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Development of Physics Learning Media Assisted by Threads Instagram for High School Students

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Abstract

Physics learning is often perceived as difficult by students due to limited opportunities to visualize and imagine the concepts being taught, which in turn reduces their engagement and interest in learning. One of the topics that is still delivered using lecture methods and textbooks is optical instruments. Therefore, an innovative learning medium is needed to boost student engagement. This study aims to examine its validity through theoretical and empirical analysis, assess its practicality, and determine its effectiveness.

This research is a development study (Research and Development) using the 4-D model, which consists of four stages: define, design, develop, and disseminate. The developed media utilizes the Threads application on Instagram to support physics learning. The research subjects included media expert validators and eleventh-grade students at SMA PGRI Sungguminasa, Gowa Regency, as respondents. Physics learning is often perceived as difficult by students due to limited opportunities to visualize and imagine the concepts being taught, which in turn reduces their engagement and interest in learning. One of the topics that is still commonly delivered through lectures and textbooks is optical instruments. Therefore, an innovative learning medium is needed to enhance student engagement and understanding. In this context, the study aims to examine the validity of the developed media through theoretical and empirical analysis, as well as to assess its practicality and effectiveness in supporting physics learning.

The results indicated that the teachers' responses to the developed media reached a score of 80.65%, falling within the valid and appropriate category for supporting physics instruction. Categorized as practical, while students' responses were 92.54%, categorized as highly practical. The N-Gain test on student learning outcomes showed a score of 0.85 in the high category, with an effectiveness percentage of 84.96%, categorized as effective. Thus, the physics learning media using Threads Instagram is proven to be practical and effective as a supporting tool for physics instruction in the classroom.

Keywords: physics learning, learning media, optical instruments, threads instagram, research and development

1. Introduction

1.1 Introduce the Problem

Education plays a crucial role in improving human quality of life and developing individual potential to meet life's demands. In the context of national progress, strategies and innovations in learning are key to creating a well-structured and engaging education system for students. The advancement of science and technology influences various fields, including education. Changes in education encompass aspects such as teacher quality, curriculum, learning processes, as well as educational facilities and infrastructure. The effectiveness of learning is highly dependent on teachers' ability to utilize resources and learning media, including the use of digital technology (Supriadi, 2017)

The use of digital entertainment-based media, such as animations and other interactive media, has been proven to increase students' interest in learning. Meanwhile, learning is still dominated by textbooks with static images that are less engaging and interactive. Therefore, innovation in learning media is urgently needed to enhance learning effectiveness. The technological revolution has brought significant changes to education, one of which is the use of social media as a learning tool. Instagram, as a popular social media platform, has the potential to support learning through its interactive features. Instagram Threads allows for the systematic and engaging presentation of material using images, videos, and short texts (Feyzioğlu & Demirci, 2021).

Physics learning presents challenges in explaining abstract concepts to students. The use of innovative learning media can help improve students' understanding and interest in learning. Instagram Threads provides an opportunity for educators to present physics materials in a more engaging and accessible way. By incorporating images, short videos, and real-world examples, physics learning can become more interactive and relevant for students (Haryanti et al., 2023). A nation's success in facing globalization greatly depends on the quality of its human resources, particularly in the field of STEM (Science, Technology, Engineering, and Mathematics). STEM education aims to enhance students' scientific and technological literacy so they can apply STEM-related concepts in the professional world (Utami & Novaliendry, 2020). Furthermore, the use of digital learning media, supported by information technology, facilitates the delivery of materials in a more practical manner. By presenting content in a more engaging and easily comprehensible format, digital-based media can reduce cognitive load, thereby improving learning effectiveness. (Finamore et al., 2021).

1.2 Formulation of the Problem and Aims of the Study

Based on the aforementioned background, this study aims to develop a physics learning media assisted by the Threads Instagram application and evaluate its development results through theoretical and empirical validation. Additionally, this research examines the practicality and effectiveness of the media for high school students. The expected product is a physics learning media based on Threads Instagram that can be accessed anytime and anywhere, making physics material easier and more engaging to learn.

Instagram is a social networking platform used for sharing photos and videos with filter features and various interaction options. Threads Instagram is a part of Instagram that functions similarly to Twitter, allowing users to share photos, videos, and text-based content. In this study, the development of learning media follows the 4D model, which consists of four stages: Define, Design, Develop, and Disseminate, commonly used in various types of learning media.

