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Development of Hybrid Learning Multimedia Assisted by Telegram in Modern Physics

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Abstract: After the covid 19 period ended, learning at Medan State University was conducted face-to-face and online, creating good learning media and design is part of the effort to achieve learning objectives effectively as mandated by the education system. This study aims to develop hybrid learning multimedia assisted by telegram, which is feasible, practical and makes students independent and influential. The research was conducted at the Physics Department of State University of Medan. The phases that will be carried out during the research are needs analysis, design of learning multimedia, development and validation of learning multimedia, implementation of multimedia to students, and internal and external evaluation. The resulting product is a learning multimedia that will be applied to partners, namely students of the Physics Department who take Modern Physics courses. This multimedia was sent to the Telegram group class of 2021 B and 2021 C students. The results of this study are: (a) the percentage of assessment scores for learning multimedia from material experts is 81% and the percentage of assessment scores from media experts is 83% (b) the percentage of student independence questionnaires is 83.8% (c) the percentage of student practicality questionnaires is 88.2% (d) N-gain for PSPF 2021-B is obtained, the result obtained is 0.23 because N-gain <0.23 in the low category and N-gain for PSPF 2021-C is obtained, the result obtained is 0.3 in the medium category.

Keywords: Hybrid Learning; Modern Physics; Multimedia; Telegram

Introduction

Modern Physics is a course for fifth (5th) semester students in the Physics department. Modern Physics studies the behavior of matter and energy at the atomic scale and subatomic particles or waves. Based on observations with several students who have taken the course, the lecturer has provided learning media, but they must look for other sources supporting learning. Students need help finding learning media related to one topic and the next topic. Interviews with two lecturers who teach the course stated that they have made learning media but only for some topics, so they use learning media that already exists on the internet. Using computer media and the internet in online learning is expected to increase students' understanding of learning and sources of information and references for students (Almahasees et al., 2021; Burhendi et al., 2019; Irfandi et al., 2022).

So, based on the above problems, media for hybrid learning assisted by Telegram in Modern Physics are needed. After the covid 19 period ended, learning at Medan State University was conducted face-to-face and online. Students who are intelligent humans are also learning partners with other academic people. Creating good learning media and design is part of the effort to achieve learning objectives effectively as mandated by the education system. Managing every resource and learning facility allows for more significant interaction to provide an atmosphere of freedom of thought for both lecturers and students. Thus, the frequency of interaction between lecturers and students and other learning resources is higher, which makes it possible to

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get students to think critically and dare to develop ideas in the lectures being undertaken. Teaching students to think critically is one of the main objectives of education (Chen, 2022; Kalelioğlu & Gülbahar, 2013; Kazempour, 2015). An educator must be able to create learning that can train students' critical thinking skills to find learning information independently and actively create cognitive structures in students (Patonah, 2014).

Under these conditions, completing the demands of the task is not just fulfilling obligations but a means of adding to the portfolio during the lecture process, which is undoubtedly the basis of the scheme structure in the next journey. No matter how well the learning model or approach has been introduced, it only runs smoothly with the appropriate learning media accompanied by an integrated design. Therefore, collaborative media development is essential carried out by team of lecturers.

Learning media will be developed through multimedia such as PPT, learning videos, pictures, graphics, text, simple experiments, and evaluations. The term multimedia etymologically comes from the words multi and media. Multi means many / plural, and media means conveying messages or information. Multimedia is a combination of several media used to convey messages or information. According to Gayeski, as cited by (Munir, 2012) "multimedia is a collection of computer-based media and communication systems that have a role in building, storing, delivering, and receiving information in the form of text, graphics, audio, video and so on." According to (Garrison & Vaughan, 2012), multimedia combines text, sound, animation, and video conveyed through computers, electronic means, and other digital manipulations. According to (Surjono, 2017), the use of multimedia is not only in the field of learning or education but also in other fields, such as business, industry, tourism, and entertainment. Learning Media is hybrid learning, meaning face-to-face and online meetings will occur. Hybrid learning is a combination of distance learning activities and face-to-face learning methods. To design hybrid learning requires a good and correct understanding for teachers (Alsowat, 2022; Permana, 2022; Raes, 2022). Multimedia developed with the help of the Telegram application. Telegram is one of the social media applications released around 2013 and has now experienced rapid development to rival WhatsApp. Telegram is an internet media application with many advantages: practical, fast access, and efficiency (Aladsani, 2021; Maulidiyah, 2022; Turner, 2020). Two Russian brothers, Nikolai Durov and Pavel Durov, initiated the telegram application. Both share tasks and Nikolai focuses on application development. At the same time, Pavel is responsible for funding and infrastructure (Fitriansyah, Fifit, 2020).

