Lontar Physics Today (e-ISSN: 2828-0970)
Vol. 5 No. 1 February 2026, p 173-186
Available online at http://journal3.upgris.ac.id/index.php/lpt/index
DOI: 10.26877/lpt.v5i1.361

Development and User Response Analysis of a Wizer.me-Based Digital Worksheet for Teaching Special Relativity

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Article Info:

Article History:
received: 26 January 2026
accepted: 27 February 2026
available online: 28 February 2026

Keyword:
digital worksheet, special relativity, Wizer.me

https://doi.org/10.26877/lpt.v5i1.361

Abstract:

Physics learning on special relativity material faces challenges due to its abstract, difficult-to-visualize concepts, while conventional Student Worksheets remain dominant in schools. This study aims to develop a digital LKPD based on the Wizer.me platform for special relativity material and to analyze user responses to the developed media. This study uses a research and development (R&D) method with a 4D model, focusing on the development stage. The research subjects involved two expert validators, one physics teacher, and 45 high school students. The research instruments were in the form of expert validation sheets and user response questionnaires, with descriptive quantitative data analysis. The results showed that the developed digital LKPD has a very high level of validity, with an average validity index of 1.00, and is therefore suitable for use as a learning medium. In addition, user responses showed positive acceptance, indicated by the percentage of teacher responses of 87.3% (positive category) and student responses, which were dominated by the very positive category of 77.8%. These findings indicate that Wizer. me-based digital worksheets are practical, engaging, and relevant to support special relativity learning. Further research is recommended to examine the effectiveness of digital worksheets in improving students' conceptual understanding or learning outcomes through experimental research designs and to develop their application to other abstract physics materials and broader school contexts.

1. Introduction

Learning physics in the special relativity topic presents unique challenges because the concepts of space and time are abstract, non-intuitive, and difficult to relate to students' everyday experiences (Alstein et al., 2021; Georgiou et al., 2021; Marisda et al., 2025). Studies in secondary education have shown that students often struggle to construct coherent conceptual understanding when special relativity is taught through conventional instructional approaches that rely heavily on verbal explanations and textual learning materials (Kamphorst et al., 2023). Such approaches provide limited support for conceptual visualisation and active engagement, leading to low participation and motivation in physics learning. Consequently, prior research has highlighted the need for enhanced instructional strategies that explicitly address students' conceptual difficulties and support meaningful learning in special relativity (Alstein et al., 2023).

Several technologies have been developed to support physics learning through digital media, particularly in the form of digital-based student worksheets and interactive learning tools. Previous studies have used various platforms, such as PDF-based e-worksheets, learning management systems, simulation-based media (e.g., PhET), and interactive flipbooks, to enhance student engagement and conceptual understanding in physics. These technologies have shown positive impacts, especially when applied to concrete context-rich topics such as mechanics, electricity, or thermodynamics. However, many of these digital worksheets remain limited in interactivity, often functioning primarily as digital replicas of printed worksheets with static content and minimal feedback mechanisms (Bao & Koenig, 2019; Hawur et al., 2025). Furthermore, development research that not only assesses the feasibility of the media but also examines user responses, from both educators and students, in the context of real-world classroom use is still rarely reported (Distrik et al., 2024). This gap highlights the need to develop a digital LKPD specifically designed to support special relativity learning and evaluated for user acceptance.

Based on these conditions, this study developed a digital-based worksheet using the Wizer.me platform as an alternative learning solution. Wizer.me was chosen because it provides interactive features that enable the integration of text, visuals, and responsive activities into in single digital worksheet, potentially supporting active student engagement in learning the concept of special relativity (Anggraini et al., 2025; Nildasari & Nur, 2024; Sahida & Wiradimadja, 2024). Previous research has documented the development and implementation of interactive e-worksheets using Wizer.me across subjects with positive indications for enhancing both teacher practice and student engagement (Afriliyanti et al., 2023). This study aims to assess the validity of the developed digital worksheet and analyse educators' and students' responses to its use. Thus, this study offers a novel approach in developing digital worksheets for abstract physics material by emphasising media feasibility and user acceptance in the context of secondary school learning.

