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Development of Canva-Based Digital Physics Worksheets on Motion to Enhance Students' Scientific Literacy

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Abstract: This study aimed to develop and evaluate a Canva-based Digital Student Worksheet (LKPD) on motion concepts to improve students' scientific literacy. The research employed a Research and Development (R&D) approach using the ADDIE model, consisting of Analysis, Design, Development, Implementation, and Evaluation phases. Product feasibility was assessed through expert validation, while effectiveness was evaluated through limited field trials (n = 10) and large field trials (n = 20) conducted during the implementation phase. Scientific literacy was measured using PISA-based test items covering the dimensions of scientific content, context, and competency. The developed LKPD achieved a validity score of 93.8% (very valid). Practicality scores reached 94.0% from teachers and ranged from 90.5% to 94.5% from students, indicating a very practical category. The effectiveness evaluation revealed substantial improvements in students' scientific literacy, with the greatest gains observed in the scientific competency dimension, particularly in explaining scientific phenomena and interpreting data related to motion concepts. N-Gain scores reached 0.71 in the limited field trial and 0.75 in the large field trial, both categorized as high. These findings indicate that the Canva-based digital LKPD is valid, practical, and effective for supporting interactive physics learning and enhancing students' scientific literacy in secondary education.

Keywords: Canva; Digital physics worksheets; Motion in physics; Scientific literacy

Introduction

Physics is one of the scientific disciplines that plays a strategic role in developing students' scientific, analytical, and critical thinking skills, particularly at the senior high school level. Physics learning is not only oriented toward mastering concepts but also toward students' ability to understand, explain, and apply natural phenomena using systematic scientific processes. In the context of the twenty-first century and the era of digital transformation, the demands on educational quality continue to increase, requiring students not only to master scientific concepts but also to develop strong scientific literacy skills. Scientific literacy has long been recognized by the OECD as the ability to explain scientific phenomena, evaluate and interpret scientific evidence, and apply scientific knowledge to real-life situations (OECD, 2019). More recently, the OECD PISA 2025 Science Framework expanded this concept by emphasizing scientific knowledge, scientific competencies, scientific contexts, and agency in the Anthropocene as essential dimensions of scientific literacy (OECD, 2023).

The increasing integration of digital technology into education has transformed learning into a more flexible, interactive, and technology-supported process (Giandra et al., 2024; Amiri et al., 2024; Michael et al., 2023; Meriva, 2024; Tondeur et al., 2017). The integration of digital technology is no longer merely complementary but has become a core component of effective instructional design. Furthermore, digital transformation promotes pedagogical innovation, broadens access to learning

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resources, and strengthens the readiness of educational systems to respond to global challenges in the twenty-first century (Paul, 2018; Punya, 2019; Zou et al., 2025). Various international studies have shown that the use of digital media in science learning significantly improves students' cognitive and affective engagement (Paas & Merriënboer, 2020; Sung et al., 2016). In Indonesia, these developments are reflected in the implementation of the Merdeka Belajar policy, which encourages more flexible, contextual, and technology-enhanced learning practices (Muhammad et al., 2025; Mulyasa, 2022; Sobandi et al., 2023).

Despite these developments, scientific literacy among Indonesian students remains a significant concern. The latest PISA results indicate that Indonesia continues to perform below the OECD average in science literacy, suggesting persistent challenges in science education quality (OECD, 2024). Low scientific literacy has been associated with limitations in critical thinking, problem-solving, and evidence-based decision-making skills (Bramastia & Rahayu, 2023; Dawson et al., 2024; Rahayu et al., 2025; Romanova et al., 2024). Moreover, literacy in the twenty-first century extends beyond traditional reading and writing skills to encompass critical, creative, collaborative, communicative, and digital competencies (Gyta et al., 2022).

One factor contributing to low scientific literacy is the continued dominance of teacher-centered instruction and the limited use of interactive digital learning media (Iriandana & Lutfi, 2026). Conventional learning approaches often fail to support students in constructing meaningful understanding of scientific concepts and connecting classroom knowledge with real-world phenomena. Contemporary learning theories emphasize that multimedia integration can enhance learning effectiveness by presenting information through complementary visual and verbal channels (Nurhatmi, 2025; Pane et al., 2025). Likewise, Cognitive Load Theory highlights the importance of instructional designs that optimize information processing while reducing unnecessary cognitive burden (J. et al., 2019; Paas & Merriënboer, 2020). Previous studies have demonstrated that interactive digital learning media positively influence student engagement, learning achievement, and scientific literacy development (Gyta et al., 2022; Kasmawati et al., 2025a; Kosakoy et al., 2025).