Previous research that supports this, namely (J. R. Gultom et al., 2022; Nugroho et al., 2022; Sari et al., 2022) results of the study, showed that effective learning after the Covid-19 pandemic was hybrid learning, it was chosen as the most suitable learning because it could cover the shortcomings of online and offline learning. Based on the background described, researchers are interested in conducting research titled "Development of Hybrid Learning Multimedia Assisted by telegram in Modern Physics." The research objectives to be achieved in the study are to produce hybrid learning multimedia assisted by telegram in Modern Physics, which is feasible. To determine student responses to hybrid learning multimedia assisted by telegram in Modern Physics. To determine the independence of hybrid learning multimedia assisted by telegram in Modern Physics. To determine the practicality of hybrid learning multimedia assisted telegram in Modern Physics. To determine the effectiveness of hybrid learning multimedia assisted by telegram in Modern Physics

Method

This research will be conducted at the Physics Department of State University of Medan. The research subjects are students in class 2021 who have taken Modern Physics courses and will take Modern Physics courses in classes PSPF 2021-C and PSPF 2021-B. This research uses the Research and Development (R&D) model, namely ADDIE (Analysis, Design, Development, Implementation, Evaluation), which consists of analysis, design, development, implementation, and evaluation. The stages of research and development of the ADDIE R&D (Research and Development) model are as follows:

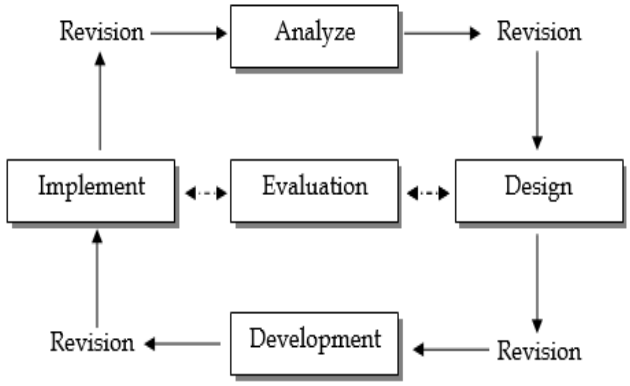

Figure 1. Research Stages

Instruments or data collection tools in this study use observation, tests, non-tests (questionnaires), and documentation. Data analysis techniques are carried out using analysis techniques. After all data has been obtained and collected, the data needs to be analyzed.

Qualitative and quantitative data analysis techniques are used by researchers in this development. Qualitative data was obtained from the results of observations before researching the 2020 Dik D Physics Department at State University of Medan. Quantitative data consists of assessment scores by material experts, media experts, practicality questionnaires, student independence questionnaires, and media effectiveness.

For the percentage of feasibility

Table 1. Percentage Scale

Percentage of Achievement (%)	Scale	Interpretation Score
76 ≤ skor ≤ 100	4	Very Feasible
51 ≤ skor ≤ 75	3	Feasible
26 ≤ skor ≤ 50	2	Pretty Feasible
0 ≤ skor ≤ 25	1	Less Feasible

Practicality data analysis

The practicality of the product can be seen in the Table 2.

Table 2. Criteria for Interpretation of Product Practicality

Interpretation Criteria	Percentage (%)
Very practical	81<X<100
Practical	61<X<80
Pretty Practical	41<X<60
Not Practical	21<X<40
Very Not Practical	0<X<20

Data analysis of increased independence

Data analysis for increasing student learning independence using the Likert scale formula is as Formula 1:

$$p = \frac{f}{n} \times 100\% \quad (1)$$

Description:
p = percentage
f = frequency
n = number of ideal scores

After the score is obtained, it is then entered into a rating scale to determine the results of the questionnaire data with provisions such as Table 3.

