 2.

$$Ps = \frac{\sum S_i}{n} 100 \% \tag{2}$$

Keterangan:

Ps = Score percentage

$\sum S_i$  = Skoce item of i aspect

n = Statements quantity of i indicator

**Table 2.** The Interpretation of Practicality Test Result

The Practicality Percentage	The Practicality Classification	Description
86 – 100 %	Very practical	Very feasible to use
76 – 85 %	Practical	Feasible to use
60 – 75 %	Adequate practical	Adequate feasible to use
< 60 %	Not practical	Not feasible to use

### 3. RESULTS AND DISCUSSION

#### 3.1 Research Results

Multimedia based on Whiteboard Animation is analyzed by material expert using questionnaire. The multimedia assessment of material consist the feasibility of contents, linguistic, and presentation. The validity of material expert is needed in multimedia development process to find out the multimedia feasibility based on material contents that arranged. The result of material expert validation towards Whiteboard Animation multimedia is presented on Table 3.



**Table 3.** The Result of Material Expert Validation

Assessment Aspect	Indicator	Score	The Rate of Each Indicators	The Rate of Aspect	Category
Contents feasibility	1. The suitability of material with core of competency, fundamental of competency, and learning indicators	4	83%	87%	Very feasible
	2. The accuracy of concept	4			
	3. The completeness of material	4			
	4. The accuracy of notations and symbols	5			
	5. The accuracy of terms	4			
	6. The updating of material	4			
Linguistic feasibility	1. Communicative	5	90%		
	2. The accuracy of linguistic	4			
	3. The simplicity of linguistic	5			
	4. The quality of explanation	4			
Presentation feasibility	1. The perceptible presentation of text and picture	5	88%		
	2. The complementarity of presentation	4			
	3. The systematic presentation	4			
	4. The completeness of presentation	4			
	5. Consistency of using terms and symbols	5			

Data on the Table 3 shows that material on the developed multimedia is very feasible to use, with an average of 87%. This result indicate that learning based on Whiteboard Animation can support learning process and enhance student understanding about impulse and momentum.

The multimedia also analyzed by media expert using questionnaire. The multimedia assesment on media consist display accuracy aspect, aesthetics, efficiency, and endurance. Validation of media expert is needed in multimedia development process to figure out the feasible level of multimedia based on designed media quality in order that can be used by students. The result of media expert validation towards Whiteboard Animation multimedia is presented on Table 4.

**Table 4.** The Result of Media Validation

Assessment Aspect	Indicator	Score	The Rate of Indicators	The Rate Aspects	Category
Display accuracy aspect	1. The quality of picture	4	83%	84%	Very Feasible
	2. The quality of sound	4			
	3. The quality of lighting	4			
	4. Text legibility	4			
	5. Text lay out	5			
	6. Consistency of font, figure, space, and punctuation mark	4			
	7. Material presentation time	4			



Assessment Aspect	Indicator	Score	The Rate of Indicators	The Rate Aspects	Category
Aesthetics	1. Media attraction	4	80%		
	2. Harmonisation of choosing colors and figures	4			
	3. Combination of used colors	4			
Efficiency	1. Simplicity of utilization	5	87%		
	2. Simplicity of storage	4			
	3. Does not need a certain special action for using	4			
Endurance	1. Can be used in long period	5	90%		
	2. Not easily broken	4			

Data on the Table 4 figure out that the feasibility of media of Whiteboard Animation obtain very feasible category with average 84%. It shows that multimedia based on Whiteboard Animation can be used as one of feasible study resource to encourage learning process.

Multimedia that has stated valid then tested to small group to find out the practicality of product. The practicality tested to 5 students by using questionnaire with likert scale, which are consist 5 scales from 1 to 5 for the best responses. The result of small group test is presented on Table 5.

