SCHOOLAR: Social and Literature Study in Education
Vol. 5 No. 2 October 2025, Page. 1 - 9
E-ISSN: 2797-0299

Design of Interactive Media on Dynamic Electricity as Alternative Physics Learning Approach

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ABSTRACT
The development of digital technology has brought significant transformations in various aspects of life, including education. This study aims to develop and validate interactive learning media based on the Canva application for the topic of Dynamic Electricity. Physics learning in secondary schools is still hampered by the dominance of conventional methods and the use of static, non-interactive media, resulting in low student engagement and weak conceptual understanding, especially in dynamic electricity materials. The media is designed to visualize abstract concepts such as current, voltage, resistance, and Ohm's Law to make them easier for students to understand. This research is a research and development study referring to the development model proposed by Borg and Gall. Validation was carried out by material experts, media experts, and linguists. The validation results indicate that the media is considered very valid and feasible for use, with eligibility criteria including content, accuracy, design, and language use. Thus, this media has the potential to increase student motivation and understanding. However, this research is still limited to the validation stage; therefore, further classroom trials are needed to measure its effectiveness.

***Keywords**: Interactive Media; Dynamic Electricity; Validation; Digital Era*

INTRODUCTION
The development of digital technology has brought significant transformation in various aspects of life, including education. The digital era demands innovation in learning processes, in terms of strategies, approaches, and the media employed. In physics learning, which is often associated with abstract concepts requiring strong visualization, the use of innovative and interactive media has become increasingly important. One of the physics topics that particularly requires visual support is dynamic electricity, as concepts such as electric current, potential difference, resistance, and electrical circuits are often difficult to grasp solely through lectures and textual explanations (Ratumbuysang et al., 2021).

However, classroom practices show that physics learning, especially in secondary schools, still relies heavily on conventional methods such as lectures, textbooks, and problem-solving exercises (Tubagus et al., 2024). The learning media used are often static, non-interactive, and insufficient in bridging students' understanding of complex physical concepts (Ali et al., 2024). These limitations contribute to low student engagement and weak conceptual comprehension in learning dynamic electricity. Findings from PISA and various national studies reveal that Indonesian students' scientific literacy remains below the OECD average, particularly in scientific reasoning and basic physics comprehension (OECD, 2019).

Previous studies have demonstrated that interactive media can enhance motivation, participation, and student understanding in science learning (Hasnawiyah & Maslena, 2024). Interactive media enable the visualization of concepts, direct interaction with content, and more engaging learning experiences (Pradana, 2025). Nevertheless, most existing media developments remain general in scope and are not specifically designed for dynamic electricity. Furthermore, limited research has addressed the design of interactive media that considers school resource constraints and accessibility for teachers and students in diverse settings.

This study seeks to fill this gap by offering an interactive learning media design specifically for dynamic electricity as an alternative innovative medium in the digital era. The novelty of this research lies in its design approach, which emphasizes the visualization of physics concepts, interactivity, and ease of use for both teachers and students. It supports prior findings on the importance of media innovation in physics education while addressing the limitations of previous studies that paid little attention to subject-specific needs and accessibility.

Thus, the purpose of this study is to design and validate interactive learning media for dynamic electricity as an alternative solution for physics learning that is more effective, engaging, and aligned with the demands of the digital era.

METHOD

This research is a research and development study that refers to the development model proposed by Borg and Gall (Sugiyono, 2010). The model is designed to produce or develop a specific product that is then tested for its feasibility through expert validation as well as field trials. Borg and Gall present ten development steps; however, in this study, the stages were adjusted according to the needs until a final product ready for implementation was produced. The Borg and Gall development model is illustrated in Figure 1.

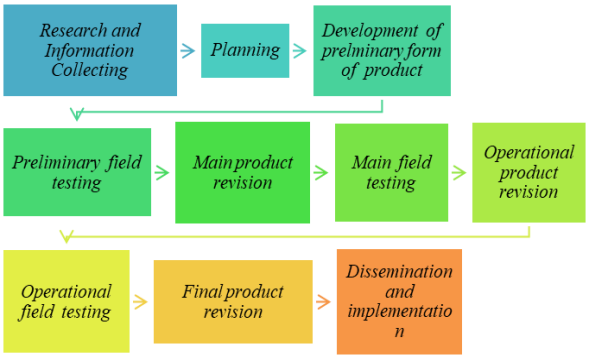

Figure 1 Borg and Gall Development Model

The development stages in this study include: (1) preliminary research and information gathering, (2) planning, (3) initial product development, (4) expert validation by subject matter and media experts, and (5) product revision based on expert feedback. The selection of these steps was adjusted to the research focus, which was limited to the validation and revision stages.