1.3 Literature Review

Physics Learning

The study of physics serves as a means to deepen understanding of the natural universe, foster analytical and reasoning competencies, and advance intellectual development. (Hafsah et al., 2016). On the other hand, physics is recognized as a natural science requiring deep conceptual understanding (Supardi et al., 2015). Physics is one of the subjects in high school, classified as a branch of natural sciences (Ilmu Pengetahuan Alam, IPA). Effective physics learning is based on the essence of physics as both a process and a product. The product includes theories, principles, laws, and equations, while the process involves discovering and applying these products in real-life contexts (Amaliyah & Hakim, 2023).

Physics is often perceived as a difficult and less popular subject among students because it requires the mastery of abstract concepts that are not always directly observable in everyday life, as well as the application of complex mathematical formulas and problem-solving strategies. This combination of conceptual and analytical demands can create cognitive overload, leading many students to experience difficulties in understanding the material and to develop negative attitudes towards the subject (Haryanti et al., 2023).

Objectives of Physics Learning

Physics learning emphasizes students' ability to think scientifically, comprehend factual knowledge based on concepts and calculus, and develop experimental attitudes (Lahme et al., n.d.). The objectives of physics learning include fostering an understanding of fundamental principles and concepts, while also enhancing analytical skills, problem-solving abilities, and logical reasoning (Siemens et al., 2005). Eemphasized that physics learning is intended to foster curiosity, stimulate interest in natural phenomena, and develop the ability to communicate scientific concepts effectively (Junita et al., 2023).

Characteristics of Physics Learning

Effective physics learning influences teaching outcomes and deepens conceptual understanding. It adopts an inquiry-based approach where students actively participate in experiments, observations, and data analysis. This hands-on experience fosters curiosity and a better grasp of physical concepts (Dwyer et al., 2014). Furthermore, physics learning emphasizes critical and analytical thinking. Students are encouraged to identify problems, analysed information, and develop logical and creative problem-solving strategies. Critical thinking strategies enhance students' ability to solve physics problems effectively (Kurniawan, 2022). Technology and digital media are increasingly integrated into physics learning. Computer simulations, interactive software, and multimedia help visualize abstract physics concepts, making learning more engaging and accessible (Marcinauskas et al., 2024).

Scope of Physics Learning

High school physics learning covers various topics fundamental to understanding physics:

1. Mechanics: Newton's laws, momentum, kinetic energy, and gravity (Halliday et al., 2014).
2. Thermodynamics: Energy changes, heat, and thermal cycles (Fayakun & Joko, 2015).
3. Electromagnetism: Coulomb's law, Gauss's law, electromagnetic induction, and electrical circuits (Griffiths & Inglefield, 2005).
4. Optics: Light refraction, lens and mirror imaging, diffraction, and interference (Hecht, 2017).
5. Modern Physics: Special relativity and quantum mechanics (Tomlinson, 2014).
6. Applied Physics: Practical applications in technology and medicine (Sweller, 2010).
7. Laboratory Learning: Hands-on experiments to reinforce conceptual understanding (Wilson & Hernández-Hall, 2014).

Learning Media

1. Definition of Learning Media Learning media are tools or resources used to convey information effectively. These include visual, audio, or interactive materials that enhance students' engagement and understanding (Hamari et al., 2014).
2. Objectives of Learning Media Learning media aim to: a. Enhance learning appeal by creating engaging environments (Utami & Novaliendry, 2020). b. Clarify concepts using visual aids (Ertmer et al., 2017). c. Improve retention and comprehension (Mayer, 2002). d. foster student participation through interactive tools (Dwyer et al., 2014).
3. Functions of Learning Media Learning media serve to: a. Improve teaching effectiveness (Mayer, 2002). b. Facilitate active learning (Hamari et al., 2014). c. Create an engaging learning environment (Keengwe, 2015). d. Support multimodal learning (Clark et al., 2003).
4. The integration of technology has advanced the development of learning media, making education more interactive and accessible (Harefa & La'ia, 2021). To be effective, learning media should be designed in alignment with established learning theories, including constructivism, cognitivism, social learning, and connectivism (Shabani et al., 2010).

Steps in developing learning media include:

1. Needs analysis (Luthfi & Surya, 2024).
2. Content design (Ertmer et al., 2017).
3. Content development (Hegarty & Tarampi, 2015).
4. Initial testing and evaluation (Guo et al., 2014).
5. Revision and updates (Bates & Sangra, 2011).