**Table 5.** The Result of Small Group Test

No	Indicator	Score	The Rate of Aspect	Category
1	The material in multimedia is suitable with fundamental competency	4	86%	Very Practical
2	The material consisted in multimedia help student to understand the material and the concept	4		
3	The presentation of material on the media build my interest for reading the content	4		
4	The kind of font used is interesting and easy to read	4		
5	The size of the text is proportional and easy to read	4		
6	The colors pattern of the media is harmonic	4		
7	The material form has been suitable with syllabus	4		
8	The figure and photo on the media is interesting and can clarify the material	4		
9	The media has good time duration which is not too long and not too short	5		
10	Media can be used to learn the material repeatedly	5		
11	Linguistic that used in media is simple and easy to understood	5		
12	The presented media can enhance interest and motivation learning student	4		
13	The back sound does not disturb student to watch the video	5		
14	The media display is interesting and enjoyable	4		
15	The design that used on the media is good	4		
16	The media encourage and stimulate me to generalize the material	5		





Data on Table 5 show that the test on small group attained very practical category. Therefore, the Whiteboard Animation multimedia on impulse dan momentum material is feasible to used in small scale.

The result of small group test then revised to optimize the practicality of product in order ready to be used by student in bigger scale. The big group test is tested to 30 student by giving questionnaire, which is consist two choices are “no” for scale of zero (0) and “yes” for scale of one (1). The result of the big group test is interpreted on the Table 6.

**Table 6.** The Result of Big Group Test

No	Indicator	Score	The Rate of Aspect	Category
1	The material in multimedia is suitable with fundamental competency	26	89%	Very Practical
2	The material consisted in multimedia help student to understand the material and the concept	27		
3	The presentation of material on the media build my interest for reading the content	25		
4	The kind of font used is interesting and easy to read	28		
5	The size of the text is proportional and easy to read	27		
6	The colors pattern of the media is harmonic	29		
7	The material form has been suitable with syllabus	25		
8	The figure and photo on the media is interesting and can clarify the material	28		
9	The media has good time duration which is not too long and not too short	26		
10	Media can be used to learn the material repeatedly	29		
11	Linguistic that used in media is simple and easy to understood	26		
12	The presented media can enhance interest and motivation learning student	28		
13	The back sound does not disturb student to watch the video	26		
14	The media display is interesting and enjoyable	27		
15	The design that used on the media is good	25		
16	The media encourage and stimulate me to generalize the material	27		

Data on the Table 6 indicates that the developed multimedia also has very feasible category in big scale utilization, which is get average of 89% or in very practical category. Therefore, multimedia based on Whiteboard Animation on impulse and momentum material is very feasible and practical to be used by student.

**3.2 Discussion**

Data analyze result indicates that multimedia based on Whiteboard Animation is very feasible and practical to used a one of learning resource of impulse and momentum material. The data analyze of material feasibility on the aspect of content, linguistic, and presentation attained that each indicator obtain high score. The result score of each aspect are, 83% on material feasibility, 90% on linguistic feasibility, and 88% on presentation feasibility. These results indicate that each indicator of material validation aspect have been very suitable with the learning needs, which gain average of 87% or categorized very feasible.

Based on validation on content feasibility by material expert, stated that multimedia contain a suitable material with core of competency, fundamental competency, also learning indicator. Beside that, concept, material, notations and symbols, and terms that used on the multimedia are accurate and up to date. These results show that the material contents of developed multimedia is very valid.

Based on validation of the linguistic feasibility, attained that linguistic which is used on the multimedia is communicative, right, and simple. Beside that, the material on multimedia is explained well in order to give simplicity to student for understanding the material content. This statement indicates that the aspect of linguistic on the developed multimedia is very valid.

Based on validation on presentation aspect, obtained that the texts and figures on the multimedia presented very well. In addition, component of presentation complementary, completeness, also terms and symbols which are used on the multimedia is



presented well. Moreover, all of content of the multimedia designed systematically in order to give simplicity to user for learning their material.

Beside that, validation data analyze result by media expert shown that the developed multimedia is feasible to be used. The data of media feasibility is analyzed based on display accuracy aspect, aesthetics, efficiency, also endurance. The result of media feasibility attained that each aspect of assessment towards media gains very feasible. The result of each media aspect is, 83% for display accuracy, 80% for aesthetics aspect, 87% for efficiency aspect, also 90% for endurance aspect. Consequently, it can be generalized that each indicator on each aspect of the assessment has been suitable with the media utilization needs in learning, which is gain average of 84% or categorized very feasible.

