

E-Poster Learning Media Based on Scientific Approach on Temperature and Heat Material

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Abstract

ABSTRACT

This study aims to produce an e-poster learning media based on a scientific approach on temperature and heat material on temperature and heat material suitable for use in learning. The method used in this study is a research and development (R&D) method with the ADDIE model (Analysis, Design, Development, Implementation, Evaluation). Media experts and material experts have validated this e-poster learning media. The validation results from media experts get a percentage value of 81.25%, and the validation results from content experts get a percentage value of 80%. This e-poster learning media has also gone through a trial stage for teachers and students. The results of the teacher trial get a percentage value of 85.45%, and the results of the student trial get a percentage value of 91.4%.

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INTRODUCTION

Information and Communication Technology (ICT) is developing rapidly and making it easier for humans to carry out their activities (Rusman et al., 2023; Balaban, Rienties, & Winne, 2023). This development is reflected in Indonesia's ICT Development Index, which increased from 5.90 in 2023 to 6.02 in 2024, indicating continuous progress in ICT access, use, and development (BPS, 2025). The development of ICT has also been increasingly integrated into the education sector to support more interactive and accessible learning. In 2025, the Indonesian Ministry of Primary and Secondary Education distributed interactive digital panels, laptops, and external hard drives to 288,865 educational institutions, while internet access was provided to 8,152 educational institutions to support the implementation of digital learning (Kemendikdasmen, 2026).

However, the rapid development of ICT has not been accompanied by an increase in the quality of education in Indonesia. The quality of Indonesia's education has decreased from the 2022 PISA results compared to the 2018 PISA results. Based on the 2022 PISA results, Indonesia obtained an average score of 383 in science and 366 in mathematics, which were below the OECD averages of 485 in science and 472 in mathematics, from a survey of 81 countries and economies

(OECD, 2023). The contributing factor is inadequate facilities and infrastructure and the use of technology.

Based on the results of the needs analysis conducted by researchers, as many as 95% of students need learning media that are easily accessible using smartphones such as e- posters. E-poster is one of the learning media with the help of technology. Poster learning media consists of images, colors, and writing containing messages with attractive designs (Surya & Wenda, 2023; Alamsyah, Taufiq, & Rivai, 2022; Jannah et al., 2022). At the same time, e-posters are posters used and displayed in electronic media so that they are easily accessible by students and are not easily damaged because they are not printed in the form of paper or banners.

In studying physics, students should play an active role in learning. So that students are not only able to remember and memorize formulas, but students can understand concepts and facts in physics. This is in line with the declining ability of science performance, one of which is physics. A scientific-based learning process such as a scientific approach can be carried out (Momo et al., 2024; Epinur et al., 2024). Scientific approach or in English Scientific Approach is a learning process designed using a scientific approach so that students play an active role in building competency attitudes, knowledge, and skills through the stages of observing, asking, gathering information, reasoning, and communicating (Nur'ariyani et al., 2023; Almasri, 2024).

The learning process using a scientific approach can improve science performance because students are directly involved in understanding concepts (Gizaw & Sota, 2023; Syukri et al., 2025; Alfinita et al., 2026). This is supported by the results of the needs analysis conducted by researchers. As many as 97% of students need to conduct experiments to understand the concept of physics. Based on the description above, it can be concluded that it is necessary to develop an e-poster learning media based on a scientific approach on the material of temperature and heat, namely the subject of the expansion of substances. The choice of temperature and heat material on the development of substances is seen from the results of item analysis conducted by researchers. Of the several physics questions given, as many as 40 out of 80 students answered incorrectly on the material of temperature and heat on the subject of expansion of substances.

METHOD

The method used in this research is Research and Development (R&D). The Research and Development (R & R&D) method is a method in research to produce and test the effectiveness of a product being developed (Iskandar et al., 2023; Setiawati, Wardani, & Lestari, 2024; Adisti et al., 2023). This study refers to the ADDIE model whose stages consist of Analysis (analysis), Design (Design), Development (Development), Implementation (Implementation), and Evaluation (Evaluation).

The first stage is analysis. At this stage, information is collected to identify the needs of students for the background of this research. Researchers analyzed students' needs for learning media. In addition, researchers also conducted item analysis to find out the physics material that students did not understand. The second stage designs. Design is the stage for designing media products to be developed. At this stage, the researcher begins to design or framework of the e-poster learning media. The third stage is the development stage. At this stage, the researcher made an e-poster learning media product according to the design made at the design stage. The fourth stage is the implementation stage. The finished media product is then validated by media experts and material experts and tested on teachers and students. The last step is evaluation. At the evaluation stage, product improvements are made based on suggestions and input

The description continues with an explanation of the participants involved, including the study population, and the sampling method used to obtain a representative sample. Next, the research instrument is presented in detail, including sample questionnaire items, scoring methods, and psychometric characteristics such as validity and reliability.