2. Theoretical Framework

2.1. Digital Student Worksheets in Physics Learning

Learning physics requires learning tools that can facilitate students in actively building conceptual understanding, and student worksheets have been shown to serve this purpose by guiding learners through structured activities and reflective tasks (Kasmawati et al., 2025). Meta-analytic evidence indicates that worksheets in science learning are associated with improvements in student learning outcomes, reflecting their role in supporting conceptual understanding and engagement (Chutami & Suhartini, 2021). Live interactive worksheets further demonstrate that interactive learning tools can increase student engagement and autonomy in the learning process. One learning tool that plays a crucial role in this process is the student worksheet. Student worksheets are designed to guide students' learning through a systematic series of tasks, questions, and work steps, so that students not only receive information but also engage in thinking and problem-solving. In the context of physics learning, student worksheets serve as a tool to help students connect theoretical concepts with the underlying scientific reasoning process (Sarina et al., 2025). Along with the development of educational technology, student worksheets have shifted from printed to digital formats. Digital student worksheets enable the integration of various learning elements, such as text, images, visualizations, and interactive activities, which can increase student engagement in learning (Ikhsan et al., 2025). The use of digital-based student worksheets provides opportunities for students to learn more independently, flexibly, and responsively to feedback.

2.2. Learning Difficulties in Special Relativity

Special relativity is a topic in physics with a high level of abstraction because it addresses concepts of space and time that cannot be directly observed in everyday life. Core concepts such as time dilation, length contraction, and the relativity of simultaneity require strong conceptual thinking and reasoning skills from students. As a result, students often struggle in visualize these concepts and to connect mathematical formulations with their physical meanings. In physics learning, especially with abstract material, the use of appropriate learning media is crucial for supporting conceptual understanding. Learning special relativity requires learning media that not only present information textually but also facilitate conceptual exploration through visual representations and structured learning activities (Latifah et al., 2024). Without adequate visualization and guided learning support, students may struggle to actively engage with abstract concepts, leading to low motivation and superficial understanding. Digital student worksheets are considered relevant for supporting learning in special relativity because they can designed to guide students in understanding concepts gradually and contextually, while encouraging active participation in the learning process (Khualid & Rohmah, 2025).

2.3. Learning and Curriculum Demands in Special Relativity Learning

Current physics curricula emphasize developing conceptual understanding, active learning, and integrating digital technology in classroom instruction. In the context of special relativity learning at the secondary school level, curriculum demands require learning activities that support concept visualization, student engagement, and higher-order thinking skills. However, field conditions indicate that learning practices are still dominated by conventional student worksheets with limited visualization and interactivity. This situation creates a gap between curriculum expectations and actual classroom implementation, particularly for abstract physics topics such as special relativity. Therefore, there is a need for learning media that align with curriculum demands by supporting interactive learning, conceptual exploration, and digital integration.

2.4. Wizer.me-Based Digital Worksheets as a Learning Solution

In this study, the development of digital-based worksheets using the Wizer.me platform is positioned as a response to the learning difficulties of special relativity and the demands of the curriculum. Wizer.me allows the integration of visual elements, interactive tasks, and immediate feedback, which can support students in exploring abstract concepts more effectively. Previous research has shown that interactive worksheets developed with Wizer.me can facilitate reciprocal interaction between students and learning materials, support conceptual engagement, and improve learning motivation in classroom contexts (Sahida & Wiradimadja, 2024). Moreover, studies have reported positive responses from educators and learners regarding the ease of use and flexibility of Wizer.me in creating interactive learning materials. Digital worksheets developed with Wizer.me have also demonstrated validity and practical effectiveness across subjects such as informatics and mathematics, suggesting their potential to guide structured learning processes. By accommodating both abstraction in physics content and curriculum demands for interactive learning, Wizer.me-based digital worksheets are considered a promising learning medium for special relativity instruction

2.5. Conceptual Framework of the Study

Based on the theoretical discussion above, learning special relativity requires learning media that bridge the abstract characteristics of the material with students' needs for interactive and visual learning. Field conditions indicate a research gap caused by the dominance of conventional worksheets, limited digital visualization, and a lack of studies examining user responses to digital worksheets in special relativity learning.

Therefore, this research is formulated within a conceptual framework that describes the relationships among field conditions, learning difficulties in special relativity, curriculum demands, research gaps, and solutions offered through the development of Wizer.me-based digital student worksheets. This conceptual framework serves as the basis for designing and implementing the research, as illustrated in Figure 1.