Based on the result of display accuracy aspect, the multimedia consist qualified teks, figures, sound, and lighting, so the contents of multimedia can be read, seen, and heard well by user. Beside that, the presentation of material use effective time for studying. The font, figure, space, and punctuation marks which are used on the multimedia also presented well and consistent.

Based on data analyze result on the aesthetics aspect, the multimedia based on Whiteboard Animation display is presented interestingly. The attraction of media caused by choosing and using interesting colors and its combination. Moreover, colors that displayed on the figure and text can enhance student learning motivation.

Beside that, based on data analyze result on the product efficiency aspect, the developed multimedia can be used and saved easily. Moreover, media utilization does not need a special action in using. Thus, utilization of Whiteboard Animation for impulse and momentum is stated efficient.

The superiority of Whiteboard Animation on impulse and momentum material is can be used in long period and not easy to be broken. These situation caused by the ability of the multimedia to be saved in link or file video in order to be easily saved and can be learned in any time and space. This is attained from the media analyze result on endurance aspect, which is has average about 90% or categorized very feasible.

The result of media and material validation then tested to small group in order to find out the practicality level based on 5 student responses. Based on practicality test analyze, attained that each indicator gain high score. The average value attained based on responses test reach 86% and become categorized very practical. These result shows that each indicator on the multimedia has been suitable with student needs in encouraging learning process. The small group test data analyze result also gain that the multimedia based on Whiteboard Animation on impulse and momentum material is very practical to be used and very interesting.

The result of small group then tested to bigger group, which is consist 30 student. Based on the data analyze result of the test on big group, attained that each indicator gain high score, with average of 89%. That value shows that the existence of percentage escalation of field test result between small group test and big group test. Based on the student response result, the material included on the multimedia is suitable with the core of competency, and the presentation system gives simplify on understading the material to student. Moreover, the utilization of font and text is proportional, and the elected colors is harmonic, so these property help the material explained well and clearly. In addition, the figures and linguistic is presented interestingly, simple, and easy to understand, so that the material become more clear to learn. Because of that, the design visualization of media can enhance student learning interest, in order to motivate student to generalize the presented material. Moreover, multimedia based on Whiteboard Animation can be used for learning the impulse and momentum material repeatedly, in order to improve student understanding. These results show that multimedia based on Whiteboard Animation is very practical to used by student, so that also become effective in supporting the learning process.

Thus, it can be concluded that the developed multimedia based on Whiteboard Animation on impulse and momentum material present material and media well which is categorized very feasible with percentage about 87% and 84%. In addition, the multimedia developed well which is categorized very practical with percentage about 89%. Moreover, the practicality test result indicates that the multimedia can enhance student learning motivation. The final percentage of these assesments shown on Figure 2.



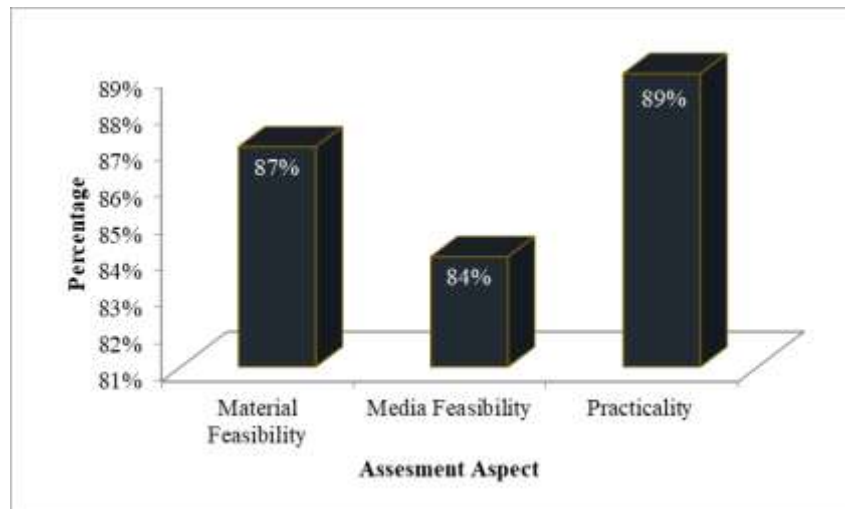


Figure 2. The Assesment Results Percentage of Multimedia

#### 4. CONCLUSION

Based on the research result, then the conclusion attained is below:

- 1) The multimedia based on Whiteboard Animation on impulse and momentum material gains very feasible to be used, with percentage about 87% by material expert and 84% by media expert. In addition, the aspect of content feasibility, linguistic, and presentation on the developed multimedia attained very feasible. Moreover, the display accuracy, aesthetics, efficiency, and the endurance of media also gain very feasible category.
- 2) The multimedia based on Whiteboard Animation on impulse and momentum material is stated very practical with percentage about 89% by student responses which is consist, the simple utilization, time efficiency, attraction, and the beneficial.
- 3) The multimedia based on Whiteboard Animation on impulse and momentum material can enhance student learning motivation. Based on the practicality test result, was found that student is very interesting, and motivated to learn the developed multimedia due to the ability of multimedia in explanation the material interestingly and easy to understand.

#### REFERENCES

1. Alhidayatuddiniyah. 2021. Pengembangan Media Pembelajaran Berbasis Whiteboard Animation pada Pokok Bahasan Hukum Coulomb. Seminar Nasional Riset dan Teknologi 2021. Jakarta: 14 Januari 2021, 14-17.
2. Anas, L. 2019. Pengembangan Sistem Aplikasi Multimedia Interaktif pada Pelajaran (Fisika Energy) untuk Tingkat Sekolah Menengah Atas. Jurnal Teknologi Pendidikan, 21(1), 24-41.
3. Anggraini, A., I., Warsono, Hamidiyah, H., & Jatmika, S. 2020. Developing Whiteboard Animation Video Through Local Wisdom on Work and Energy Materials as Physics Learning Solutions During the Covid-19 Pandemic. Proceeding of the 6<sup>th</sup> International Seminar on Science Education. Yogyakarta: Universitas Negeri Yogyakarta, 394-400.
4. Anggraini, A., I., Winarti, & Resmiyanto, R. 2018. Pengembangan Multimedia Pembelajaran Fisika Berbasis Whiteboard Animation Video Materi Suhu dan Kalor. Seminar Nasional Pendidikan Fisika IV 2018 (1-7). Yogyakarta: Program Studi Pendidikan Fisika, UIN Sunan Kalijaga.
5. Ardianto, Bertikanto, C., & Nyeneng, I., D., P. 2019. Pengaruh Keterampilan Berpikir Kritis Melalui Pembelajaran Berbasis Aneka Sumber Belajar Terhadap Hasil Belajar Fisika Siswa. Jurnal Pendidikan Fisika, 7(1), 28-38.
6. Gunawan, I., G., D., Suda, I., K., & Primayana, K., H. 2020. Webinar Sebagai Sumber Belajar di Tengah Pandemi Covid-19. Purwadita: Jurnal Agama dan Budaya, 4(2), 127-132.
7. Hadiapurwa, A., Novian, R., M., & Harahap, N. 2021. Pemanfaatan Perpustakaan Digital sebagai Sumber Belajar Elektronik pada Masa Pandemi COVID-19 di Tingkat SMA. Jurnal Penelitian Pendidikan, 21(2), 36-48.