Learning Media Assisted by Instagram Threads

Innovative and interactive physics learning through Instagram Threads can make lessons more engaging. This platform allows teachers to present physics concepts in an appealing and digestible manner (Marini, 2023).

2. Method

In this study, the validity and reliability of the instrument were measured to ensure the accuracy of the obtained data. Validity refers to the extent to which an instrument measures what it is intended to measure, while reliability relates to the consistency of measurement results (Gregory, 2015). The use of the Likert scale in attitude measurement has been widely applied in educational research, where its validity and reliability are analysed to ensure credible results (Putranadi et al., 2021).

Table 1. Inter-Rater Agreement Model for Media Validation

Assessor I \ Assessor II	1-2	3-4
1-2	A	B
3-4	C	D

$$R = \frac{D}{A + B + C + D}$$

Description:
R: Media Validation
A: Both experts disagree
B: Expert I agrees, Expert II disagrees
C: Expert I disagrees, Expert II agrees
D: Both experts agree

Validation Criteria:
0.80 – 1.00: Very high content validity
0.60 – 0.79: High content validity
0.40 – 0.59: Moderate content validity
0.20 – 0.39: Low content validity

0.00 – 0.19: Very low content validity

In the context of instructional media development, the use of technology has become a crucial aspect in enhancing the effectiveness of the teaching and learning process. Interactive multimedia-based learning media have been proven to improve students' conceptual understanding (Nurdin et al., 2017). Furthermore, the utilization of digital media in physics education has demonstrated significant effectiveness in enhancing students' comprehension of concepts (Utami & Novaliendry, 2020). Evaluations of the practicality of technology-based learning media indicate that integrating technology into science education can increase student engagement and learning outcomes (Bagus et al., 2023).

Table 2. Response Test Questionnaire Scores.

Alternative	Positive Score	Negative Score
Strongly Agree	5	1
Agree	4	2
Doubtful	3	3
Disagree	2	4
Strongly Disagree	1	5

$$\mathrm{P} = \frac{\mathrm{f}}{n}\, x\ 100\%$$

Explanation:
P: Practicality Percentage
f: Number of positive responses from students for each emerging aspect
n: Total number of students

$$Response\ Percentage = \frac{\sum A}{\sum B}\, x\ 100\%$$

With:
ΣA: Total obtained response score
ΣB: Maximum possible questionnaire response score

Table 3. Categories of Student and Teacher Responses.

Response Percentage	Interpretation
< 20.002	Impractical
21.00 – 40.00	Less Practical
41.00 – 60.00	Quite Practical
61.00 – 80.00	Practical
81.00 – 100	Very Practical

From a cognitive perspective, the concept of metacognition plays a crucial role in enhancing students' awareness of their own learning processes. Metacognition is defined as an individual's awareness and control over their thinking strategies in learning (Nelson et al., 2009). By understanding how they learn, students can more effectively manage their learning strategies.

To measure learning effectiveness, the N-Gain Score calculation is commonly used. This method assesses the improvement in student learning outcomes before and after an intervention in educational research (Hafsah et al., 2016). In other studies, the N-Gain Score has also been widely applied in evaluating technology-based learning to determine the effectiveness of a learning method (Fayakun & Joko, 2015). Converting scores into more meaningful values is also a key aspect of learning evaluation, providing educators and students with an easier-to-understand interpretation (Zainal, 2013).

$$< g > = \frac{posttest - pretest}{maximum\ score - \ pretest}$$

Table 4. N-Gain Classification

No.	g Grade	Interpretation
1	g > 0,70	High
2	0,30 < g < 0,70	Currently
3	g < 0,30	Low

$$Acquired\ score = \frac{Total\ score}{Number\ of\ qustions} x\ 100\%$$

3. Results

This study developed physics learning media assisted by Threads Instagram for high school students using the 4D model, which consists of the stages of Define, Design, Development, and Disseminate. However, the dissemination stage was limited to one class. In the Define stage, interviews with physics teachers and students at SMA PGRI Sungguminasa Gowa revealed that learning was still teacher-centered, students' reading interest in physics was low, and their learning independence was lacking. A material and concept analysis were conducted to ensure that the learning media aligned with students' characteristics. In the Design stage, the researcher developed the media by selecting Threads Instagram as the primary platform due to its popularity among teenagers and accessibility via smartphones (Clark et al., 2003). Canva was used to create images and animations, CapCut for editing and adding voiceovers (Mayer, 2002), and Threads Instagram as the platform for sharing learning materials. The content format was designed to align with the optical instrument’s topic in the 11th-grade syllabus of the 2013 revised curriculum. Assessment instruments included media validation sheets, student and teacher response questionnaires, as well as pre-test and post-test evaluations to measure the validity, practicality, and effectiveness of the developed learning media.