This section also clearly outlines the research procedures followed, including implementation stages and a timeframe, if relevant. The data analysis plan is then explained,

including the statistical techniques used, the types of comparisons made, and literature references if complex or unusual methods are used. from the validator. The ADDIE model can be depicted in the chart below:

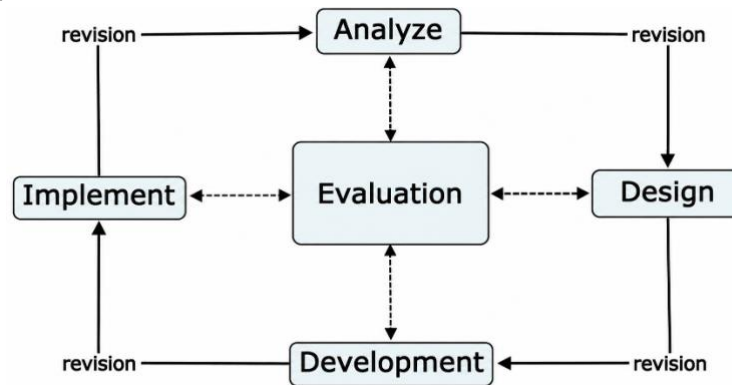


Figure 1. Addie Model Chart [12]

According to Afriani, research and development used in education is a development and validation that produces educational products (Afriani, 2025). The research and development steps carried out by the researcher are described in the chart below:

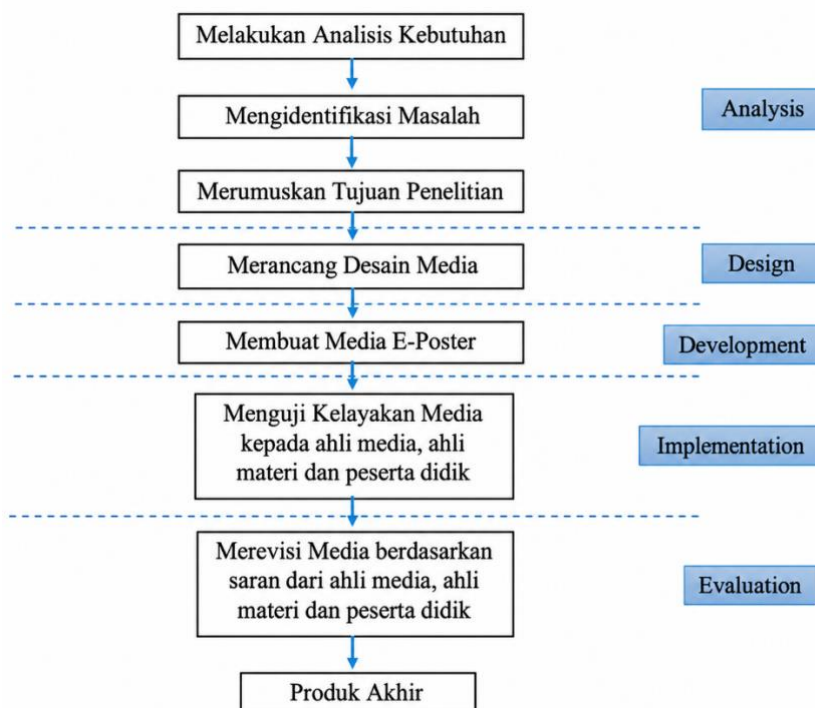


Figure 2. Research And Development Chart

To determine the feasibility of the product developed by the researcher, validation tests were carried out by media experts and material experts, as well as trials by teachers and students. The assessment of the developed product refers to the Likert scale with a score range of 1-5 according to the scoring rules made by the researcher.

To calculate the percentage of score, the following formula is used:

$$\text{Score percentage} = \frac{\Sigma \text{ acquisition score}}{\Sigma \text{ maximum score}} \times 100\%$$

After calculating and getting the percentage score, the scientific approach-based e- poster learning media on temperature and heat material can be analyzed for its feasibility level using the feasibility interpretation scale below.