Among the various topics in physics, motion is considered one of the most fundamental yet conceptually challenging topics. Motion learning requires students to integrate mathematical equations, graphical representations, and physical interpretations simultaneously. Students frequently encounter difficulties in interpreting kinematic graphs and relating graphical information to actual physical phenomena, resulting in persistent misconceptions (Meriva, 2024; Resbiantoro et al., 2022). Consequently, motion learning requires instructional resources that can effectively support visualization, contextualization, and scientific reasoning.

The urgency of addressing this issue is evident in the context of SMA Negeri 6 Padangsidimpuan. Preliminary assessments conducted among Grade X students revealed that the average scientific literacy score was only 41.2%, with approximately 90.7% of students categorized as having low or very low levels of scientific literacy. These findings indicate a substantial gap between the intended goals of science education and students' actual competencies. Furthermore, classroom observations revealed that most students possess smartphones and have regular access to digital devices. However, these technologies are rarely utilized as learning resources in physics instruction. Learning activities remain largely dependent on printed teaching materials and teacher explanations, while opportunities for laboratory investigations are constrained by limited facilities and instructional time. This situation highlights the need for innovative digital learning resources capable of transforming students' technological readiness into meaningful scientific learning experiences (Harahap et al., 2022; Nasution et al., 2024).

One promising solution is the digitalization of student worksheets (LKPD) using Canva for Education. Canva enables educators to design visually attractive, interactive, and accessible learning materials that can support students' engagement and conceptual understanding. Previous studies have demonstrated that Canva-based learning media can improve students' motivation, engagement, and learning outcomes (Alifah et al., 2022; Kasmawati et al., 2025b; Kasmawati et al., 2025a). Furthermore, Canva facilitates the integration of concept visualizations, contextual scientific phenomena, multimedia elements, and interactive learning activities that support the development of scientific literacy (Anggrini et al., 2025).

Although numerous studies have investigated Canva-based learning media, existing research has primarily focused on visual presentation, learning motivation, and general academic achievement. Limited attention has been given to the development of Canva-based digital physics worksheets that explicitly integrate scientific literacy dimensions within motion learning. More specifically, previous studies have not sufficiently explored the integration of interactive kinematic graph visualizations, scientific data interpretation activities, and contextual motion-related problems designed to address students' misconceptions while simultaneously fostering scientific literacy competencies. Furthermore, studies incorporating the dimensions of scientific literacy proposed in the OECD PISA 2025 Science

Framework into Canva-based digital learning resources remain scarce.

The novelty of this study lies in three major aspects. First, the developed Canva-based digital physics worksheets integrate interactive kinematic graph visualizations, contextual motion-related phenomena, and scientific data interpretation activities specifically designed to address common misconceptions in motion learning. Second, the worksheets explicitly incorporate the dimensions of scientific literacy proposed in the OECD PISA 2025 Science Framework, including scientific knowledge, scientific competencies, scientific contexts, and agency. Third, unlike many previous studies that focused primarily on media development and usability, this study evaluates the developed product through expert validation, limited field testing, and large field testing within the ADDIE development framework to determine its feasibility, practicality, and effectiveness based on field-testing results. To the best of our knowledge, no previous study has simultaneously integrated interactive kinematic graph visualization, PISA 2025 scientific literacy dimensions, and Canva-based digital worksheets specifically for motion learning at the senior high school level.

Therefore, this study is important both theoretically and practically. Theoretically, it contributes to the growing body of knowledge regarding digital learning innovation and scientific literacy development in physics education. Practically, it provides an evidence-based digital learning resource that supports technology-enhanced physics instruction and contributes to improving students' scientific literacy in accordance with the demands of twenty-first-century education. Based on this background, this study aims to develop Canva-based digital physics worksheets on motion concepts and evaluate their feasibility, practicality, and effectiveness in improving the scientific literacy of Grade X students at SMA Negeri 6 Padangsidimpuan.