The research subjects consisted of subject matter experts, who assessed the content and accuracy of the dynamic electricity material, and media experts, who evaluated the design, appearance, interactivity, and usability aspects. The research instruments included material and media validation sheets as well as student response questionnaires distributed via Google Forms, all using a Likert scale of 1–5 to evaluate the feasibility of the media based on predetermined indicators (Prihatiningtyas et al., 2022).

The research procedures involved developing interactive media on dynamic electricity based on needs analysis and literature review, followed by validation from subject matter and media experts. Revisions were then made according to expert feedback, after which the product was tested in a limited trial with students to obtain responses. Finally, further improvements were carried out based on the trial results. Data analysis was conducted to evaluate the feasibility of the learning media. Validation results from subject matter experts, media experts, and student responses were calculated using percentage analysis with the following formula:

$$P = \frac{\Sigma x}{\Sigma xi} \times 100\%$$

Information:

- P = Percentage of feasibility
- Σx = Total score obtained
- Σxi = Total ideal score
- 100% = Constant

The resulting percentages were then interpreted using the criteria in Table 1**.**

Table 1 Percentage Scale of Media Feasibility

Percentage (%)	Criteria
81.0% – 100.0%	Highly Valid
61.0% – 80.0%	Valid
41.0% – 60.0%	Fairly valid
21.0% – 40.0%	Less valid
0.0% – 20.0%	Not valid

The media is considered feasible for use if it falls into the categories of "Valid" or "Highly Valid" based on expert validation results.

RESULT AND DISCUSSION

Result

1. Potential and Problems

The development of digital technology offers significant opportunities for education to present innovative, interactive, and engaging learning experiences. The topic of Dynamic Electricity in Physics contains abstract concepts such as current, voltage, resistance, Ohm's Law, and Kirchhoff's Law, which are highly suitable to be presented through visual and interactive approaches.

However, classroom practices indicate low student interest in Physics, particularly in Dynamic Electricity. Learning is still dominated by lecture-based methods and textbooks, making students passive and easily bored. Teachers also face challenges related to design skills and limited time for creating interactive media. Based on this analysis, the development of interactive digital-based learning media is expected to be a solution to improve students' interest and conceptual understanding.

2. Data Collection

Data collection was carried out through expert validation to assess the feasibility of the developed interactive learning media. Two types of experts were involved:

- Subject Matter Experts, who evaluated the suitability of the content, accuracy of Physics concepts, and relevance to the curriculum.
- Media Experts who assessed the aspects of design, readability, interactivity, and visual appropriateness.

The instruments used were online validation questionnaires. The scores from the assessments were used to determine the feasibility level of the media and identify necessary revisions.

3. Product Design

The development of the media was conducted through three main stages:

The storyline was designed to structure the content flow from the introduction, learning material, to the closing section. The interactive media storyline included First Slide: Cover, Second Slide: Home or Concept Map, Third Slide: Motivation, Fourth Slide: Learning Objectives, Fifth Slide: Main Material, Sixth Slide: Force, Seventh Slide: Newton's First Law, Eighth Slide: Mass, Ninth Slide: Newton's Second Law, Tenth Slide: Newton's Third Law, Eleventh Slide: Weight, Gravitational Force, and Normal Force, and Twelfth Slide: Quiz. Preparation of Supporting Components. Supporting components used in the development of the interactive media included images, animations, instructional videos, PhET simulations, and Canva features. Development of Canva-Based Interactive Media on Dynamic Electricity.

At this stage, the media is divided into three sub-themes, namely the introduction, content, and conclusion, each of which can be seen in the figures below:

- The introduction of the Canva-based interactive learning media includes the cover, main menu, user instructions, learning objectives, concept map, and material menu, as shown in Figure 2.