Figure 1 illustrates the conceptual framework of this study, which is structured into four main components: field conditions, learning and curriculum demands, research gap, and the proposed solution. The *field conditions* component reflects the current situation of physics learning in schools, where instruction is still dominated by conventional student worksheets with limited visualization, particularly in abstract topics such as special relativity. These conditions contribute to low student motivation and participation, as students experience difficulties in understanding concepts related to space and time that cannot be directly observed. The *learning and curriculum* demands component emphasizes the need for interactive learning approaches that support concept visualization, digital integration, and active student engagement, in line with 21st-century learning principles. In the context of special relativity, these demands highlight the importance of learning media that can bridge abstract concepts with students' cognitive needs through structured and visual learning activities.

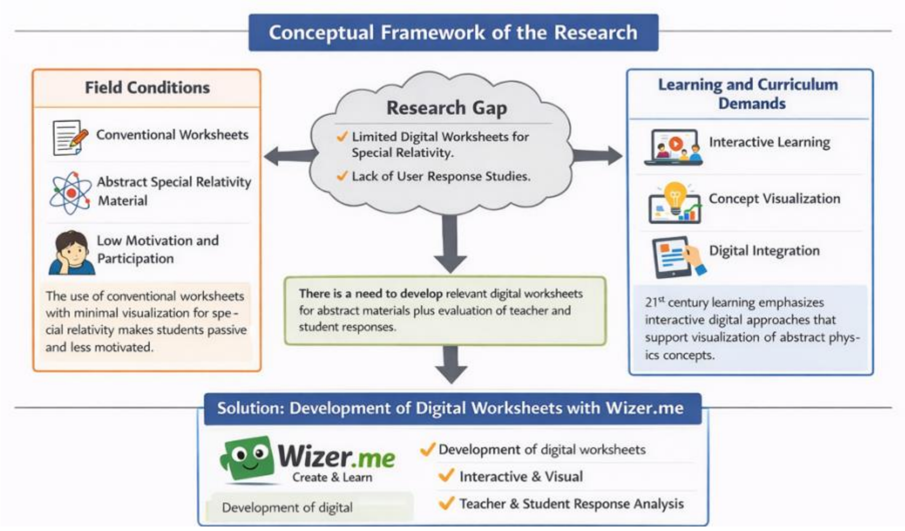


Figure 1. *Research framework for developing digital LKPD based on Wizer.me on special relativity material.*

Based on the discrepancy between field conditions and curriculum demands, *a research gap* is identified, namely the limited availability of digital student worksheets specifically designed for abstract physics topics and the lack of studies examining teacher and student responses to such digital learning media. To address this gap, the proposed solution is to develop digital student worksheets on the Wizer.me platform. Wizer.me is selected because it offers interactive, visual, and task-based learning features that accommodate the abstraction level of special relativity content while aligning with curriculum demands. In addition, the platform allows for the collection and analysis of teacher and student responses, which are essential for evaluating the feasibility and practicality of the developed digital worksheets.

3. Method

3.1. Types and Stages of Research

This study employed a Research and Development (R&D) approach to develop Wizer.me-based digital student worksheet for special relativity learning and analyzing its feasibility and user responses. The development process followed the 4D model, consisting of Define, Design, Develop, and Disseminate stages. Each stage was implemented operationally to ensure systematic development, validation, and limited implementation of the digital worksheet in accordance with the research objectives (Sugiyono, 2019). The research flow for developing a digital LKPD based on Wizer.me, using the 4D model, is shown in Figure 2.

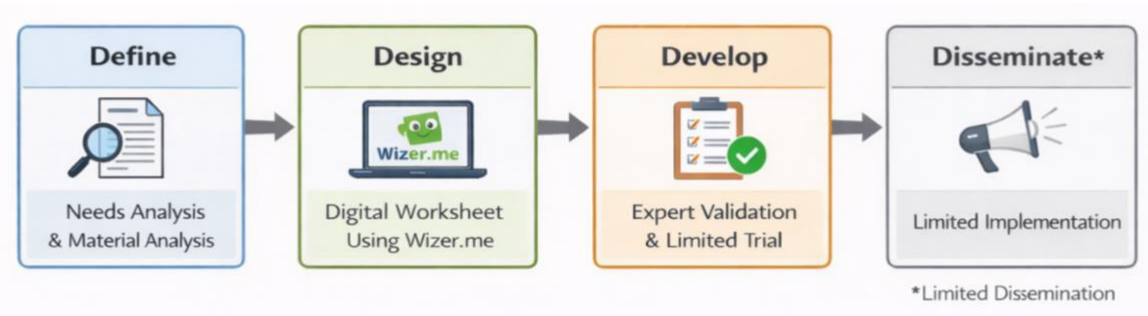


Figure 2. *Research flow for developing digital LKPD based on Wizer.me using 4D model.*