8. Ikhbal, M., Musril, H., A. 2020. Perancangan Media Pembelajaran Fisika Berbasis Android. Information Management for Educators and Professionals, 5(1), 15-24.
9. Ki'i, O., A., Naen, A., B., Maing, C., M., M., & Dewa, E. 2022. Persepsi Peserta Didik Terhadap Penggunaan Media Video Animasi Whiteboard pada Pembelajaran Fisika di Masa Pandemi Covid 19. Jurnal Riset Teknologi dan Inovasi Pendidikan, 5(2), 83-92.
10. Malina, I., Yuliani, H., & Syar, N., I. 2021. Analisis Kebutuhan E-Modul Fisika Sebagai Bahan Ajar Berbasis PBL di MA Muslimat NU. Silampari Jurnal Pendidikan Ilmu Fisika, 3(1), 70-80.
11. Melinda, S., Purwanto, A., & Putri, D., H. 2021. Analisis Motivasi Belajar Siswa Tingkat SMA dalam Pembelajaran Fisika secara Online. Jurnal Ilmiah Pendidikan Fisika, 5(3), 388-397.
12. Musliman, A., & Kasman, U. 2022. Efektivitas Model Inkuiri Terbimbing untuk Melatih Kemampuan Berpikir Kritis Siswa pada Konsep Fisika yang Bersifat Abstrak. Jurnal Jendela Pendidikan, 2(1), 48-53.
13. Muzayyanah, E., Saraswati, D., L., & Setyowati, L. 2022. Pengembangan Modul Multimedia Terintegrasi Berbasis Inkuiri Terbimbing pada Materi Fisika. Prosiding Seminar Nasional Sains. Jakarta: Universitas Indraprasta PGRI, 62-70.
14. Nandyansah, W., & Suprpto, N. 2019. Pengembangan Media Pembelajaran Berbasis Augmented Reality untuk Melatih Keterampilan Berpikir Abstrak pada Materi Model Atom. IPF (Inovasi Pendidikan Fisika), 8(2), 756-760.
15. Permanda, A., & Simamora, N., N. 2021. Analisis Motivasi Belajar Siswa dalam Pembelajaran Fisika Kelas X IPA di SMAN 1 Batanghari. Integrated Science Education Journal (ISEJ), 2(3), 72-75.
16. Permata, A., & Bhakti, Y., B. 2020. Keefektifan Virtual Class dengan Google Classroom dalam Pembelajaran Fisika dimasa Pandemi Covid-19. JIPFRI (Jurnal Inovasi Pendidikan Fisika dan Riset Ilmiah), 4(1), 27-33.
17. Putranta, H., & Supahar. 2019. Synthesis of the Cognitive Aspects' Science Literacy and Higher Order Thinking Skills (HOTS) in Chapter Momentum and Impulse. Journal of Physics: Conference Series. Yogyakarta: Graduate School of Yogyakarta State University, 1-12.
18. Rizaldi, D., R., Jufri, A., W., & Jamaluddin. 2020. PhET: Simulasi Interaktif dalam Proses Pembelajaran Fisika. Jurnal Ilmiah Profesi Pendidikan, 5(1), 10-14.
19. Rosa, G., C., Cari, C., Aminah, N., S., & Handhika, J. 2018. Students' Understanding Level and Scientific Literacy Competencies Related to Momentum and Impulse. Journal of Physics: Conference Series. Surakarta: Sebelas Maret University, 1-8.
20. Samsinar. 2019. Urgensi Learning Resources (Sumber Belajar) dalam Meningkatkan Kualitas Pembelajaran. Jurnal Kependidikan, 13(2), 194-205.
21. Santhalia, P., W., & Sampebatu, E., C. 2020. Pengembangan Multimedia Interaktif Fisika untuk Meningkatkan Pemahaman Konsep Fisika Siswa pada Era Pandemi Covid-19. Jurnal Inovasi Pendidikan IPA, 6(2), 165-175.
22. Sugiyono. 2018. Metode Penelitian Kombinasi (Mixed Methods). Bandung: Alfabeta.
23. Triyani, G., Danawan, A., Suyana, I., & Kaniawati, I. 2019. An Investigation of Students' Misconceptions About Momentum and Impulse Through Interactive Conceptual Instruction (ICI) with Computer Simulation. Journal of Physics: Conference Series. Bandung: Universitas Pendidikan Indonesia, 1-6.
24. Ugwuanyi, C., S., Okeke, C., I., O., & Ageda, T., A. 2020. Psychological Predictors of Physics Learners' Achievement: The Moderating Influence of Gender. Cypriot Journal of Educational Sciences, 15(4), 834-842.
25. Yuberti, Latifah, S., Anugrah, A., Saregar, A., Misbah, & Jermisittiparsert, K. 2019. Approaching Problem-Solving Skills of Momentum and Impulse Phenomena Using Context and Problem-Based Learning. European Journal of Educational Research, 8(4), 1217-1227.

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