The Development stage involved creating the learning media by integrating videos, illustrated images, and voice narration using Canva and CapCut. The edited videos were then uploaded to Threads Instagram for student access. Media validation was conducted by experts to assess its validity, while student and teacher response questionnaires were used to evaluate the practicality of the media. Additionally, pre-test and post-test assessments were carried out to determine the effectiveness of the media in improving students' learning outcomes (Mayer, 2002). The results of this study indicate that physics learning media assisted by Threads Instagram can serve as an innovative digital learning alternative, enhancing student engagement and understanding of physics concepts.

The developed learning media is physics learning media assisted by Threads Instagram. At this stage, the media was validated by two expert validators from Universitas Muhammadiyah Makassar. The purpose of this validation was to refine the product based on feedback and suggestions from the validators. The validators were:

Table 5. Names of Expert Validators

No.	Validator	Job
1	Dr. Salwa Rufaidah, S.Pd., M.Pd	Lecturer of Physics Education Study Program
2	Nurazmi, S.Pd., M.Pd	Lecturer of Physics Education Study Program

The instrument assessment was conducted by checking (√) the appropriate aspects and providing notes on areas that needed improvement along with suggestions. After evaluation, the expert validators did not suggest any revisions, as they deemed the media suitable for use without modifications.

The media validation assessment consisted of three aspects: presentation feasibility, content feasibility, and language feasibility. The validation sheet is available in the appendix, while the validation results are presented in the table below.

Table 6. Expert Media Validation Results

Aspect	Grade	Category
Eligibility of Presentation	1.00	Very high content validation
Eligibility of Content	1.00	Very high content validation
Language Aspect	1.00	Very high content validation
Average	**1.00**	**Very high content validation**

The media validation results showed an average score of 1.00 across all assessment aspects, indicating very high content validity. Presentation feasibility, content feasibility, and language feasibility each scored 1.00. The validation results are presented in the graph below.

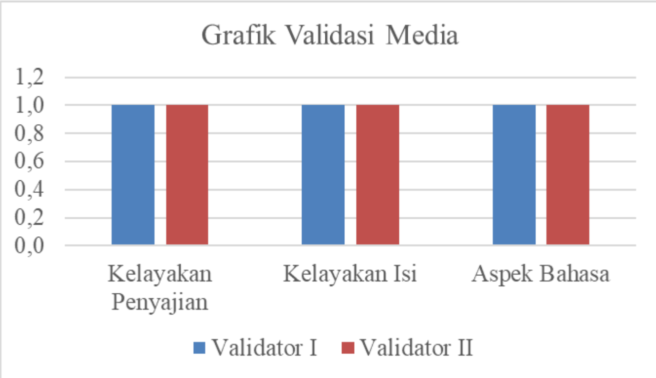

Figure 1. Media Validation Graph

The research instrument validation included student and teacher response questionnaires to assess the practicality of the developed media for dissemination. Two validators reviewed the validation sheets, which contained eight items covering three aspects: guideline feasibility, content feasibility, and language. The validation results for the teacher and student response questionnaires are as follows.

Table 7. Results of Teacher Response Questionnaire Validation

Aspect	Grade	Criteria
Eligibility of Instructions	1.00	Valid
Eligibility of Content	1.00	Valid
Language Aspect	1.00	Valid

Table 8. Results of Student Response Questionnaire Validation

Aspect	Grade	Criteria
Eligibility of Instructions	1.00	Valid
Eligibility of Content	1.00	Valid
Language Aspect	1.00	Valid

The validation results of the teacher and student response sheets indicate that all assessed aspects are valid, making them suitable for use in the study.

The Disseminate stage of the 4D model involved implementing the revised physics learning media using Threads Instagram in the classroom. A limited trial was conducted with one physics teacher and 23 students from Class XI IPA at SMA PGRI Sungguminasa, Gowa, to assess practicality, student responses, and learning effectiveness.

After being validated, the media was tested in Class XI IPA at SMA PGRI Sungguminasa, Gowa. The researcher conducted learning sessions using the developed media, starting with a pre-test to assess students' initial understanding using traditional textbooks. After completing the pre-test, the researcher introduced the Threads Instagram learning media, then distributed teacher and student response questionnaires to evaluate its practicality. A post-test was then administered to measure students' learning outcomes after using the media. The recap of teacher response data is presented in the following table and diagram.

