Jurnal Pendidikan Fisika
Vol. 14 No. 2, Desember 2025_278-285
DOI: 10.24114/jpf.v14i2.65865
p-ISSN: 2552-732X
e-ISSN: 2301-7651

Research Article

OPEN ACCESS

Analysis of the Quality of Interactive Mobile Learning Media Based on Global Warming Material at SMA Negeri 2 Medan

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ARTICLE DETAILS

Article History:
Submitted: 08-07-2025
Revised : 17-09-2025
Accepted : 27-12-2025
Published: 31-12-2025

Keywords:
Android;
MIT App Inventor;
Mobile Learing;
Global Warming

Kata Kunci:
Android;
MIT App Inventor;
Mobile Learning;
Pemanasan Global

ABSTRACT

Student disengagement and suboptimal learning completeness in physics at SMA Negeri 2 Medan, attributed to monotonous learning media, prompted the development of a mobile learning application using MIT App Inventor to enhance student interest. This inquire about utilized the Research and Development (R&D) strategy utilized the ADDIE show with lesson X understudies as subjects. The developed media showed high validity (87.03% media, 92% material), practicality (95% teacher response, 93.8% student response), and effectiveness, as indicated by a significant N-gain of 0.80 (high category) between pre-test (46.67) and post-test (90.13) scores on global warming material. The study concludes that this mobile learning physics media is highly valid, practical, and effective for use at SMA Negeri 2 Medan. Based on this data, it can be concluded that the material physics learning media based on versatile learning MIT App Inventor created by analysts is exceptionally feasibility, exceptionally practical and exceptionally effective to utilize.

ABSTRAK

Kebosanan dan rendahnya keterlibatan siswa SMA Negeri 2 Medan dalam pembelajaran fisika akibat media pembelajaran yang monoton menyebabkan dikembangkannya aplikasi mobile learning menggunakan MIT App Inventor. Penelitian ini menggunakan metode Research & Development (R&D) dengan subjek penelitian siswa kelas X. Media yang dikembangkan menunjukkan hasil yang tinggi yaitu kelayakan (87,03% media, 92% materi), praktikalitas (95% respon guru, 93,8% respon siswa), dan efektivitas yang ditunjukkan dengan nilai N-gain yang signifikan sebesar 0,80 (kategori tinggi) antara skor pre-test (46,67) dan post-test (90,13) pada materi pemanasan global. Hasil penelitian menunjukkan validitas, kepraktisan, dan efektivitas yang tinggi dari media pembelajaran fisika berbasis mobile learning dengan platform MIT App Inventor pada topik pemanasan global di SMA Negeri 2 Medan. Dengan demikian, media ini berpotensi meningkatkan kualitas pembelajaran fisika.

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INTRODUCTION

The advancement of Information and Communication Technology (ICT) has significantly impacted education, necessitating digital learning to enhance teaching and learning effectiveness. Mobile learning offers accessible learning materials via smartphones, aligning with the digital era's demands (Koroh et al., 2024). Developed nations prioritize education, recognizing the link between science, technology, and quality of life (Arifin, 2020). Effective education is crucial for societal progress, and digital literacy strengthens character education for immersive learning in Industry 4.0 (Wahab et al., 2022). The development of online learning media is essential for transitioning to modern, technology-based education (Rawung, 2020).

The digital era (4.0) has transformed education, with technology providing easy access to knowledge through diverse learning media (Yanti et al., 2022). Interactive communication characterizes this phase, enabling real-time information access and personalized learning, fostering engagement and collaboration (Yunika, 2023) The shift from writing (1.0), print (2.0), to telecommunications (3.0) has led to new, tech-based learning media. With internet access anytime, learning is now more flexible, personalized, and collaborative, improving engagement and essential skills (Jumaida et al., 2022). However, educators must adapt to rapid technological advancements (Setiyono et al., 2025). Technology simplifies daily life, making digital literacy vital for educators to create innovative learning experiences like mobile learning.

Climate change, especially global warming, is a crucial topic for senior high school students, requiring strong awareness and understanding. Engaging and accessible learning media are essential for effective delivery. Widiyono and Millati (2020) highlight the role of educational technology in improving learning quality in the "Merdeka Belajar" framework. Suryanti and Wijayanti (2020) stress the importance of digital literacy for educators in the 4.0 industrial era. In this context, MIT App Inventor is a popular platform for creating Android-based learning apps without advanced programming skills, supporting the development of interactive educational media.