Method

This study employed a Research and Development (R&D) approach to develop a Canva-based digital physics worksheet (LKPD) designed to improve students' scientific literacy in motion learning at the senior high school level. The study was conducted at SMA Negeri 6 Padangsidimpuan, North Sumatra, Indonesia, during the 2025/2026 academic year. The R&D approach was selected because it enables researchers not only to develop instructional products but also to evaluate their quality systematically in terms of validity, practicality, and effectiveness (Sugiyono, 2021; Wynn & Clarkson, 2018). In the context of twenty-first-century education, the development of technology-enhanced learning resources has become increasingly important for promoting student engagement, meaningful learning experiences, and scientific literacy development (Plass et al., 2020; Sung et al., 2016).

To ensure a systematic development process, this study adopted the ADDIE instructional design model, which consists of five interconnected phases: Analysis, Design, Development, Implementation, and Evaluation he ADDIE model was selected because it provides a flexible and structured framework for designing, developing, implementing, and evaluating technology-based instructional products while incorporating continuous evaluation throughout the development process (Pribadi, 2016).

The overall development procedure employed in this study is presented in Figure 1.

Figure 1. ADDIE instructional design model

The analysis phase was conducted to identify learning needs, student characteristics, curriculum requirements, and problems related to scientific literacy in physics learning. Data were collected through classroom observations, teacher interviews, curriculum analysis, and a review of scientific literacy indicators based on the OECD PISA 2025 Science Framework. The findings indicated that students' low scientific literacy was associated with limited use of interactive learning media and the continued dominance of teacher-centered instruction (Harahap et al., 2022).

The design phase focused on planning the Canva-based digital worksheet. Activities included formulating learning objectives, organizing instructional content, preparing concept maps, designing scientific literacy-oriented activities, developing assessment instruments, and creating worksheet layouts. The integration of visual elements such as kinematic graphs, motion illustrations, and contextual scientific phenomena was guided by Multimedia Learning Theory, which emphasizes the effective integration of verbal and visual information to facilitate meaningful learning (Clark &

Mayer, 2016). In addition, differentiated learning principles were incorporated to accommodate students' diverse learning needs (Kasmawati et al., 2025a; Paul, 2018).

The development phase involved producing the initial version of the Canva-based digital worksheet and integrating multimedia components, including images, animations, hyperlinks, scientific literacy tasks, and interactive learning activities. The developed product was subsequently validated by three experts consisting of one subject matter expert, one media expert, and one language expert to determine its feasibility and quality before implementation (Dwijayanti et al., 2022).

The implementation phase consisted of two stages of product trials: limited field testing involving 10 students and large field testing involving 20 students. During this phase, students used the developed digital worksheet in motion learning activities. Data were collected through scientific literacy pre-tests and post-tests, practicality questionnaires administered to teachers and students, and observation sheets used to assess the implementation of learning activities and students' engagement during the instructional process.

The evaluation phase was conducted continuously throughout the development process. Formative evaluation was carried out at each ADDIE phase to identify weaknesses and improve the product. Summative evaluation was conducted after implementation to determine the overall quality of the developed worksheet based on validity, practicality, and field-testing effectiveness results. The findings from this stage were used to produce the final version of the Canva-based digital worksheet.

The data collection instruments consisted of: expert validation sheets used by subject matter, media, and language experts to evaluate product feasibility; practicality questionnaires administered to teachers and students to assess usability; and scientific literacy tests administered in the pre-test and post-test to measure students' learning gains.

Data analysis in this study was conducted to assess the quality of the developed Canva-based digital worksheets in terms of validity, practicality, and effectiveness. The analysis employed a quantitative approach based on data obtained from expert validation, teacher and student responses, and scientific literacy test results. This approach was chosen to provide an objective evaluation of product quality through score and percentage calculations (Sugiyono, 2021). In research and development studies, validity, practicality, and effectiveness are considered key indicators in determining the feasibility of an instructional product. Accordingly, the data analysis in this study was carried out through three main stages, as outlined below.

The validity assessment aimed to evaluate the feasibility of the digital worksheets based on expert judgments from subject matter, media, and language specialists. Data were collected using Likert-scale validation sheets and analyzed as percentages to determine the feasibility level of the product.

Table 1. Validity criteria

Percentage (%)	Category
81–100	Very Valid
61–80	Valid
41–60	Fairly Valid
< 40	Not Valid

Source: Adapted from Sugiyono (2021)

The practicality assessment aimed to evaluate the usability of the digital worksheets in the learning process. Data were collected through teacher and student response questionnaires following the implementation of the digital worksheets and analyzed as percentages to determine the level of practicality.

