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ELEVATING INSIGHTS: PROGRESSIVE E-BOOKLET DEVELOPMENT IN TEMPERATURE AND HEAT

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Abstract :
This study aims to evaluate the feasibility of an E-Booklet centered on temperature and heat materials. Employing the Research and Development (R&D) methodology, the research adheres to the Alessi and Trollip model, progressing through planning, design, and development stages. Validation instruments, encompassing validation sheets for both material and media, were employed. The validation process involved six material experts, including lecturers and teachers, along with three media experts. Results demonstrate the high feasibility of the developed E-Booklet for temperature and heat materials, attaining an average score of 95.58%, categorized as "very feasible." Material expert validation from lecturers yielded an average score of 97.87%, categorized as "very decent," while validation from teachers resulted in an average score of 94.12%, also categorized as "very decent." Media expert validation produced an average score of 94.75%, falling within the "very decent" category. In conclusion, the developed E-Booklet for temperature and heat materials proves highly suitable for integration into the learning process. Implications of the study highlight the importance of integrating innovative digital resources to enhance educational experiences. This research contributes to advancing educational practices through the creation of effective and engaging digital learning materials in the field of temperature and heat.

Keywords: Development, E-Booklet, Temperature and Heat

INTRODUCTION

Electronic media, including the internet, smartphones, videos, and e-booklets, have become an integral part of daily life, significantly impacting various sectors, including education. With technological advancements, the use of electronic media in learning has become increasingly important to support the effectiveness of the teaching and learning process (Septianto & Umam, 2017). The main characteristic of electronically-based media is having many images and videos, making it more engaging and easy to understand (Asyhari & Diani, 2017; Fatimah & Mufti, 2014). In this context, there are several challenges faced by the education sector, including the shift in the role of educators to become

independent facilitators for students, as well as the need for media that stimulates creative and independent thinking.

In the era of digital 4.0, various information is easily obtained through the internet, accessible via smartphones. Information and knowledge can be utilized by learners to facilitate effective and efficient learning (Utami et al., 2022). The utilization of electronically-based learning resources is one of the things done to support education in the digital era. Using the internet, smartphones, films, PowerPoint, e-books, and e-booklets are some examples. One of the learning tools used by teachers to convey content, encourage student creativity, and focus student learning is instructional media. With the help of media, children become more enthusiastic about learning and are encouraged to write, speak, and be more creative. As a result, instructional media can improve the effectiveness and efficiency of the teaching and learning process and foster a positive relationship between teachers and students (Tafonao, 2018).

In the field of physics education, the use of traditional instructional media such as student worksheets (LKS) and modules has shown weaknesses, especially in attracting the interest and attention of students. Observations in various schools reflect the difficulties students face in understanding physics concepts, mainly due to the lack of appeal in the instructional media used. This factor is acknowledged by physics teachers, and the need for more innovative and engaging solutions becomes increasingly urgent. According to Ami (2012), students tend to prefer interesting readings with brief descriptions and many pictures or colors. Electronic teaching materials are a collection of systematically arranged materials that display the competencies that learners will master in the interactive multimedia learning process (Sriwahyuni et al., 2019).

The gap between student needs and the availability of current instructional media creates an opportunity to develop e-booklets as a more engaging and effective alternative. Factors such as the lack of appeal in traditional instructional media, low student interest in physics, and the limitations of paper-based media indicate the need for a solution that integrates technology to enhance the quality of physics education. According to the results of a material needs questionnaire presented by the researcher to 15 students on January 27, 2022, 90% of students believe that temperature and heat materials make the work difficult. According to the explanations given, the difficulty of the material is caused by the quantity and duration. In addition, the offered information is difficult to read both in words and graphics, making it difficult for students to understand temperature and heat materials.

Electronic booklets are efficient instructional media (Wahidah et al., 2022). E-Booklets have similarities in their use as interactive media; the only difference lies in their size (Setiawan & Wardhani, 2018). E-booklets are instructional media that can be used in the learning process both inside and outside the classroom (Darlen et al., 2015). E-booklets have a small size, their content includes terms, and there are personal documentation images from various journal literature that can broaden students' insights and summary explanations to make it easy for students to understand. This is in line with Rengel's opinion that suitable material for inclusion in the E-booklet is material that has many pictures to explain the material concisely (Hanifah et al., 2020). A booklet is a group of print technology media; a booklet is a small book with a minimum of 5 pages but no more than 48 pages outside the cover (Dewi et al., 2020). E-booklets are digital booklets that contain information and are accessed using electronic devices such as smartphones and laptops for practical use and storage (Hoiroh & Isnawati, 2020). The application used in creating e-booklets is Flip PDF Professional. Flip PDF Professional is one of the software that has advantages; it is easy to use for beginners and has features to edit pages to add multimedia such as images, videos, hyperlinks, and others (Seruni et al., 2019).