Table 3. Criteria for Improving Independence

Interpretation Criteria	Percentage (%)
Very Good	81<X<100
Good	61<X<80
Pretty Good	41<X<60
Not Good	21<X<40
Very Not Good	0 <X<20

Product Effectiveness Analysis This analysis is used to calculate the effectiveness of products from test instruments that have been given to students. Calculating the results of the study is done by comparing the results of the pretest and post-test, usually called Gain. Gain is the difference between pretest and post-test scores; Gain shows the increase in students' mastery of concepts after following the learning process. To see the increase in value, it can be calculated with the normalized gain formula (Formula 2).

$$< g >= \frac{posttest\ score - pretest\ score}{maximum\ score - pretest\ score} \quad (2)$$

After the calculation results have been obtained, then adjusted based on the categories as in Table 4 below:

Table 4. Classification of Gain according to Hake

Average Gain Score ($\boldsymbol{g}$)	Category
$-1.00 < g < 0.00$	Declining
$g = 0.00$	Same
$0.00 < g < 0.30$	Low
$0.30 < g < 0.070$	Medium
$0.70 < g < 1.00$	High

(Hake, 1998)

Result and Discussion

Research Results

This research produces a product, namely multimedia hybrid learning assisted by telegram in modern physics. Based on the development of the ADDIE Research and Development (R&D) development model used in this study, namely:

1. Analysis.

The first stage in the ADDIE development model is analysis. Researchers conducted a needs analysis through observations during the learning process of Modern Physics courses and interviews with lecturers who brought Modern Physics courses. The analysis carried out is curriculum analysis, which is used to determine the curriculum, teaching materials, RPS, and learning models used in the Physics Department in Unimed. Furthermore, material analysis is carried out to determine the material to be included in the learning multimedia based on learning objectives and learning outcomes. The material discussed in multimedia is the development of modern physics, special relativity theory, particle-wave dualism, atomic models and spectra, and the Schrodinger Equations.

2. *Design.*

The second stage in the ADDIE model is design. The design was carried out in making Multimedia learning modern physics courses. Starting from making storyboards and scenarios in making videos and designing multimedia using the Canva application, PowerPoint, and the Capcut application for editing video making.