Table 1. Feasibility Interpretation Scale

Interval	Criteria
$0 \leq x \leq 20\%$	Very Less Worthy
$20\% < x \leq 40\%$	less worthy
$40\% < x \leq 60\%$	Decent enough
$60\% < x \leq 80\%$	Worthy
$80\% < x \leq 100\%$	Very Worthy

(Syafuruddin, Widarti, & Rokhim, 2024)

RESULTS AND DISCUSSION

This research produces a product in the form of an e-poster learning media based on a scientific approach to the material of temperature and heat. The resulting media product is shown in the following figure:

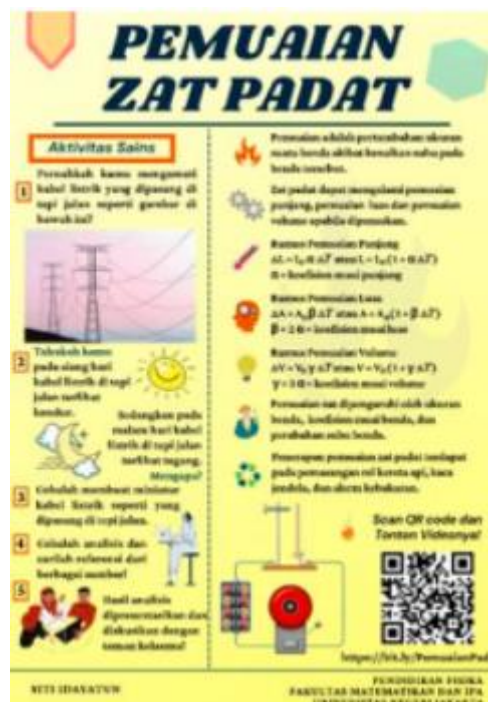


Figure 3. E-Poster Expansion Of Solids



Figure 4. Gas Expansion E-Poster



Figure 5. Liquid Expansion E-Poster

Media experts and material experts have validated the e-poster learning media. The validation results by media experts get a percentage value of 81.25% and are categorized as "Very Appropriate" media used in learning. Meanwhile, the validation results by material experts got a percentage value of 80% and were categorized as "appropriate" media used in education. In addition to the validation test, the e-poster learning media has also been tested by teachers and students. The results of the teacher's trial get a percentage value of 85.45% and are categorized as "Very Appropriate" media used in learning. At the same time, the trial results of students get a percentage value of 91.4% and are categorized as "Very Appropriate" media used in learning.

CONCLUSION

Based on the results of the validation of media experts and material experts, the e- poster learning media got an average percentage value of 80.62%. It was categorized as a very suitable medium for use in learning. Meanwhile, based on the results of teacher trials and student trials, the e-poster learning media got an average percentage value of 88.42%, so it was categorized as a suitable medium for learning.

AUTHOR CONTRIBUTION STATEMENT

RR was responsible for conceptualization, research design, methodology, data collection, data analysis, interpretation of results, writing the original draft, and reviewing and editing the manuscript. FCW provided supervision, validation, scientific consultation, and critical review of the manuscript. ASB contributed to supervision, validation, scientific consultation, and revision of the manuscript. All authors have read and approved the final version of the manuscript.

AI DISCLOSURE STATEMENT

The author acknowledges the use of artificial intelligence (AI) tools in assisting with language refinement and manuscript structuring. The AI tools were employed only for grammar checking, paraphrasing, and improving readability. All ideas, research design, data collection, analysis, and interpretation of results were carried out independently by the author. The entire content of the manuscript has been thoroughly reviewed, verified, and edited by the author, who assumes full responsibility for its authenticity and accuracy.

REFERENCES

- Adisti, A. R., Yuliasri, I., Hartono, R., & Fitriati, S. W. (2023). Developing a model of English digital poster book for teaching English in Indonesia's early childhood education. *World Journal of English Language*, 13(3), 193-209. <https://doi.org/10.5430/wjel.v13n3p193>
- Afriani, L. (2025). Understanding the design of research and development methods in the field of education. *IJESS International Journal of Education and Social Science*, 6(1), 1-5. <https://doi.org/10.56371/ijess.v6i1.333>
- Alamsyah, N., Taufiq, A. U., & Rivai, A. T. O. (2022). Development of website-based e-poster learning media on the digestive system material of class XI MA Madani Alauddin Pao-Pao students. *BIO-INOVED: Jurnal Biologi-Inovasi Pendidikan*, 4(3), 351-359. <http://doi.org/10.20527/bino.v4i3.14322>
- Alfinita, S. N. J., Paujiah, E., Solikha, M., & Amelia, S. R. (2026). The effectiveness of scientific approach-based worksheets on angiosperm classification to improve students' scientific literacy skills. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, 12(2), 374-385. <https://doi.org/10.22219/jpbi.v12i2.45079>
- Almasri, F. (2024). Exploring the Impact of Artificial Intelligence in Teaching and Learning of Science: A Systematic Review of Empirical Research. *Res Sci Educ* 54, 977-997. <https://doi.org/10.1007/s11165-024-10176-3>
- Badan Pusat Statistik. (2025). *Indeks pembangunan teknologi informasi dan komunikasi 2024*. <https://www.bps.go.id/id/publication/2025/09/30/12567c4a325929839ae63740/ict-development-index-2024.html>
- Balaban, I., Rienties, B., & Winne, P. H. (2023). Information Communication Technology (ICT) and Education. *Applied Sciences*, 13(22), 12318. <https://doi.org/10.3390/app132212318>
- Epinur, Fuldijatman, Miharti, I., & Minarni. (2024). Development of Scientific-Based Learning Devices Implemented in the Inquiry-Flipped Classroom Learning Model to Improve Science Literacy in Acid-Base Material. *Jurnal Penelitian Pendidikan IPA*, 10(12), 10509-10517. <https://doi.org/10.29303/jppipa.v10i12.9517>