To address educational challenges, innovative and engaging technology-based learning methods are necessary. MIT App Inventor offers attractive designs, multimedia integration, accessibility, and supports independent learning (Putri et al., 2024). Developing physics learning media with this platform can motivate students, foster creativity, and improve learning outcomes by providing suitable tools.

METHODS

The Research and Development (R&D) method, a process for developing and validating educational resources meant to generate and evaluate the efficacy of certain products, was used in this research. The ADDIE model, consisting of the stages of analysis, design, development, implementation, and evaluation, guided this process (Winaryati, et al., 2021).

This research was conducted at SMA Negeri 2 Medan, located at Jl. Karangsari No.435, Sari Rejo, Medan Polonia, Medan City, North Sumatra, during the odd semester of the 2024/2025 academic year. The research period spanned from October 2024 to May 2025. The subjects of this study were 36 students from class X-9 of SMA Negeri 2 Medan.

The initial analysis stage includes needs assessment through questionnaires distributed to students and interviews with teachers. The learning environment identification stage includes analysis of basic competencies, learning objectives, learning situations, students, and learning content. The second stage, design, focuses on creating a framework and design plan for mobile learning media using MIT App Inventor. The third arrange development, feasibility approval of the achievability of the outlined learning media. The fourth organize, implementation, requires the application of approved media and materials to review to through their reactions their practicality through X students of SMA Negeri 2 Medan and teacher responses. The final evaluation stage is carried out throughout the research, combining suggestions and comments and evaluating each stage to identify deficiencies and conducting

pre-tests and post-tests to obtain the effectiveness of MIT App Inventor-based learning media.

Methods for gathering data that include documentation, surveys, interviews, and observation. Data collecting tools include a questionnaire about physics learning materials based on MIT App Inventor, which is used to compute validator replies as well as student and instructor responses.

To determine the feasibility and practicality of physics learning media based on MIT App Inventor is determined by:

Table 1. Scoring Rules (Aulia & Mintohari,2023)

Score	Criteria
1	Invalid
2	Less Valid
3	Quite Valid
4	Valid
5	Very Valid

The total score obtained is entered into the Likert scale category level using the formula:

$$P = \frac{\sum x}{\sum xi} \times 100\% \quad (1)$$

Description:
P = Percentage of respone value
$\sum x$ = Score given by the responder
$\sum xi$ = Maximum score

The category value of the feasibility scale category can be seen in table 2.

Table 2. Product Feasibility Criteria (Aulia & Mintohari,2023)

Feasibility Scale	Criteria
0% - 20%	Invalid
21% - 40%	Less Valid
41% - 60%	Quite Valid
61% - 80%	Valid
81% - 100%	Very Valid

For the practicality of physics learning media based on MIT App Inventor, it is determined by the total score obtained, entered into the Likert scale category level using the formula:

$$P = \frac{\sum x}{\sum xi} \times 100\% \quad (2)$$

Description:
P = Percentage of respone value
$\sum x$ = Score given by the responder
$\sum xi$ = Maximum score

The category values for the practicality category scale can be seen in table 3.

Table 3. Product Practically Criteria (Aulia & Mintohari,2023)

Practically Scale	Criteria
0% - 20%	Inpractical
21% - 40%	Less Practical
41% - 60%	Quite Practical
61% - 80%	Practical
81% - 100%	Very Practical

To ascertain the effectiveness of physics learning materials based on MIT App Inventor, a pre-test and post-test were conducted in this study. The following criteria in table 4 can be used to test the results of the percentage of effectiveness scores.

Table 4. Product Effectiveness Criteria (Aulia & Mintohari,2023)

Practically Scale	Criteria
0% - 20%	Ineffective
21% - 40%	Less Efective
41% - 60%	QuiteEffective
61% - 80%	Effective
81% - 100%	Very Effective

Besides, to decide the increment in learning results utilizing the N-gain equation. The N-gain equation can obtain significant result.

$$g = \frac{T'1 - T1}{Tmaks - T1} \quad (3)$$

Description:
g = N-*gain* score
$T'1$ = Posttest score
$T1$ = Pretest score
$Tmaks$ = Maximum score

The comes about of the N-gain score can be analyzed utilizing the esteem criteria as appeared in table 5.