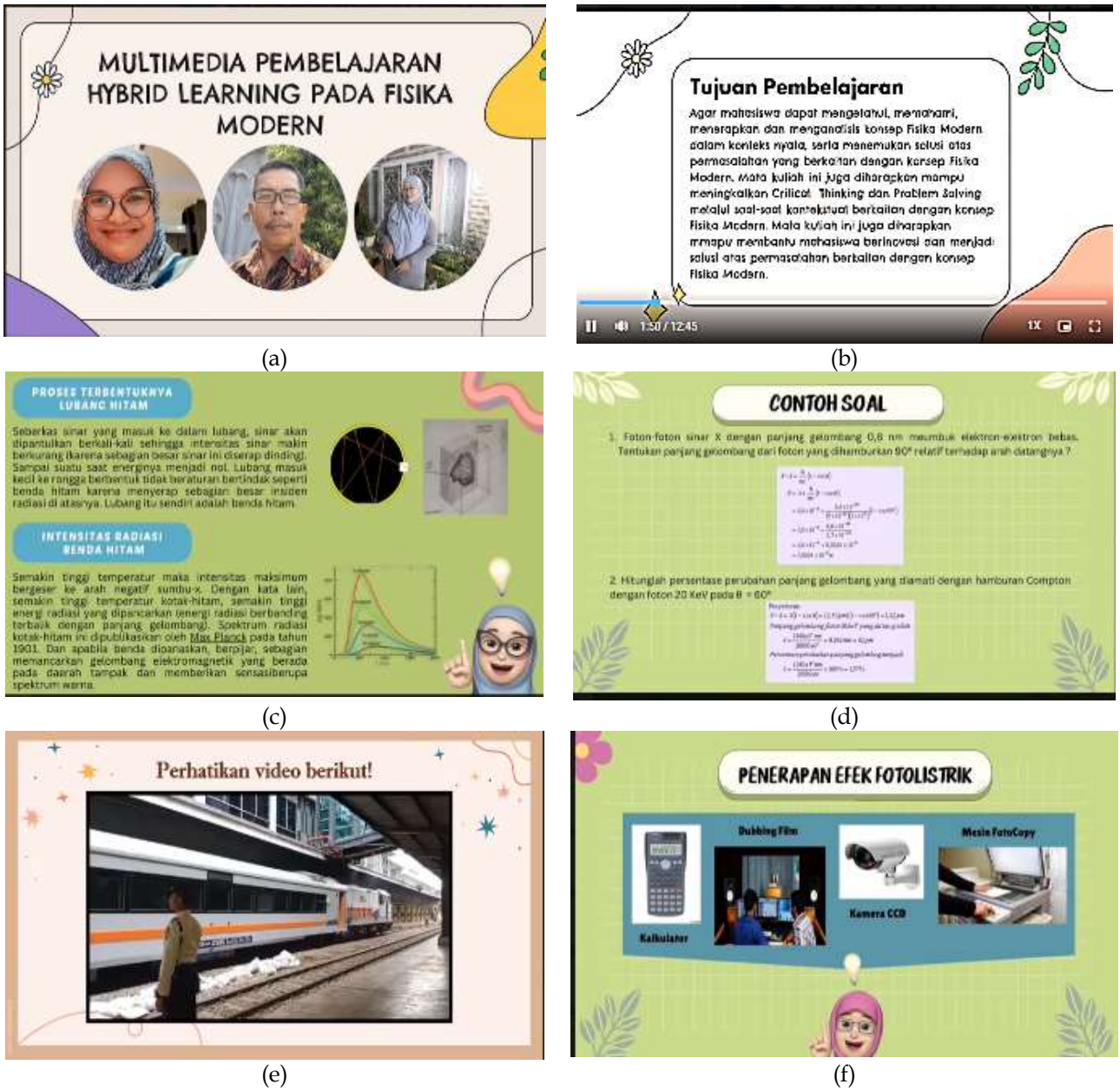

Figure 2. Results of Design the Multimedia Learning

3. *Development.*

The third stage in the ADDIE development model is development. Product manufacturing is carried out at the development stage, namely multimedia learning for Modern Physics courses. After the product has been finished, feasibility is carried out by material experts and media experts. The product is Modern Physics Hybrid Learning multimedia. The results of the material experts on hybrid learning multimedia are:

Table 5. Material Expert on Learning Multimedia

Aspects	Frequency					Score	Item	Max Score	%
	1	2	3	4	5				
Functionality	0	0	0	6	1	29	7	35	83
Reability	0	0	0	6	0	24	6	30	80
Usability	0	0	0	7	0	28	7	35	80
Total						81	20	100	81

Table 6. Media Expert on Learning Multimedia

Aspects	Frequency					Score	Item	Max Score	%
	1	2	3	4	5				
Coloring	0	0	1	6	2	37	9	45	82
Organization	0	0	0	4	2	26	6	30	86.7
Usability	0	0	0	4	0	16	4	20	80
Total						79	19		95

4. *Implementation*

The fourth stage in the ADDIE development model is implementation. After the Modern Physics multimedia has been declared very feasible to use by material experts and media experts, the trial stage is carried out for students who have taken Modern Physics courses, namely students majoring in Physics Unimed class of 2020. The product trial aims to determine the practicality and independence of students after learning multimedia. The results of the practicality questionnaire are 80% with practical criteria. The results of the student independence questionnaire are 83.8%, namely, with very good criteria. For the effectiveness of multimedia based on data from the calculation of N-gain for PSPF 2021-B, the results obtained are 0.23 because N-gain <0.23 in the low category. Based on the data from the calculation of N-gain for PSPF 2021-C, the result obtained is 0.3 because 0.3 ≤ N-gain ≤ 0.7 in the medium category.

5. *Evaluation*

At the evaluation stage, management of the results of the learning multimedia assessment and conclusion is carried out. Based on the assessment of media experts and material experts, from the practicality questionnaire, the independence questionnaire, and the effectiveness value of multimedia, it can be concluded that hybrid learning multimedia assisted by telegram is declared feasible to use, practical, and very good for student independence.