3.1.1. Define Stage

The define stage focused on identifying learning needs, curriculum demands, and the characteristics of special relativity material to serve as the foundation for developing digital worksheets. At this stage, a curriculum and learning demand analysis was conducted by examining senior high school physics competencies and learning indicators related to special relativity. This analysis showed that special relativity involves highly abstract concepts, such as reference frames, time dilation, length contraction, and the relativity of simultaneity, which require strong conceptual reasoning and cannot be directly observed in everyday experiences.

In addition, an analysis of learning needs revealed that students often struggle in understand special relativity because conventional worksheets rely heavily on textual explanations and provide limited visual support. Such learning conditions tend to result in passive student participation and low conceptual engagement. Therefore, learning media that can facilitate visualization, structured reasoning, and active involvement are required to support students in constructing abstract concepts more effectively.

Based on the curriculum and learning needs analysis, the special relativity material was then organized into a structured conceptual sequence. The concepts were arranged progressively, starting with introductory ideas on reference frames, followed by core concepts such as time dilation and length contraction, and concluding with application-oriented problems. This organization aimed to support gradual conceptual understanding rather than rote memorization.

Furthermore, a media needs analysis was conducted to determine appropriate forms of visualization, tasks, and learning activities to be integrated into the digital student worksheet. The results indicated that the worksheet should include visual representations, guided conceptual tasks, and interactive learning activities that encourage students to actively explore and reflect on abstract concepts in special relativity. These findings became the basis for designing the structure and content of the digital student worksheet in the subsequent design stage.

3.1.2. Design Stage

The design stage translated the results of the curriculum and needs analysis into a structured and operational material blueprint for Special Relativity. This blueprint was developed to ensure that the digital worksheet content implemented in Wizer.me explicitly aligns with curriculum competencies, conceptual demands, and student learning needs. Based on the senior high school physics curriculum, the competencies require students to: (1) explain inertial reference frames and relative motion, (2) analyze time dilation and length contraction both conceptually and mathematically, (3) interpret the relativity of simultaneity, and (4) apply special relativity principles in contextual situations.

Table 1. *Material Blueprint of Special Relativity Content Integrated into Wizer.me*

Core Concept	Subtopic	Indicator	Focus	Visual	Learning Task
Reference Frames	Inertia and non-inertial frames; relative motion	Explain observer-dependent motion	Relativity of motion	Dual-observer diagrams	Concept identification & short explanation
Time Dilation	Proper time vs observed time	Interpret time dilation qualitatively and quantitatively	Time dependence on velocity	Clock comparison visualization	Guided reasoning & numerical calculation
Length Contraction	Proper length vs contracted length	Analyze contraction along direction of motion	Spatial measurement differences	Moving object comparison diagram	Analytical problem-solving task
Relativity of Simultaneity	Event timing in different frames	Explain frame-dependent simultaneity	Non-absolute simultaneity	Event timeline visualization	Conceptual explanation & reflective reasoning
Application of Special Relativity	Contextual problem scenarios	Apply formulas and reasoning in real cases	Conceptual transfer	Context based illustrations	Higher-order contextual problem-solving

These competencies emphasize conceptual reasoning, visualization skills, and higher-order thinking. To operationalize these competencies, the special relativity material was organized into a detailed material blueprint as presented in Table 1.

The blueprint served as the foundation for structuring the digital worksheet in Wizer.me. The worksheet was organized into three main components: (1) introductory conceptual exploration, (2) core guided reasoning and problem-solving activities, and (3) reflective application tasks. Each learning activity was sequenced progressively from basic conceptual recognition to analytical and contextual reasoning tasks. Interactive formats such as multiple-choice questions, short-answer explanations, numerical problem-solving, and reasoning-based tasks were integrated to support conceptual scaffolding and active engagement with abstract relativity concepts.