Figure 2 Opening Design Of Canva-Based Interactive Learning Media

- The content of the interactive learning media includes materials on dynamic electricity, consisting of an introduction, the concept of electric current, electric voltage, electrical resistance, sources of direct current voltage, factors affecting resistance, Ohm's Law, Kirchhoff's First Law, Kirchhoff's Second Law, electrical energy, electrical power, electrical measuring instruments, PhET simulations, instructional videos, as well as example problems and their discussions. It is also equipped with interactive worksheets (LKPD) and additional PhET simulations (Figure 3).

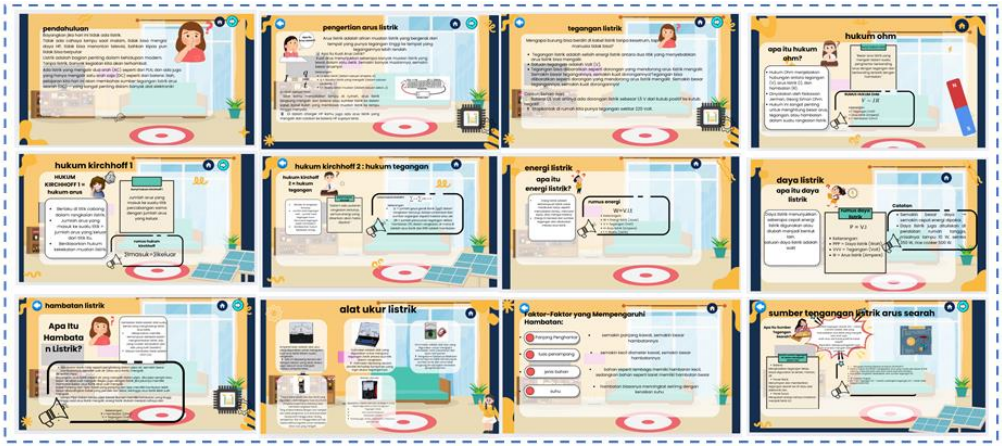

Figure 3 Content Design of Canva-Based Interactive Learning Media

- Closing Section: included references and author biography (Figure 4).

Figure 4 Closing Design of Canva-Based Interactive Learning Media

The complete design of the interactive learning media can be accessed through the following link:https://media-pembelajaran-pai.my.canva.site/salinan-dari-media-pembelajaran-interaktif-listrik-dinamis to view details of the layout, features, and user flow.

A. Design Validation

At this stage, the validation of the interactive learning media design developed was carried out by experts to determine its feasibility, based on assessments from subject matter experts in physics education and media experts in instructional design.

1. Results of Subject Matter Expert Validation

The validation of the media and materials was conducted by three lecturers from the Physics Education Department at KH. A. Wahab Hasbullah University, Jombang. Validation was carried out using an online questionnaire via Google Form at the link:https://forms.gle/CY6wtSbTFwFofYYz9. The results obtained from the completed questionnaires are presented in Table 2.

Table 2 Results of Media Expert Validation

Assessment Aspect	Indicator	Percentage (%)	Average Percentage (%)	Criteria
Simplicity	Images and animations in the media are easy to understand	83.3	75	Valid
	Instructions and navigation are easy to follow	66.7		
Coherence	The sequence of displays between pages is logical and follows the learning flow	75.0	71	Valid
	Media usage instructions are easy to follow	66.7		
Emphasis	The use of colors and text effectively emphasizes important information.	75.0	75	Valid
Balance	The proportion of text and images is appropriate	83.3	83	Highly valid
Form	The design and layout are attractive and not confusing	75.0	79	Valid
	Fonts are easy to read and consistent	83.3		
Color	The combination of background and text colors is comfortable to view	75,0	88	Highly valid
	Colors are not too striking or confusing	100,0		
Average Validation Score		78,3		Valid

Media validation was conducted to ensure that the developed learning media met the criteria of being effective, engaging, and aligned with learning objectives. This validation, carried out by media experts, assessed several aspects: simplicity, coherence, emphasis, balance, form, and color. The results presented in Table 2 can be summarized as follows:

- Simplicity scored an average of 75%, showing that images, animations, and instructional texts in the media are reasonably easy to understand and follow. This aspect is categorized as valid.
- Coherence obtained an average of 71%, indicating that the sequence of displays and learning flow is fairly logical and aligns with instructional expectations. The usage instructions were also considered easy to follow. This aspect is categorized as valid.
- Emphasis scored an average of 75%, demonstrating that the use of colors and text effectively highlights important information. This confirms that the emphasis aspect is valid.
- Balance received a high score of 83%, suggesting that the proportions of text and images are appropriate and visually balanced. This aspect is categorized as very valid.
- Form obtained an average score of 79%, meaning that the design, layout, and font types support readability and consistency, making the media convenient to use. This aspect is categorized as valid.