Table 5. *Gain* Value Classification (Aulia & Mintohari,2023)

Gain (g) Value	Criteria
$0{,}0 < g \leq 0{,}3$	Low
$0{,}3 < g \leq 0{,}7$	Medium
$0{,}7 < g \leq 1{,}0$	High

RESULT AND DICUSSION

This research uses a development research method, namely Research and Development (R&D). The R&D method is a research method used to produce certain products and test the effectiveness of certain products (Sugiyono, 2024). Research uses R&D because research ultimately produces new products to improve existing products (Aprilia et al., 2024). The goals of this investigate is to create learning media. The media created is within the frame of portable learning based on MIT App Inventor on Global Warming material. In this inquire about, the ADDIE demonstrate is utilized to depict the media advancement handle which clarifies the comes about of inquire about conducted through five stages of the ADDIE demonstrate.

a. Analysis Result

This research began with an analysis of class X students at SMA Negeri 2 Medan through teacher interviews and classroom observations. The findings revealed that students experienced boredom and a lack of interest in physics lessons that relied solely on printed books and PowerPoint presentations, despite the school's permission for smartphone use. Consequently, their engagement in physics was low, and their learning outcomes were significantly below the established Minimum Completeness Criteria (KKTP). As a result, the majority of students expressed a desire for more engaging and interactive learning media.

b. Design Result

After in-depth analysis, the development of learning media continues to the strategic design stage. This stage includes comprehensive planning of all components of the developed physics learning media. The following is the design and stages of media creation in table 6.

Table 6. Design of Media

Stages	Creation Step Display
Home Page On the home page, click "start" to continue to the menu display to use the learning application.	
Main Display/Menu On the main display/menu there are several menu features that students can use.	
Introduction The display in the introduction section contains instructions for using the application	
Competence The competency section contains learning achievements, learning objectives and indicators	
Material This material page contains information about Global Warming. Students can view the comprehensive display of this content in the class X Physics book, specifically the Global Warming chapter.	
Video The learning video display contains learning videos about the greenhouse effect, ozone layer depletion, global warming and efforts to overcome global warming.	
Simulation The simulation uses PhET simulation to make it easier for students to conduct global warming experiments and there is a LKPD regarding the PhET simulation used.	

Stages	Creation Step Display
Evaluation In the evaluation there is a formative test to measure student's understanding after studying the global warming material	
Discussion On the discussion page there is a chat forum to discuss learning.	
Profile The profile page is the last part of this media which contains the developer's identity	

c. Development Result

The development stage is the process of realizing the initial design of the learning media that has been prepared previously. The most objective of this stageis to create and produce versatile learning-based material physics learning media created utilizing the MIT App Inventor stage, so that the media is announced commendable as a learning asset.

1. Media Feasibiliy

Table 7. Media validation data Result by media experts

Aspect	*Percentage*	Criteria
Content feasibility	80%	Very Valid
Software feasibility	90%	Very Valid
Language feasibility	91,1%	Very Valid
Mean	87,03%	Very Valid

During the validation process, validators provided improvement suggestions to enhance the product's quality. After being revised based on the media expert's assessment, the learning media obtained an average feasibility score of 87.03%, indicating very high feasibility due to its alignment with the sound wave material and readiness for use in learning.

2. Material Feasibility

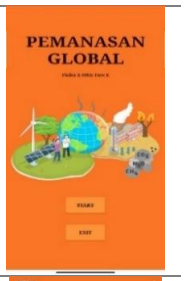
Table 8. Material validation data Result by material experts

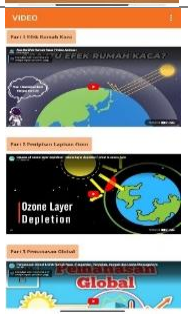
Aspect	*Percentage*	Criteria
Content feasibility	91,67%	Very Valid
Software feasibility	96,67%	Very Valid
Language feasibility	88,57%	Very Valid
Mean	92%	Very Valid

During the validation process, validators provided improvement suggestions to enhance the product's quality. After being revised based on the material expert's assessment, the learning media obtained an average feasibility score of 92%, indicating very high feasibility due to its alignment with the sound wave material and readiness for use in learning.