3.1.3. Develop Stage

The development stage aimed to produce a valid and feasible digital student worksheet through expert validation and limited user testing. This stage consisted of two main activities: validating the digital worksheet and the response questionnaires prior to implementation. The developed worksheet was evaluated by three expert validators: a physics Education expert, an instructional media expert, and an educational evaluation expert. The involvement of three experts was intended to ensure a comprehensive assessment from content, pedagogical, and technical perspectives.

The validation instrument assessed three main aspects: (1) content accuracy and conceptual correctness of special relativity material, (2) language clarity and readability of instructions and explanations, and (3) media presentation and visual organization, including layout, integration of visualizations, and task structure within the Wizer.me platform. Each validation item was rated on a 4-point scale from 1 (Not Appropriate) to 4 (Very Appropriate). The content validity of each item was calculated using Aiken's V coefficient to determine the degree of agreement among experts regarding the relevance and appropriateness of the developed worksheet. Items with Aiken's V values equal to or greater than 0.80 were considered valid and suitable for implementation. Revisions were made based on expert suggestions before proceeding to the limited trial stage. The content validity of each item was calculated using Aiken's V coefficient, according to

$$V = \frac{\Sigma s}{n(c-1)}$$

where $s = r - l_0$, r is the rating given by the expert, l_0 is the lowest score (1), c is the highest score (4), and n is the number of experts ($n = 3$). Items with $V \geq 0{,}80$ were considered valid.

Two response questionnaires were developed to measure teacher and student perceptions after using the digital worksheet. As part of the development stage, a teacher response questionnaire was constructed to measure the practicality and instructional relevance of the digital worksheet. The complete list of questionnaire items is shown in Table 2.

Table 2. *Teacher Response Questionnaire Items*

No	Aspect	Item Statement
1	Alignment	The digital worksheet aligns with the learning objectives.
2	Content Accuracy	The special relativity content is accurate and appropriate
3	Clarity	The instructions are clear and understandable
4	Practicality	The worksheet is practical for classroom use.
5	Visualization	The visualization supports conceptual understanding.
6	Engagement	The interactive tasks actively engage students.
7	Usability	The Wizer.me platform is easy to operate.
8	Sustainability	The worksheet can be sustainably implemented in physics learning.

To examine students' learning experiences and engagement during the implementation of the digital worksheet, a structured student-response questionnaire was developed. The questionnaire items, covering attractiveness, ease of use, conceptual support, engagement, and overall satisfaction, are presented in Table 3.

Table 3. *Student Response Questionnaire*

No	Aspect	Item Statement
1	Attractiveness	The digital worksheet is visually attractive
2	Ease of Use	The worksheet is easy to use
3	Clarity	The instructions are clear
4	Visualization	The visualization helps me understand abstract concepts
5	Concept support	The activities help me understand time dilation and length contraction
6	Engagement	I am more engaged when learning with this worksheet
7	Critical thinking	The worksheet encourages me to think critically
8	Satisfaction	Overall, I am satisfied with using this digital worksheet

Before implementation, both questionnaires were validated by the three experts. The validation process focused on the relevance of each item to the research objectives, the clarity of wording, the suitability of the items for the intended respondents, and their alignment with the measured construct. Each item was rated using a four-point relevance scale. Aiken's V was calculated for each item. Items with $V \geq 0{,}80$ were retained for the limited trial.

After revisions based on expert feedback, a limited trial was conducted involving one physics teacher and 45 students. User responses were collected using the validated questionnaires and analyzed using percentage analysis to determine the practicality and acceptance of the digital worksheet.

3.1.4. Disseminate Stage

The dissemination stage was conducted through a limited classroom implementation at SMAN 2 Jeneponto. The participants consisted of one physics teacher and 45 Grade XI senior high school students who were studying special relativity. The teacher was involved in facilitating the learning process, while the students participated in the learning activities using the developed digital worksheet.

The implementation began with an orientation session in which the researcher introduced the Wizer.me-based digital worksheet and provided guidance on how to access and navigate the platform. Students were instructed to log in using the provided access link and complete the structured learning activities integrated into the worksheet. The teacher facilitated classroom discussion and provided additional explanations when necessary. The learning activities were conducted during regular physics class hours.