Table 9. Recapitulation of Teacher Response Questionnaire Data

No.	Indicator	Number of Aspect	Ideal Score	Percentage	Interpretation
1	Cognitive	28	32	87,50%	Very Practical
2	Affective	18	24	75,00%	Practical
3	Conative	12	18	66,67%	Practical
Average teacher response		**50**	**62**	**80,65%**	**Practical**

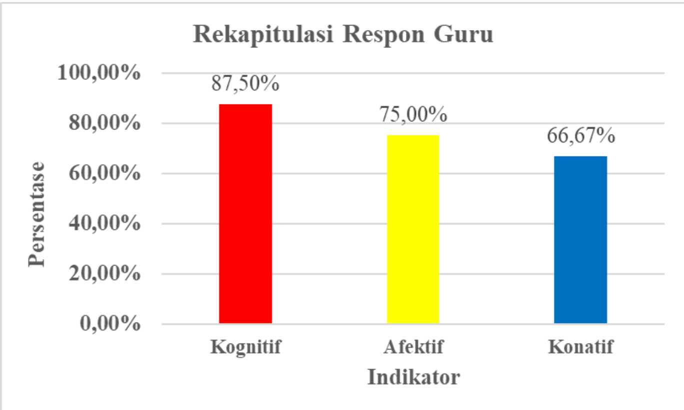

Figure 2. Graph of Teacher Response Results

The average teacher response in Table 4.5 is 80.65%, indicating that the Threads Instagram-assisted physics learning media is practical and suitable for use. The response graph shows that the cognitive indicator scored 87.50% (very practical), the affective indicator 75.00% (practical), and the conative indicator 66.67% (practical). The recap of student response data is presented in the following table and graph.

Table 10. Recapitulation of Student Response Questionnaire Data

No.	Indicator	Number of Aspect	Ideal Score	Percentage	Interpretation
1	Cognitive	635	740	85,81%	Very Practical
2	Affective	753	760	99,08%	Very Practical
3	Conative	315	340	92,65%	Very Practical
Average students' response		**1493**	**1613**	**92,54%**	**Very Practical**

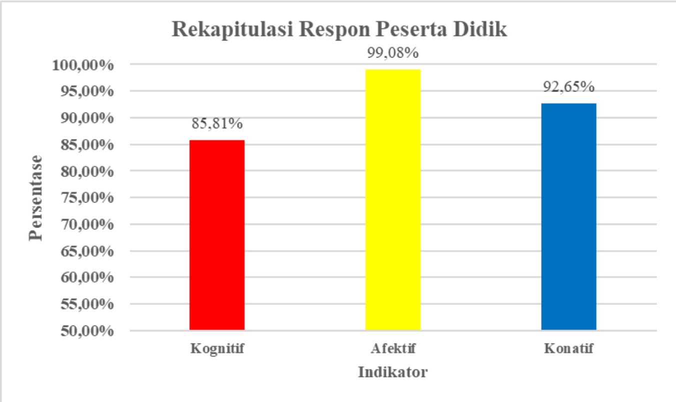

Figure 3. Graph of Student Response Results

Based on Table 4.6, the student response survey, involving 23 students from class XI IPA, showed an average response rate of 92.54%, categorized as very practical. The response graph indicates cognitive (85.81%), affective (99.08%), and conative (92.65%) indicators, all within the very practical category. This suggests that the media effectively supports classroom learning, as students responded positively to its use.

To measure its effectiveness, students completed a pre-test before learning and a post-test after using the Threads Instagram-assisted physics learning media. The comparison of pre-test and post-test results is presented in the following table and graph.