Based on research on the role of E-booklets in learning outcomes, it is found that E-booklets are designed with concise and systematic explanations, accompanied by images as illustrations. This design facilitates the understanding of concepts or facts by students, making it easier for them to use in the learning process (Enawaty & Lestari, 2015). E-booklets that are informative with attractive designs can trigger curiosity, allowing students to easily understand the content presented during the learning process. The research results show that E-booklets are effective in improving student learning outcomes (Pralisaputri K R et al., 2016). In addition to presenting materials, booklets play a role as learning assets that can help students add and develop existing references. Furthermore, booklets can also help students develop deeper learning outcomes (Puspita et al., 2017). E-booklets can be extensive teaching materials that allow students to learn in-depth (Ningsih & Adesti, 2019). With this teaching material, it will

stimulate optimal brain performance. The created E-booklet is integrated with digital-based learning applications that facilitate the implementation of learning, as stated by (Amalia, Yuniawatika, & Murti, 2020).

This study aims to address the weaknesses of existing physics learning media by leveraging the potential of electronic media, especially e-booklets. The success of this research is expected to increase students' interest, understanding, and learning outcomes related to temperature and heat materials. Additionally, this research can provide new insights into the development of physics learning media that are more adaptive to technological advancements. Through the development of e-booklets, this research aims to provide a concrete solution to students' dissatisfaction with existing physics learning media. By utilizing interactive features, images, and personal documentation, e-booklets are expected to enhance student engagement in the physics teaching and learning process, providing a more interesting alternative compared to traditional media.

RESEARCH METHOD

This study adopts the Research and Development (R&D) research method with the Alessi and Trolip research model, focusing on the development of learning media in the form of e-booklets for the subject of Temperature and Heat at the high school level (Stephen M Alessi and Stanley R Trollip, 2001). Another definition explains that the research and development method is a process or step to develop new products or improve existing ones, which can be accountable (Nana Syaodih Sukmadinata, 2013).In terms of sample determination, this research involves expert material validators, media expert validators, and students from grade XI IPA in high school. Sample selection is done through purposive sampling, where the researcher selectively chooses subjects with knowledge and experience relevant to the research needs (Sugiono, 2016). The steps in the R&D development model are as follows:

Planning Stage

The Planning stage is the process used by employees to determine the purpose of developing a particular product to be launched. The specific steps that need to be taken include: determining the subject matter through observation and discussion; analyzing the personality of the test subject; and finally, identifying and collecting relevant information.

Design Stage

The design phase is the stage of creating the initial concept, in this case the basic concept of the E-Booklet. Analyzing ideas related to the material to be presented is one of the tasks performed during the design phase. This design phase is divided into the following stages:

a. Identifying the topic or subject matter being discussed.
b. Organizing the information in order of learning objectives.
c. Creating an outline or writing draft.
d. Writing the material.
e. Providing pictures.
f. E-Booklet Design.

The E-Booklet is being designed as beautifully as possible in an effort to increase children's interest in reading. There are various ways to accomplish this stage, including:

1. Design the cover of the e-booklet.
2. Layout design
3. Content layout for the e-book.

Development Stage

Implementation of the design concept into the product. The aim is to produce a product in the form of an e-brochure learning environment in accordance with the format determined at the design stage. This stage begins with the preparation of supporting materials, namely the preparation of all components as well as information that goes into the final product. There are three functions in this development phase, namely: a) Product creation; b) Validation; c) Revision.

The research instruments consist of a media expert assessment sheet, a material expert validation sheet, and a student response questionnaire. These assessment sheets are used to evaluate the feasibility

of the media and materials, while the response questionnaire aims to gather students' perspectives on the use of e-booklets. The validity of the media, materials, and student responses is analyzed using formulas (Widoyoko, 2012). The following are the formulas used:

$$P = \left(\frac{\Sigma s}{\Sigma_{max}}\right) \times 100\%$$

information:
P = Validation percentage.
Σs = Number of scores from validators.
Σ_{max} = The maximum number of scores.
100 = Constant.