Data collection was carried out immediately after the completion of the learning session. Teacher and student responses were gathered using validated online questionnaires distributed through a digital form. Students completed the questionnaire individually, while the teacher completed a separate response questionnaire after observing the learning process. The collected data were analyzed descriptively using percentage analysis to determine the level of practicality and user acceptance of the digital worksheet.

This study adhered to ethical research principles. Ethical approval for the study was obtained from the institutional authority prior to data collection. Informed consent was secured from the participating teacher and students before implementation. Participants were informed about the purpose of the study, research procedures, voluntary participation, and the confidentiality of their responses. Students were assured that their participation would not affect their academic evaluation, and all collected data were anonymized to protect participant identity.

3.2. Research Subjects

The research participants included expert validators, physics educators, and high school students. The expert validators assessed the feasibility of the digital student worksheets in terms of content, language, and media presentation. Educators and students served as users, providing feedback on the digital student worksheets developed. Details of the research subjects are presented in Table 4.

Table 4. *Research Subjects*

Subject	Number	Role
Expert Validators	2	Assessed the feasibility of the digital worksheet
Physics teacher	1	Provided feedback on the use of the digital worksheet
Student	45	Provided feedback on the worksheet's design, usability, and usefulness

3.3. Data Analysis Instruments and Techniques

The research instruments used included an expert validation sheet and a user response questionnaire. The expert validation sheet was used to assess the feasibility of the digital student worksheets. In contrast, the user response questionnaire was used to collect educators' and students' responses to its use. The data types, instruments, respondents, and analysis techniques used in this study are presented in Table 5.

Table 5. *Research Instruments and Data Analysis Techniques*

Data Type	Instrument	Respondents	Analysis Techniques
Media eligibility	Expert validation sheet	Expert Validator	Descriptive analysis (scores and categories)
User response	Response questionnaire	Teacher and students	Percentage analysis and category interpretation

The data obtained were analyzed using descriptive techniques. For expert validation, each item was rated on a predetermined scoring scale, and the validity index was calculated as the total score divided by the maximum possible score. The resulting scores were then converted into validity categories using established criteria to determine the feasibility of the digital student worksheets.

User responses from educators and students were analyzed using percentage analysis. The percentage score was calculated by dividing the total score by the maximum possible score and multiplying the result by 100%. The percentage results were then interpreted using predefined response category criteria, namely very positive, positive, moderately positive, and less positive. These analyses were used to determine both the feasibility of the developed digital student worksheets and the categories of user responses toward their implementation.

4. Result

4.1. Validity of the Digital Student Worksheet

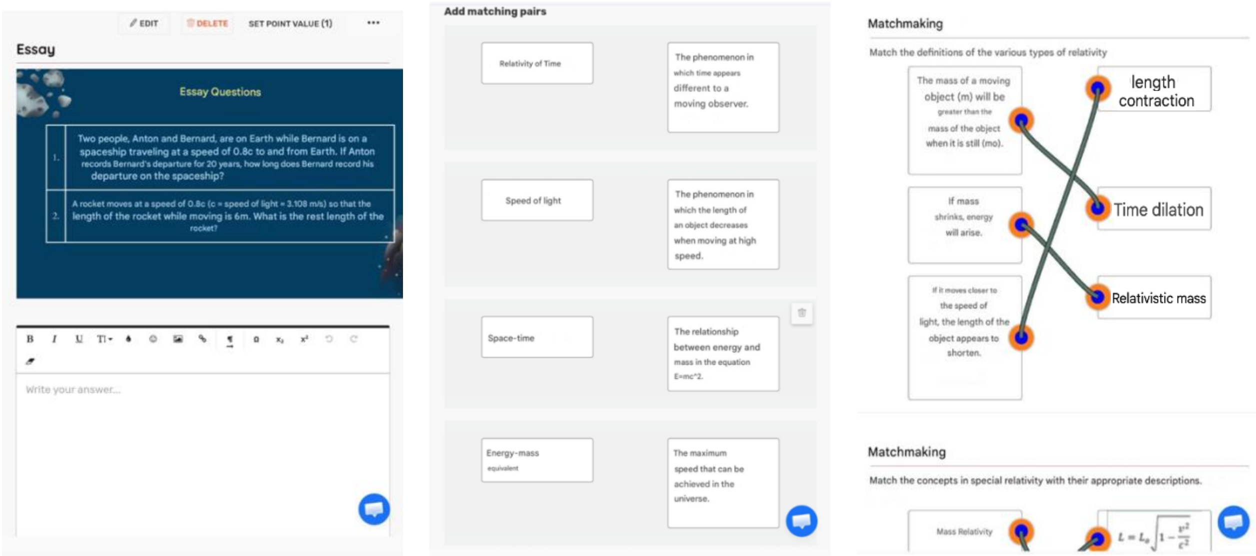
The validity of the Wizer.me-based digital student worksheet on special relativity was determined through an assessment by expert validators. The assessment covered several aspects, including presentation, content appropriateness, and language use. The analysis showed that the developed digital student worksheet achieved an average validity index of 1.00, indicating validity across all assessed aspects.