After validation of the MIT App Inventor-based mobile learning physics learning media, several suggestions were given so that this learning media is more feasible to be tested and used. The following is a revision of the mobile learning-based physics learning media developed with MIT App Inventor presented in table 9 which has been adjusted based on suggestions and input from the validator.

Table 9. Learning Media Before and After Revision

Regarding	Before Revision	After Revision
Cover (The front cover page should be adjusted to the cognitive development of students)		
Main Menu (The menu display needs to be arranged more neatly)		

Regarding	Before Revision	After Revision
Material (Need to add the latest case examples related to global warming and the greenhouse effect)		
Font (The font should be more standardized on several pages)		
Video (On the video page, a short narrative should be added before the video is displayed)		

d. Implementation Result

The implementation stage is the activity of applying the developed learning media product to users directly. The reason of this stage is to evaluate the level of practically and get criticism feedback on the physics mobile learning media develop based on MIT App Inventor platform. The media implementation was carried out by involving a physics teacher from SMA Negeri 2 Medan and 36 grade X students from the same school. The results of this implementation are used as a basis for assessing the practicality of the media in the learning process.

1. Teacher Respone

Table 11. Teacher Respone data Result

Aspect	*Percentage*	Criteria
Content	93,33%	Very Practical
Language	91,42%	Very Practical
Presentation	94,28%	Very Practical
Mobile Learning	97,5%	Very Practical
Mean	94,13%	Very Practical

The practicality of the media was evaluated through filling out a questionnaire by physics teachers of SMA Negeri 2 Medan. Based on the data in table 11, the assessment results show that the MIT App Inventor-based mobile learning physics learning media used for the topic of Global Warming obtained an average score of 94.13% which is included in the very practical category.

2. Students Respone

Table 12. Students Respone data Result

Aspect	*Percentage*	Criteria
Content	90,74%	Very Practical
Presentation	93,17%	Very Practical
Language	93,61%	Very Practical
Media Display	94,72%	Very Practical
Accessibility	97,11%	Very Practical
Mean	93,87%	Very Practical

The practicality of the media was evaluated through filling out a questionnaire by 36 students X class of SMA Negeri 2 Medan. Based on the data in table 12, the assessment results show that the MIT App Inventor-based mobile learning physics learning media used for the topic of Global Warming obtained an average score of 93.87% which is included in the very practical category.

e. Evaluation Result

The evaluation stage was carried out throughout the research by combining suggestions and comments and conducting evaluations at each stage to identify deficiencies and obtain effectiveness data through pre-tests and post-tests that had been conducted to determine the effectiveness of MIT App Inventor-based learning media.

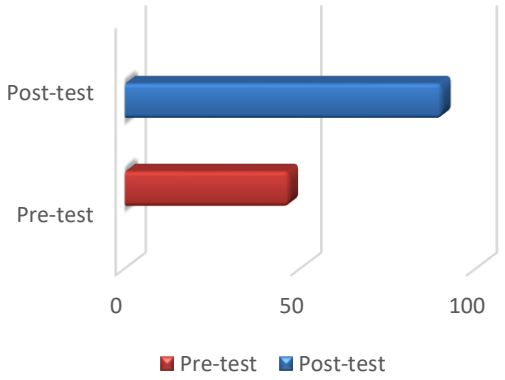


Figure 1. Pre-test and Post-test Result

The effectiveness of the learning media was evaluated by comparing pretest and posttest scores on global warming, revealing a 90,13 average learning completion rate, categorized as very effective. This indicates that the MIT App Inventor-based mobile learning media significantly improved student understanding, further supported by a high average N-Gain score of 0,80.

CONCLUSION

This research concludes that the MIT App Inventor-based mobile learning physics media on global warming, developed through the ADDIE model, is feasible for learning with a media expert validation of 87.03% (very feasible, with minor revisions needed for material references which scored 91.58% as feasible). Furthermore, it is practical for use, scoring 94.13% from student responses and 93.87% from teacher responses (both very practical). Finally, the media is effective in improving learning outcomes, achieving a 90.13% learning completeness (very effective) and a high N-gain score of 0.80, indicating a significant increase in student learning. For future research on MIT App Inventor-based mobile learning media, it is suggested to investigate specific student learning outcomes like thinking and problem-solving skills, and to incorporate more diverse interactive features such as virtual labs or adaptive quizzes to enhance engagement and deepen understanding of physics concepts related to global warming. Furthermore, future studies should focus on integrating this media into the national physics curriculum and evaluating its long-term impact on student conceptual understanding over extended periods.