Table 2. Practicality criteria

Percentage (%)	Category
81–100	Very Practical
61–80	Practical
41–60	Fairly Practical
< 40	Not Practical

The effectiveness assessment aimed to evaluate the extent to which the Canva-based digital worksheets enhanced students' scientific literacy. This was measured by comparing pre-test and post-test scores using N-Gain Score (Hake, 2016).

$$g = \frac{S_{Post} - S_{Pre}}{S_{Max} - S_{Pre}} \times 100\ \% \quad (1)$$

where *g* represents the normalized gain score.

Table 3. N-Gain interpretation

N-Gain Value	Category
$g \geq 0.70$	High
$0.30 \leq g < 0.70$	Medium
$g < 0.30$	Low

Result and Discussion

The results and discussion are presented systematically following the stages of the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation), which serves as the procedural framework for developing Canva-based digital worksheets on motion topics. Each stage is discussed separately, supported by empirical data, analysis, and relevant theoretical justifications.

The analysis stage was conducted through direct observations, in-depth interviews, and a preliminary assessment at SMA Negeri 6 Padangsidimpuan. The findings revealed four interrelated fundamental problems. First, the average score of students' daily assessments on motion topics was only 61.5, which is significantly below the Minimum Mastery Criterion (MMC) set at 70. Second, students' initial scientific literacy, measured using a PISA-based instrument, showed an average of 47.4%, which falls into the very low category. This condition is comparable to Gyta et al. (2022) reported that the average scientific literacy of students in Padangsidimpuan was only 46.93%, indicating similar structural challenges in physics learning in the North Sumatra region. Third, 100% of teachers still relied on lecture-based methods without utilizing digital learning media. Fourth, 87% of students reported perceiving physics as a difficult and uninteresting subject, reflecting low learning motivation.

Beyond problem identification, this stage encompassed a curriculum analysis referring to Basic Competency 3.2 in the Regulation of the Minister of Education and Culture No. 37 of 2018, an analysis of Grade VIII student characteristics, and an exploration of the local context of Padangsidimpuan as a basis for contextualized learning materials. These findings highlight the urgency of developing Canva-based digital worksheets as a structured, evidence-based pedagogical intervention (Kemdikbud, 2020; Punya, 2019).

Based on the findings from the analysis stage, the design stage was systematically developed to produce a blueprint for digital worksheets that address each identified problem. This stage resulted in a hierarchically structured learning framework, ranging from simple inquiry-based activities to the application of concepts in real-life contexts.

The main components designed at this stage include: a competency map and learning objectives based on PISA-oriented scientific literacy; a structured sequence of learning activities covering uniform motion, uniformly accelerated motion, and Newton's laws of motion; a tiered scaffolding design referring to the Zone of Proximal Development proposed by Lev Vygotsky; and scientific literacy assessment instruments based on the three indicators of the PISA Framework (OECD, 2023). This design applies the principle of meaningful learning, which connects abstract physics concepts with students' real-life experiences.

The principles of the Cognitive Theory of Multimedia Learning (CTML) serve as the foundation for the instructional design, ensuring that each worksheet page is developed to optimize the simultaneous processing of visual and verbal information without imposing excessive cognitive load.

The development stage consisted of two interrelated activities: the production of digital worksheets using the Canva for Education platform and product validation conducted by three panels of experts. These activities were carried out iteratively in accordance with the principles of the ADDIE model, whereby each piece of feedback from the validators was promptly addressed through product revisions before proceeding to the implementation stage. The cover design of the digital worksheets is presented in Figure 2.

Figure 2. The Cover and main interface of the Canva-based digital worksheets

Figure 2 presents the cover and main interface of the developed Canva-based digital worksheets, designed with a visual-interactive approach that integrates text, illustrations, and digital navigation features to enhance learning experiences and foster students' scientific literacy. The competency map is presented in the following section.

Figure 3. Linear motion: uniform motion and uniformly accelerated motion

Figure 3 presents the linear motion content in the developed Canva-based digital worksheets, designed using a visual-interactive approach that integrates textual explanations, illustrations, and graphical representations to enhance students' conceptual understanding of kinematics. The evaluation section is shown in Figure 4.

Figure 4. Scientific literacy evaluation

The validity of the product was evaluated by three expert panels (content, media, and language) using a 5-point Likert scale. The overall mean validation score was 93.8%, which falls into the "Very Valid" category according to the criteria established by Riduwan (2015), the threshold for the "Very Valid" category was established at ≥ 85%. A summary of the validation results from each expert is presented in Table 4.