Table 6. *Results of Media Expert Validation Using Aiken's V*

Aspect	Number of Items	Validator I (Mean)	Validator II (Mean)	Validator III (Mean)	Aiken's V	Validity Category
Worksheet presentation	6	4.00	4.00	4.00	1.00	Valid
Content presentation	4	4.00	4.00	4.00	1.00	Valid
Language presentation	4	4.00	4.00	4.00	1.00	Valid
Overall Average		4.00	4.00	4.00	1.00	Valid

Note: The validity index was calculated by dividing the mean score by the maximum possible score (4).

The validity of the Wizer.me-based digital student worksheet was evaluated by three expert validators using Aiken's V coefficient. The validation covered worksheet presentation, content presentation, and language presentation. The results indicate that all aspects achieved an Aiken's V value of 1.00, which falls into the valid category. This finding suggests strong agreement among experts regarding the relevance, clarity, and appropriateness of the developed digital worksheet. Therefore, the worksheet is considered valid and feasible for use in special relativity learning. The final version was designed as an interactive digital worksheet hosted on the Wizer.me platform. It integrates conceptual explanations, guided problem-solving activities, and visualization-based learning tasks aligned with key topics in special relativity. Figure 3 presents the interface and selected instructional components of the worksheet, including analytical problems (Figure 3a), concept-matching tasks (Figure 3b), and interactive mapping activities (Figure 3c).



(a) *Analytical problems* (b) *Definition matching* (c) *Concept mapping*

Figure 3. *Interface and sample content of the developed digital worksheet*

4.2. User Responses to the Digital Student Worksheet

User responses to the digital student worksheet were obtained from educators and students involved in the limited trial. The questionnaire results indicated that educators' responses to the use of the digital student worksheet were positive, with a percentage of 87.3%. Furthermore, student responses were predominantly very positive, with a percentage of 77.8%. These data indicate that the majority of students responded very favourably to the use of the Wizer.me-based digital student worksheet in special relativity learning.

5. Discussion

This discussion section aims to interpret the research findings presented in the previous section by linking them to the research objectives and conceptual framework. The discussion focuses on the significance of the findings related to the validity of the Wizer. me-based digital worksheet and user responses to the developed media, without repeating the quantitative data presented previously. Therefore, this section emphasizes the analysis of the relevance and implications of the research findings in the context of special relativity learning in secondary schools.

5.1. Interpretation of Findings

The very high validity of the Wizer.me-based digital student worksheet indicates that the developed media meet feasibility standards as a learning medium in terms of content, language, and presentation (Faradila, 2025; Mitasari & Hidayah, 2022). Expert validation results confirm that the worksheet components—such as structure, activity flow, and instruction clarity—are appropriate for supporting learning in special relativity. This finding suggests that the digital worksheet has been developed systematically and meets the essential criteria required for instructional media in physics learning.

In the context of special relativity, which involves abstract and non-intuitive concepts, the availability of well-structured and visually supported learning media is crucial. The validated digital worksheet facilitates a more organized presentation of abstract material and supports students in concept exploration rather than passive information reception (Alstein et al., 2021; Tarng et al., 2022). Therefore, the validation results indicate that the Wizer.me-based digital worksheet is suitable for use as a supporting learning medium in special relativity instruction.