The result of this research is a highly suitable, practical, and compelling multimedia hybrid learning approach for Modern Physics, which significantly enhances self-reliance. The development model employed in this study is the ADDIE model. This multimedia was designed to make it easy for learners to grasp the concepts of Modern Physics. Previously, students found it challenging to understand the material solely by reading textbooks, so a medium that can engage and facilitate learning, such as multimedia, is needed. The topics covered include the Development of Modern Physics, the Special Theory of Relativity, Wave-Particle Duality, Atomic Models and Spectra, and Schrödinger's Equation. This multimedia consists of PowerPoint presentations, videos, formula derivations, graphics, and applications of Modern Physics in everyday life, sample questions, and exercises. Various applications were used to create this multimedia, including (a) Canva for creating engaging animations. Canva provides features and uses for education, explaining that Canva is a tool for creativity and collaboration in all classrooms. It is the only design platform needed in class, fostering creativity and collaborative skills, making visual learning and communication easy and enjoyable (Hidayah et al., 2023; Holisoh et al., 2023; Monoarfa & Haling, 2021); (b) PowerPoint, where Modern Physics content is typed in PowerPoint presentations. Files created in PowerPoint are usually more accessible and practical due to their offline accessibility and relatively smaller file size (Wulandari, 2022); (c) Capcut for video editing. This application offers numerous templates and can be downloaded and used for free.

This hybrid learning multimedia was developed with the assistance of Telegram, a mobile application that can be installed via the Play Store if not already on your device. Telegram can be accessed from various devices, including smartphones, tablets, computers, laptops, and more (Ernawati et al., 2022). The Telegram app can share documents, photos, videos, and other files. Other features developed by Telegram include secret chats, Telegram groups, Telegram channels, and Telegram bots (Vladimir, 2021).

Several learning sessions were conducted online and face-to-face because this course consists of 3 credit hours. The first 1.5 credit hours were delivered online, explaining the learning objectives, taking attendance, clarifying learning outcomes, and directing students to access the multimedia. The next 1.5 credit hours involved face-to-face classroom discussions of the multimedia and group discussions. According to (Gultom et al., 2021; Haetami, 2023; Husamah, 2014), the goals of hybrid learning are as follows: (1) to help students develop better learning processes based on their learning styles and preferences; (2) to provide practical and realistic opportunities for instructors and students to learn independently, effectively, and continuously, and (3) to offer flexible scheduling for students by combining the best aspects of face-to-face and online learning.

After designing and creating this multimedia, it was evaluated for its suitability by content experts and media experts. The assessment score percentages for the learning multimedia were 81% from content experts, indicating it is highly suitable. Suggestions from content experts included adding current content that facilitates concept understanding. The assessment score percentages from media experts were 83%, indicating it is highly suitable. Media experts suggested minimizing the amount of text on the media and using moving text or text transitions during audio explanations. In terms of practicality, the practicality questionnaire resulted in an

80% score. As for the students' self-reliance, the questionnaire yielded a score of 83.8%, indicating it was very good. For the effectiveness of the multimedia, based on the data obtained from the calculation of N-gain for PSPF 2021-B, the result was 0.23, categorized as low since N-gain < 0.23. Based on the data from the calculation of N-gain for PSPF 2021-C, the result was 0.3, categorized as moderate since 0.3 ≤ N-gain ≤ 0.7. The advantages of this multimedia hybrid learning approach are a) it can be accessed anytime and anywhere, enabling students to learn independently, and b) it can be accessed without internet data. However, the drawback is that students may passively consume the content without active engagement.

Conclusion

The resulting product is a hybrid learning multimedia assisted by telegram. The results of the feasibility of material experts and media experts on learning design and learning multimedia show very feasible criteria for use. The results of the practicability questionnaire given to students in 2020 are Practical. The results of the independence questionnaire given to students of cohort 2020 are outstanding in increasing student independence. N-gain for PSPF 2021-B is in the low category, and N-gain for PSPF 2021-C is in the medium category.

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Author Contributions
Yeni Megalina, Rugaya, Juniar Hutahaean: writing-original draft preparation, result, discussion, methodology, analysis, conclusion; Rajo Hasim Lubis: proofreading, review, and editing.

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Conflicts of Interest
The authors declare that there is no conflict of interestregarding the publication of this paper.

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