- Color achieved the highest average score of 88%, showing that the combination of background and text colors is visually comfortable, not overly striking, and easy on the eyes. This aspect is categorized as very valid.

Overall, the average score of media expert validation was 78.3%, which falls into the valid category. Therefore, it can be concluded that the developed learning media meet the required feasibility standards for use in instructional activities. Although some aspects, such as coherence and simplicity, could still be improved, the media is generally well-developed and ready to be used to support students' learning processes.

2. Results of Subject Matter Expert Validation

Validation by subject matter experts was conducted to ensure that the content of the learning media was aligned with instructional objectives, conceptually accurate, and feasible for use in the learning process. The assessments and feedback from subject matter experts are presented in Table 3 below.

Table 3 Results of Content Validation

Assessment Aspect	Indicator	Percentage (%)	Average Percentage (%)	Criteria
Format	Presentation of material is engaging and interactive	83.3	77.8	Valid
	Navigation and use of media are easy for students to understand	75.0		
	Material arrangement follows the sequence of basic competencies	75.0		
Content	Material aligns with syllabus/curriculum focus	91.7	79.8	Valid
	Concept explanations are clear and applicable	83.3		
	Images/animations/videos help explain abstract concepts	75.0		
	Practice questions cover cognitive aspects	83.3		
	Practice questions align with the presented content	75.0		
	Presentation is systematic and logical	75.0		
	Content matches students' ability levels	75.0		
Language	Language is easy to understand and communicative	83.3	85.4	Highly valid
	No confusing terms	83.3		
	Sentences are clear and concise	91.7		
	Spelling and grammar are correct	83.3		
Overall Average Percentage		83.3	Valid	

The subject matter expert validation assessed the feasibility of the learning content presented in the developed media. The validated aspects included format, content, and language, each consisting of several indicators to ensure clarity, accuracy, and comprehensibility.

a. Format Aspect

The format aspect obtained an average score of 77.8%, categorized as valid. This shows that the presentation of materials is engaging, systematic, and follows a proper learning structure. Navigation and content organization were considered easy enough for students to follow. However, some indicators, such as material organization and basic design, only received 75%, indicating that improvements are needed in the technical presentation of the media's format.

b. Content Aspect

The content aspect received an average score of 79.8%, also categorized as valid. The highest score was obtained in the indicator of alignment with the syllabus/curriculum (91.7%) and explanation of abstract concepts (83.3%), showing that the content meets current learning standards and presents concepts clearly. Nevertheless, some indicators, such as the use of images or videos to explain abstract concepts, only scored 75%, suggesting that visual elements need enhancement to strengthen students' conceptual understanding.

c. Language Aspect

The language aspect obtained the highest score, with an average of 85.4%, categorized as very valid. This indicates that the language used in the media is easy to understand, communicative, avoids ambiguity, and follows correct grammar and spelling rules. The highest indicator score (91.7%) was achieved for clarity of sentences without unnecessary complexity, demonstrating that the material presentation is highly effective in aiding comprehension.

Based on the results of subject matter expert validation across all three aspects, the overall average score shows that the learning media is valid for use. The language aspect stands out as the strongest, while the format and content aspects are considered good but could be further improved, particularly in visual presentation and structural organization. Therefore, the media meets the feasibility standards for effective learning content and is ready for classroom implementation.

B. Product Revision

The validated interactive learning media were subsequently revised based on the experts' comments and suggestions during the validation process. The feedback from the validators is presented in Table 4.

Table 4 Comments and Suggestions from Validators

Validator	Comments and Suggestions
Subject Matter Expert	Overall, the material is good and complete. However, images should be added to help students better understand dynamic electricity, such as examples of series and parallel circuits. The inclusion of these images will allow learners to easily distinguish between series and parallel diagrams.
Media Expert	The navigation of the media is somewhat difficult to follow. The media is good, but since it is in the form of PowerPoint, the background design needs attention so that it does not interfere with the text. In addition, too many animations per slide are not recommended due to potential internet bandwidth limitations. Consistency in font type and size should also be maintained. Finally, a quiz or evaluation component should be included to assess students' learning outcomes.