Table 1. Product Eligibility Criteria

Criteria	Percentage	Qualification	Follow-up
SB	81% - 100%	Very worthy	Can be used without revision
B	62,51% - 81,25%	Worthy	Can be used with minor revisions
K	43,76% - 62,50%	Not worth it	Can be used with revisions according to expert notes
SK	25% - 43,75%	Not feasible	The media must first be thoroughly revised before it can be used

The data collection process includes observation, interviews, analysis of student characteristics, collection of learning material sources, drafting, writing the e-booklet content, and product testing with expert validators and students. In addition, data analysis is carried out by measuring product validity through a Likert scale on the media expert and material expert assessment sheets. The validation percentage is calculated to determine the feasibility category of the product. The impact analysis on learning focuses on assessing the material and learning effects through the material expert validation sheet. Meanwhile, the analysis of the subject's perspective on learning involves measuring student responses to the e-booklet by calculating the percentage of responses. Using this method, the research aims to produce a Temperature and Heat e-booklet that is not only valid and effective but also responsive to the needs of students. The development process is carried out through planning, design, and development stages, followed by alpha and beta testing to evaluate the feasibility and effectiveness of the developed e-booklet.

RESULTS AND DISCUSSION

The development of teaching media in the form of an e-booklet for the topic of temperature and heat is based on interviews with physics teachers regarding the use of teaching media such as modules and worksheets that were less engaging, making it challenging for teachers to convey related materials, especially in the temperature and heat topic. In line with research by Rehusisma et al. (2017), stating that e-booklet media used in learning has a practical level, is easy to understand with the addition of an attractive color display, and clear images on the learning media. This can make students more active and enthusiastic in participating in learning activities, and the images facilitate students in understanding the material significantly, making the theory or concept more meaningful in the cognitive structure of students. The use of multimedia and learning materials such as e-booklets is to reinforce the topics provided by teachers in both classroom and online learning contexts (Rahmawati et al., 2021). These sources simplify learning activities and improve performance in the context of teaching and learning (Cahyadi, 2019).

Observations regarding the material that is difficult for 11th-grade students to understand include the temperature and heat material, as it is quite complex. The coverage of the material tends to be more in the form of reading, lacking interesting and colorful examples with images, making students less interested in reading and studying it. Based on the analysis of these problems, the researcher maximizes the facilities used by students by using e-booklet teaching media on the temperature and heat material.

The results of the student learning needs questionnaire show that students prefer learning materials that are easy and simple, which can be easily carried anywhere. All students who filled out the

questionnaire wanted additional content in the textbook consisting of pictures and sample problems. Students tend to prefer interesting readings with brief descriptions and many pictures or colors. A total of 66.6% of students mentioned that their learning resources come from electronic media such as laptops, smartphones, the internet, and e-books on the internet.

The process of designing e-booklet teaching media begins with the selection of sources by taking documentation from several journal literatures. The material written in teaching media is obtained from several international and national journals. The results of this design stage are in the form of an initial draft of teaching media that will be tested. In addition, at this stage, the preparation of Lesson Design Structure (LDS), instruments to measure student learning outcomes, and expert validation instruments are also carried out.

Tabel 2. Overall Percentage of E-booklet Validation

No	Validator	Percentage	Criteria
1	Media Expert	94,75%	Very worthy
2	Material Expert (Lecturer)	97,87%	Very worthy
3	Material Expert (Teacher)	94,12%	Very worthy
	Total average score	95,58%	Very worthy

The feasibility of the e-booklet on the topic of temperature and heat was assessed by six lecturers from UIN Ar-Raniry Banda Aceh and three high school teachers. The evaluation results were categorized into four criteria: Very worthy (SB), Worthy (B), Not worth it (K), and Not feasible (SK), which were then processed into a presentation for feasibility criteria. From the evaluation results, it was found that the e-booklet is highly feasible with an overall percentage of 97.87%, including content feasibility at 95.75% and language feasibility at 100%. Various studies and developments regarding the feasibility of learning resources in the form of booklets have been reported, including research by Harlis et al. (2021), which is considered valid and effective in improving student learning outcomes. Another study was conducted by Hoiroh and Isnawati (2020), which yielded valid results and could assist students in getting to know mushrooms more closely. Another research conducted by Fitriani and Krisnawati (2019), had valid results for use. A study by Lavenia et al. (2017) also showed valid results for use.

Subsequently, material validation was conducted by three physics teachers. Based on their assessments, the e-booklet on the topic of temperature and heat obtained a very feasible level with an overall percentage of 94.12%. Content feasibility reached 96.75%, while language feasibility reached 91.50%. Thus, it can be concluded that the e-booklet has passed the feasibility test by experts and teachers, indicating that as a learning medium, the e-booklet on the topic of temperature and heat is highly suitable for use in physics education at the high school level.