- Gizaw, G., & Sota, S. (2023). Improving science process skills of students: A review of literature. *Science Education International*, 34(3), 216-224. <https://doi.org/10.33828/sei.v34.i3.5>
- Iskandar, M. Y., Hendra, H., Syafril, S., Putra, A. E., Nanda, D. W., & Efendi, R. (2023). Developing Interactive Multimedia for Natural Science in High School. *International Journal of Multidisciplinary Research of Higher Education (IJMURHICA)*, 6(3), 128-135. <https://doi.org/10.24036/ijmurhica.v6i3.127>
- Jannah, R., Fona, Z., Fakhriah, F., & Khaira, N. (2022). The Use of Poster Media to Enhance Student Learning Outcomes in Descriptive Text Writing. *Journal of English Language Teaching, Linguistics, and Literature (JETLEE)*, 2(1), 26-34. <https://doi.org/10.47766/jetlee.v2i1.204>
- Momo, A. H., Iru, L., Syahbudin, S., Salimin, S., Irawaty, I., Rini, W. O., Nerlin, N., Saleh, M., & Piara, M. (2024). Implementation of a media-based citizen science project learning model using a scientific approach in Civic Education to enhance student critical thinking skills. *Jurnal Civics: Media Kajian Kewarganegaraan*, 21(2), 254-261. <https://doi.org/10.21831/jc.v21i2.71095>
- Nur'ariyani, S., Jumyati, J., Yuliyanti, Y., Nulhakim, L., & Leksono, S. M. (2023). Scientific approach to learning science in elementary schools. *Jurnal Penelitian Pendidikan IPA*, 9(8), 6659-6666. <https://doi.org/10.29303/jppipa.v9i8.3680>
- OECD (2023), *PISA 2022 Results (Volume I): The State of Learning and Equity in Education*, PISA, OECD Publishing, Paris, <https://doi.org/10.1787/53f23881-en>.
- Rafsanjani, H. (2023). Education transformation in 5.0 society development era. In *AIP Conference Proceedings* (Vol. 2727, p. 020050). <https://doi.org/10.1063/5.0141657>
- Setiawati, I., Wardani, S., & Lestari, W. (2024). Development of Wordwall-based Indonesian Geographical Condition Assessment Instrument in Modipaskogo E-Book for Elementary School Students. *Riwayat: Educational Journal of History and Humanities*, 7(1), 48-65. <https://doi.org/10.24815/jr.v7i1.36597>
- Surya, N. F., & Wenda, D. D. N. (2023). Evaluating the effectiveness of poster & picture card media in teaching the water cycle to elementary students. *Utamax: Journal of Ultimate Research and Trends in Education*, 5(3), 204-213. <https://doi.org/10.31849/utamax.v5i3.15021>
- Syafruddin, A. B., Widarti, H. R., & Rokhim, D. A. (2024). Development of instagram-based learning media to increase students learning interest in acid-base materials. *Turkish Online Journal of Distance Education*, 25(2), 228-245. <https://doi.org/10.17718/tojde.1312770>
- Syukri, M., Basri, M., Halim, A., & Maghfirah, S. (2025). Improving Students Ability to Evaluate and Conclude Through a Scientific Approach. *Current STEAM and Education Research*, 3(1), 1-12. <https://doi.org/10.58797/cser.030101>
- Jatnika, Y. (2026, January 26). *Papan digital interaktif mempermudah siswa memahami sains*. Pusat Layanan Pembiayaan Pendidikan, Kementerian Pendidikan Dasar dan Menengah Republik Indonesia. <https://puslapdik.kemendikdasmen.go.id/papan-digital-interaktif-mempermudah-siswa-memahami-sains/>