Discussion

The findings of this study indicate that the development of interactive learning media based on Canva for the topic of Dynamic Electricity offers a potential solution to address the low interest and limited understanding of students regarding abstract physics concepts. Validation conducted by subject matter and media experts produced an average score of 78.3% (valid) for the media aspect and 83.3% (valid) for the content aspect, indicating that the product meets feasibility standards for use in teaching and learning.

These findings are consistent with Mayer's (2024) Multimedia Learning Theory, which states that presenting material through a combination of text, images, animations, and audio can enhance the understanding of abstract concepts by supporting information processing in long-term memory. Concepts in Dynamic Electricity, such as current, voltage, resistance, Ohm's Law, and Kirchhoff's Laws, were found to be more easily understood through interactive visualizations. Previous studies consistently show that the use of PhET simulations in physics education significantly improves conceptual understanding compared to traditional lecture methods (Rianti et al., 2024; Susilawati et al., 2022). Both experimental and quasi-experimental studies across different levels of education—from secondary schools to universities—demonstrated that students taught with PhET simulations achieved higher post-test scores and greater normalized learning gains (N-gain) compared to those taught exclusively through lectures (Muflihah et al., 2023).

In terms of media design, the highest scores were obtained in the indicators of color combination (88%) and balance of text and images (83%), showing that the visual design supports readability and learning comfort. This aligns with Hyun-Jung & Hyun-Ju's (2009) view that readability is influenced by semantic, graphic, and cognitive factors. Readable text, clear layouts, and a balanced integration of visuals and text enhance both comprehension and learning comfort. However, the lowest score was found in the coherence indicator (71%), suggesting that navigation flow still needs improvement to become more intuitive. Han (2000) emphasized that good navigation is a key factor in creating a positive user experience, serving as a bridge between users and content by helping them understand the structure, find information, and move efficiently within an application or platform.

Regarding the content aspect, the language indicator received the highest score (85.4%), indicating that the language used in the media is clear, communicative, and grammatically appropriate. This is crucial because the use of simple and clear language has been shown to reduce students' cognitive load (Ashraf et al., 2020). Bahari et al. (2023) found that accessible explanations, whether presented in text or visual form, significantly enhance students' ability to process information. In the context of digital learning, readability and linguistic simplification are particularly important to prevent students from being overwhelmed by complex information. Nonetheless, the content aspect still requires improvement, especially in the use of images and illustrations for series and parallel circuits. Visualization through images, diagrams, or animations strengthens students' comprehension via the mechanism of dual coding, in which information is processed verbally and visually at the same time (Khalil et al., 2005).

Feedback from the media expert validator emphasizing the importance of including quizzes or evaluation features in the learning media was also considered relevant. Interactive evaluation plays a crucial role in measuring students' mastery of material and providing immediate feedback (Black & Wiliam, 2009). Therefore, during the revision stage, the researchers added a quiz feature, simplified the overall design, and optimized animations to minimize potential issues related to internet connectivity.

Overall, this study supports the findings of Putra et al. (2020), who reported that the use of interactive digital learning media in Physics not only improves learning outcomes but also motivates students to be more engaged. Nevertheless, optimizing navigation, ensuring font consistency, and simplifying animations are recommended steps to enhance the quality of the media for future implementation.

Thus, the Canva-based interactive learning media developed in this study is considered feasible to be used as an innovative alternative in Physics learning, particularly on the topic of Dynamic Electricity, as it successfully integrates visual, interactive, and evaluative approaches that have been proven to improve students' understanding and learning motivation.

CONCLUSIONS

The development of Canva-based interactive learning media on Dynamic Electricity has been proven feasible, with validation results from media experts (78.3%) and material experts (83.3%) indicating a valid category. The language aspect even reached a highly valid score (85.4%), demonstrating the clarity of content delivery that supports the understanding of abstract physics concepts. This media is considered capable of bridging the need for visualization in a communicative, engaging, and digitally relevant manner.

However, this study is still limited to the internal validation stage and has not yet been directly tested in classroom settings. Therefore, further research is required, including field trials, the development of additional interactive features, and effectiveness testing in diverse conditions. With further refinement, this media has strong potential to serve as an innovative solution for enhancing students' motivation and conceptual understanding in Physics learning, particularly on the topic of Dynamic Electricity.

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