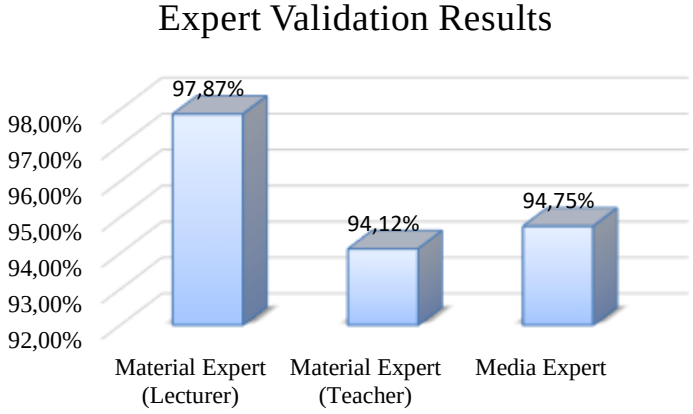

Figure 1. Material Expert Validation Chart

Based on the above graph, the validation results from the media expert obtained a percentage of 94.75% with the criteria of very feasible, and from the content expert (lecturer) obtained a percentage of 97.87% with the criteria of very feasible. The same goes for the content expert (teacher) who obtained a percentage of 94.12% with the criteria of very feasible. If we look at the validation results from the media and content experts, the average score obtained is 95.58%. Thus, it can be concluded that the e-booklet is highly feasible for use in the learning process.

Data analysis highlights that the development of e-booklet teaching media on the topic of temperature and heat, based on interviews with physics teachers, yielded very positive results. These findings consistently support previous research, especially studies conducted by (Ni Komang Cintya Dewi & Luh Ayu Tirtayani, 2022). The results of that study show that the e-booklet not only enhances interactivity in physics learning but also provides a better understanding of conceptual knowledge. Key factors contributing to the success of the e-booklet include the clarity of color display and images, which help increase student participation and deepen their understanding of the material.

In the context of students' difficulty in understanding the complex topic of temperature and heat, the e-booklet proves to be an effective solution. Observations of the lack of interesting examples and visual appeal in previous materials emphasize the importance of using e-booklets to increase students' interest in learning challenging subjects. From the perspective of students' learning needs, e-booklets align with their preferences for simple, portable learning materials presented with images and example questions. This is in line with the trend that most student learning resources come from electronic media such as laptops, smartphones, and e-books on the internet. Compared to previous research findings, especially in terms of content expert validation, the e-booklet is considered highly feasible. Significant improvements in image identity, language consistency, writing techniques, and the addition of material summaries confirm the progress made in overcoming previous instructional material deficiencies.

This study has produced a significant innovation in the development of e-booklet teaching media for plant material. This e-booklet is designed with an attractive interface, integrating interesting images and colors to increase student engagement and facilitate understanding of the material. The success of the e-booklet is also reflected in the increased interactivity in the learning process, where interactive elements such as comprehension questions and links to additional resources are integrated. Student responses to the questionnaire indicate that the e-booklet effectively addresses students' learning needs, with a preference for simple, portable material that includes images and example questions. Additionally, the use of e-booklets aligns with the trend of integrating technology into education, meeting students' preferences for electronic learning resources.

However, this study has some limitations. Although the e-booklet has proven effective for the temperature and heat topic, generalizing its effectiveness to other physics topics requires further research. Limited access to technology in some areas can also affect the effectiveness of e-booklets as a teaching medium. The evaluation of the success of e-booklets tends to rely on subjective responses from students and experts, prompting future research to consider more objective evaluation methods. Finally, although e-booklets meet the needs of most students, it is important to acknowledge that one approach may not be suitable for all learning styles, emphasizing the importance of diversifying teaching methods as a focus for further research. With an understanding of these innovations and limitations, the development of e-booklets can continue to be optimized to support physics education at the high school level.

The implications of this study include an increase in the variety of learning media in both online and offline learning contexts. Furthermore, e-booklets can provide a better learning experience for students, especially in understanding complex physics materials. Recommendations for future research could involve further exploration of the effectiveness of e-booklets in other physics topics and the development of more in-depth evaluation methods. The main implication of this research is the potential of e-booklets as an effective and innovative learning medium at the high school level.

CONCLUSION

Research on the development of e-booklets for temperature and heat material has yielded highly positive results. The e-booklet successfully enhances interactivity and conceptual understanding in physics, particularly in comprehending complex subjects like temperature and heat. Key factors contributing to the e-booklet's success involve the clarity of color displays and images, fostering

increased student participation. The e-booklet proves to be an effective solution to address students' difficulties in understanding visually unappealing material. From the perspective of students' learning needs, the e-booklet aligns with their preference for simple, portable learning materials, consistent with the trend of using electronic media in education. Material expert validation indicates that the e-booklet is highly feasible, with significant improvements in image identity, language consistency, and the addition of material summaries. The implications of this research involve enhancing the variety of online and offline learning media. Recommendations for future research could explore the effectiveness of e-booklets in other physics topics and the development of more in-depth evaluation methods. The primary conclusion is the potential of e-booklets as effective and innovative learning media at the high school level.

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