The overall mean validation score of 93.8% exceeds the "Very Valid" threshold (85%) and surpasses comparable studies, which reported scores of 88.3% and 87.1%, respectively. This high validation score confirms that the iterative validation cycle of the ADDIE model is effective in ensuring product quality across all dimensions—content, media, and language—prior to field implementation.

Table 4. Validation results of Canva-based digital worksheets

Validation Aspect	Validator 1 (%)	Validator 2 (%)	Mean (%)	Category
Content Expert	89.3	98.7	94.0	Very Valid
Media Expert	90.0	97.1	93.6	Very Valid
Language Expert	92.5	95.0	93.8	Very Valid
Overall Mean			93.8	Very Valid

The implementation stage was conducted at SMA Negeri 6 Padangsidimpuan using a quasi-experimental design involving small and large groups. The practicality of the digital worksheets was evaluated from two perspectives: science teachers' responses and responses from students in the experimental group. Practicality from the teachers' perspective was measured using a 10-item questionnaire covering dimensions of ease of use, content relevance, student engagement, and support for scientific literacy. The results of the questionnaire are presented in Table 5.

Table 5. Teachers' responses to the Canva-based digital worksheets

Statement	Score	Percentage & Category
Ease of use and access to the digital worksheets	5	100% (Very Practical)
Alignment of content with learning objectives	5	100% (Very Practical)
Ability of the worksheets to enhance student engagement	5	100% (Very Practical)
Clarity of usage instructions	4	80% (Practical)
Attractive and professional visual design	5	100% (Very Practical)
Appropriateness of time allocation for worksheet activities	4	80% (Practical)
Ability of the worksheets to support students' scientific literacy	5	100% (Very Practical)
Ease of distribution to students	5	100% (Very Practical)
Availability of adequate teacher guidance	4	80% (Practical)
Support for students' independent learning	5	100% (Very Practical)
Total Practicality Score		94.0% (Very Practical)

The practicality from the teachers' perspective reached 94.0% (Very Practical). Teachers highly appreciated the ease of distributing the digital worksheets through Canva URL links, an advantage that is particularly relevant given the infrastructure limitations at SMA Negeri 6 Padangsidimpuan. The item measuring the ability of the worksheets to support

students' scientific literacy received a perfect score (100%), indicating that teachers perceived the product as effectively facilitating the development of students' scientific skills.

Three items that received a score of 4 (80%)—namely clarity of instructions, appropriateness of time allocation, and availability of teacher guidance—were identified as areas for improvement in the subsequent development cycle.

The initial practicality test was conducted with a small group consisting of 10 students. This stage aimed to identify readability, ease of use, and initial constraints in using the Canva-based digital worksheets. The data were collected through student response questionnaires administered after the use of the worksheets.

Table 6. Small-group practicality test results

Assessment Aspect	Mean Score	Percentage (%)	Category
Appearance and design of the worksheets	4.60	92	Very Practical
Ease of use	4.50	90	Very Practical
Clarity of instructions	4.30	86	Very Practical
Learning usefulness	4.70	94	Very Practical
Average	4.53	90.5	Very Practical

Following revisions based on the small-group trial results, the digital worksheets were implemented in a larger group of 20 students. This stage was intended to assess the product's practicality under more extensive classroom conditions.

Table 7. Large-group practicality test results

Assessment Aspect	Mean Score	Percentage (%)	Category
Appearance and design of the worksheets	4.75	95	Very Practical
Ease of use	4.70	94	Very Practical
Clarity of instructions	4.65	93	Very Practical
Learning usefulness	4.80	96	Very Practical
Average	4.73	94.5	Very Practical

As shown in Table 7, the average practicality score of the digital worksheets in the large-group trial was 94.5%, categorized as "Very Practical." This finding indicates an improvement compared to the small-group trial, suggesting that the revisions implemented effectively enhanced the quality of the product, especially regarding the clarity of instructions and usability.

The evaluation stage aimed to assess the effectiveness of the Canva-based digital worksheets in enhancing students' scientific literacy based on three key indicators of the PISA Framework: identifying scientific evidence from motion-related phenomena, including uniform motion, uniformly accelerated motion, and Newtonian mechanics; explaining scientific phenomena within the context of motion; and applying scientific evidence in real-world situations. Effectiveness was evaluated using the normalized gain (N-Gain) metric (Hake, 2016). During the evaluation stage, both small-scale and large-scale trials were conducted. The small-group trial functioned as a preliminary assessment to evaluate the effectiveness of the Canva-based digital worksheets in enhancing students' scientific literacy. Effectiveness was measured by comparing pre-test and post-test scores and analyzed using the normalized gain (N-Gain) to determine the extent of students' learning improvement. The findings from this stage provided initial evidence of product quality prior to broader implementation.