REFERENCES

Aprilia, N. D., Rahmawati, A., Oktaviani, W., Aufa, R. F., Prayitno, A. H., & Anggrasari, L. A. (2024). Pengembangan Media Smart Apps dalam Materi Pembelajaran Ekosistem Kelas V Sekolah Dasar. *Seminar Nasional Sosial Sains, Pendidikan, Humaniora* , 712-722.

Arifin, Z. (2020). Transformisme Pendidikan di Negara Maju: Inisiatif Filosofid Pengembangan Mutu Pendidikan di Indonesia. *Hikmah: Journal of Islamic Studies*, *16*(1),38-56.

Aulia, W., & Mintohari. (2023). Pengembangan Media Pembelajaran Berbasis Multimedia Interaktif Materi Tata Surya Kelas VI Sekolah Dasar. *Jurnal Pendidikan Guru Sekolah Dasar*, *8*(2) 220-234.

Jumaida, Supriadi, Musril, H. A., & Okra, R. (2022). Perancangan Media Pembelajaran Menggunakan APP Inventor pada Mata Pelajaran Pemograman Dasar Kelas X SMKN 4 Payakumbuh. *Indonesian Journal of Learning and Technological Innovation*, *1*(2)187-204.

Koroh, V. V., Palilingan, R. N., Polii, J., & Lolowang, J. (2024). Implementasi Media Pembelajaran Interaktif Fisika Berbasis Aplikasi Android Dengan MIT APP Inventor. *Algoritma : Jurnal Matematika, Ilmu pengetahuan Alam, Kebumian dan Angkasa*, *2*(4), 28-38.

Putri, M. H., Jannah, M., Fitriati, I., Ridwan, & Ariyani. (2024). Efektivitas Penggunaan Mit App Inventor Pada STKIP Taman Siswa Bima. *JUSTIN: Jurnal Sistem dan Teknologi Informasi*, *12*(2), 351-356.

Rawung, R. K. (2021). Pengembangan Media Pembelajaran Daring Era 4.0 Di Masa Pandemic Covid-19. *Jurnal Inovasi dan Manajemen Pendidikan 1*(1), 67-79.

Setiyono, P., Haryati, T., & Wuryandini, E. (2025). Strategi Digitalisasi Sekolah dan Kualitas Pembelajaran di Era 4.0. *Indonesian Research Journal On Education*, *5*(1) 458-464.

Sugiyono. (2024). *Metode Penelitian Kuantitatif, Kualitatif dan R&D*. Bandung: Alfabeta.

Suryanti, & Wijayanti, L. (2018). Literasi Digital: Kompetensi Mendesak Pendidik di era Revolusi Industri 4.0. *Jurnal Pendidikan Dasar*, *2*(1) 1-9.

Wahab, A., Sari, A. R., Zuana, M. M., Luturmas, Y., & Kuncoro, B. (2022). Penguatan Pendidikan Karakter Melalui Literasi Digital Sebagai Strategi Dalam Menuju Pembelajaran Imersif Era 4.0. *Jurnal Pendidikan dan Konseling*, *4*(5) 4644-4653.

Widiyono, A., & Millati, I. (2021). Peran teknologi Pendidikan dalam Perspektif Merdeka Belajar di Era 4.0. *Journal of Education and Teaching*, *2*(1) 1-9.

Winaryati, E., Munsarif, M., Mardiana, & Suwahono. (2021). *Cercular Model of RD&D*. Semarang: KBM Indonesia.

Yanti, Y., Mulyangingsih, N. N., & Slamet, R. (2022). Pengembangan Media Pembelajaran Fisika Berbasis Android dengan MIT App Inventor pada Pokok Bahasan Fluida Statis. *Jurnal Ilmiah Mahasiswa Pendidikan Fisika*, *3*(1) 57-65.

Yunika, F. D. (2023). Inovasi Pemanfaatan Teknologi Sebagai Media Pembelajaran di Era 4.0. *Confrence of Elementary Studies (C.E.S)*, 286-291.