Table 11. Analysis Results of Pre-Test and Post-Test Scores

Category	Pre-Test	Post-Tes
Number Of Samples	23	23
Average of score	33,65	89,91
The highest score	50	100
The lowest score	13	73
Ideal score	100	100

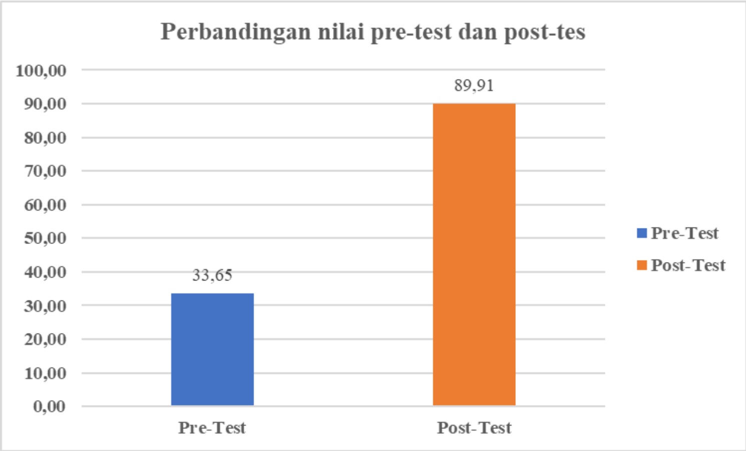

Figure 4. Comparison Graph of Pre-Test and Post-Test Scores

After collecting all data (pre-test and post-test), the significance of students' learning improvement was analyzed using the N-Gain formula. The results of the N-Gain test for student learning outcomes are presented in the following table.

Table 12. Distribution of N-Gain Scores

CLASSIFICATION OF N-GAIN SCORE	
N-Gain Scores Range	**Category**
0.85	High
0	Medium
0	Low

Table 13. Results of N-Gain Effectiveness Test

Interpretation Categories of N-Gain Effectiveness	
Percentage (%)	**Category**
0	Not Effective
0	Less Effective
0	Moderately Effective
84.82	Effective

Based on the N-Gain test results, the N-Gain score of 0.85 indicates a high category. The effectiveness test results show a range of >76%, concluding that the physics learning media using Threads Instagram is effective and suitable as a teaching aid.

4. Discussion

The findings of this study provide strong evidence supporting the effectiveness of physics learning media assisted by Threads Instagram for high school students. The results confirm the primary hypothesis that the developed media is valid, practical, and effective in enhancing students' learning outcomes in physics. The validation process by experts showed that the media met high theoretical validity standards (1.00, categorized as very valid), ensuring that the content, presentation, and language aspects were well-structured and appropriate for classroom implementation.

The practicality of the media was confirmed by the responses from both teachers and students. The teacher's response score of 80.65% (categorized as practical) indicates that the media is feasible and user-friendly for instructional purposes. Meanwhile, the students' response score of 92.54% (categorized as very practical) reflects their high level of engagement and positive reception towards the learning experience facilitated by Threads Instagram. These findings align with previous studies highlighting the role of digital media in increasing student motivation and engagement in physics learning (Utami & Novaliendry, 2020).

Effectiveness was measured through pre-test and post-test comparisons using the N-Gain formula. The N-Gain score of 0.85 (categorized as high) and an effectiveness percentage of 84.96% further substantiate that the learning media significantly improved students' understanding of optical instruments. This result corroborates existing research that emphasizes the advantages of multimedia-based learning tools in fostering conceptual comprehension in science education (Nurdin et al., 2017).

Despite its promising results, this study acknowledges several limitations. The reliance on Threads Instagram as a learning platform raises concerns about accessibility, as not all students may have access to the application due to age restrictions or parental control settings. Additionally, while the media effectively visualized optical instruments through images and videos, its capability to deliver more complex physics concepts requiring hands-on demonstrations remains limited. These factors should be considered for future research and development to enhance media adaptability across broader physics topics.

Another potential limitation is the reliance on pre-test and post-test assessments, which primarily measure short-term learning gains. Future studies should consider longitudinal assessments to evaluate the long-term retention of knowledge and the media's impact on students' ability to apply concepts in real-world situations. Furthermore, technical issues such as internet connectivity and platform stability may affect the seamless integration of this media into classroom learning.

Despite these limitations, the study contributes to the growing body of research on digital media integration in education. The use of social media platforms like Threads Instagram offers a novel approach that aligns with students' digital habits, making learning more interactive and engaging. The positive responses from both students and teachers highlight the potential of social media-assisted learning as an effective educational tool.

5. Conclusion

This study concludes that the physics learning media assisted by Threads Instagram is valid, practical, and effective in improving student learning outcomes. The media successfully enhances engagement and motivation, making physics learning more interactive and accessible. While limitations exist, the overall findings suggest that this approach is a valuable addition to digital learning strategies in science education. Future research should focus on expanding the media's scope, addressing accessibility challenges, and exploring its effectiveness in broader educational contexts.

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Obtained.

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The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Data sharing statement

No additional data are available.

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