Positive responses from educators indicate that the digital worksheet is practical and easy to implement in classroom settings. This finding aligns with previous studies highlighting that usability and practicality are key factors influencing teachers' acceptance of digital learning media (Huang et al., 2022; Nildasari & Nur, 2024). Similarly, students' overwhelmingly positive responses reflect high levels of engagement and acceptance, suggesting that interactive and visual features embedded in the worksheet effectively support learning in abstract physics topics (Arsyad et al., 2024).

5.2. Implications

The findings imply that digital student worksheets developed using interactive platforms such as Wizer.me can serve as a viable alternative to conventional worksheets, particularly for abstract physics topics. The high validity and positive user responses suggest that such worksheets can support student engagement and facilitate more active participation in learning processes. For educators, the use of validated digital worksheets offers a practical instructional tool that aligns with current demands for interactive and technology-supported learning environments.

From a broader instructional perspective, the use of digital worksheets can enhance the quality of physics learning by integrating visual elements, interactive tasks, and immediate feedback. These features are particularly relevant for secondary school physics learning, where conceptual understanding plays a critical role.

5.3. Limitations

Despite the positive findings, this study has several limitations. The analysis focused on media validity and user responses and did not examine the effectiveness of the digital worksheet in improving students' conceptual understanding or learning outcomes. In addition, the implementation was conducted in a single school context with a relatively small sample size, which may limit the generalizability of the results. Therefore, future studies are recommended to employ experimental research designs and involve broader implementation settings to further investigate the instructional impact of Wizer.me-based digital student worksheets.

6. Conclusion

This study aimed to develop a digital-based worksheet using the Wizer.me platform for special relativity and to analyze user responses to the developed media. The results showed that the digital LKPD had very high validity, with an average validity index of 1.00, indicating it is suitable for use as a physics learning medium. Furthermore, user responses showed positive acceptance, as indicated by a percentage of 87.3% of educators' responses (positive) and a predominant percentage of 77.8% of student responses in the very positive category. These findings indicate that the Wizer.me-based digital LKPD is practical, engaging, and relevant to support abstract special relativity learning. Further research is recommended to assess the effectiveness of this digital LKPD in improving students' conceptual understanding or learning outcomes through experimental designs, and to develop and implement it in other abstract physics materials and in broader school contexts.

Further research is recommended to examine the effectiveness of using the Wizer.me-based digital LKPD in improving student conceptual understanding or learning outcomes through experimental research designs. In addition, the development and application of digital LKPD on other abstract physics materials, as well as testing in a broader school context, need to be carried out to obtain a more comprehensive picture of the potential and sustainability of using digital learning media in physics learning.

Authors Contribution

Nurjannah: Conceptualization, Methodology, Data curation, Formal analysis, Writing – original draft. **Dewi Hikmah Marisda:** Conceptualization, Methodology, Writing – review & editing, Supervision. **Ana Dhiqfaini Sultan:** Methodology, Writing – review & editing, Supervision. All authors have reviewed and approved the final manuscript and agreed to the order of authorship.

Acknowledgements

The authors would like to thank all parties who contributed to the implementation of this research. Thanks are extended to the expert validators who provided constructive input and suggestions for developing the digital student worksheets, as well as to the educators and students at SMA Negeri 2 Jeneponto who participated in the trial and provided feedback on the developed learning media. Appreciation is also extended to the schools and institutions that provided support and facilities to enable this research to be carried out successfully.

Ethical statement

This study was conducted at SMAN 2 Jeneponto. Permission to conduct the research and collect data was obtained from the school authorities. Participation was voluntary, and informed consent was obtained from all participants before data collection. No sensitive personal data was collected, and all responses were anonymized and used solely for research purposes. All procedures complied with applicable ethical guidelines for educational research.

Declaration of AI use

The authors used ChatGPT (OpenAI) to improve sentence clarity and readability in the original Indonesian draft. Finally, Grammarly was used to polish the English language (grammar, spelling, punctuation, and style). All AI-assisted outputs were reviewed and edited by the authors, who remain fully responsible for the accuracy, originality, and integrity of the final manuscript.

Conflict of Interest

The authors declare that there is no conflict of interest, either financial or non-financial, that could be perceived as influencing the work reported in this manuscript. All authors have reviewed and approved this statement.

Supplementary Materials and Data Availability

No public repository is currently available for the dataset. However, the instruments and key data summaries used in this study can be obtained from the corresponding author upon reasonable request.

Any data shared will be anonymized and provided in accordance with the ethical approval and institutional regulations.

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