Table 8. Scientific literacy results (small group)

Description	Score
Mean Pre-test	46.0
Mean Post-test	83.9
Mean N-Gain	0.71
Category	High

Based on Table 8, the results indicate a significant improvement in students' mean scores, increasing from 46.0 to 83.9, with an N-Gain value of 0.71, which falls into the high category. This finding suggests that the Canva-based digital worksheets were effective in the initial stage, although further refinement was still required before implementation in a larger group.

Following revisions based on the small-group trial results, the Canva-based digital worksheets were subsequently implemented in a large group to evaluate their effectiveness under more representative learning conditions. The analysis was conducted using the same procedure, namely by comparing pre-test and post-test scores and calculating the N-Gain to assess the overall improvement in students' scientific literacy.

Table 9. Scientific literacy results (large group)

Description	Score
Mean Pre-test	46.9
Mean Post-test	86.6
Mean N-Gain	0.75
Category	High

Based on Table 9, a more optimal improvement was observed compared to the small-group trial, with the mean post-test score reaching 86.6 and an N-Gain value of 0.75, which falls into the high category. This finding indicates that the Canva-based digital worksheets became more effective after undergoing revisions and were able to enhance students' scientific literacy more consistently.

To obtain a more comprehensive understanding of the effectiveness of the digital worksheets, a comparison was conducted between the results of the small-group and large-group trials. This comparison aimed to examine the consistency of learning improvement and the stability of the product's effectiveness when implemented with a larger number of students.

Table 10. Comparison of small-group and large-group results

Aspect	Small Group	Large Group
Pre-test	46.0	46.9
Post-test	83.9	86.6
N-Gain	0.71	0.75
Category	High	High

As shown in Table 10, both groups exhibited significant improvements, with N-Gain values classified as high. Nevertheless, the large group demonstrated higher and more consistent results. This suggests that the Canva-based digital worksheets are not only effective during the initial trial phase but also sustain their effectiveness in broader instructional settings. These findings are in line with prior research by Melinah et al. (2026) and Sarawati et al. (2025) prior research has reported a 31.4% increase in learning outcomes using Canva-based worksheets, along with a 27.8% improvement in students' conceptual understanding (Keliat & Sabri, 2025). Furthermore, a meta-analysis has confirmed that digital learning media yield an average effect size of 0.33 on science learning outcomes. The N-Gain achieved in this study (0.74) surpasses those reported (Kasmawati et al., 2025a) surpasses those reported in ADDIE-based differentiated LKID, where the large-group N-Gain was 0.499.

The substantial improvement in students' scientific literacy across both small and large groups can be interpreted through multiple complementary theoretical perspectives and is supported by empirical evidence. The analysis revealed that the mean N-Gain increased from 0.71 in the small group to 0.75 in the large group, with both values categorized as high.

These results suggest that the Canva-based digital worksheets are not only effective in preliminary trials but also demonstrate sustained and even improved effectiveness when implemented at a larger scale.

The observed improvement can be attributed to the implementation of scaffolding principles in the worksheet design, allowing students to progress gradually in line with the Zone of Proximal Development theory by Lev Vygotsky. Scaffolding-based instruction has been empirically demonstrated to support the development of students' cognitive skills from lower-order to higher-order thinking (Nuriyah et al., 2025). In this study, the worksheet activities were systematically designed in a progressive sequence, allowing students to develop scientific literacy incrementally. This progression is evidenced by the improvement in pre-test and post-test scores and the consistency of the N-Gain results.

The effectiveness of the digital worksheets is further reinforced by the application of dual coding principles, achieved through the integration of visual and textual elements within the Canva platform. The use of diagrams, illustrations, and visual representations facilitates a more concrete understanding of physics concepts. This finding aligns with the Cognitive Theory of Multimedia Learning developed by Richard E. Mayer (Clark & Mayer, 2016), which posits that the integration of visual and verbal information enhances learners' understanding and retention. Recent research further indicates that multimedia-based instructional media significantly improve students' cognitive engagement and academic performance (Sung et al., 2016).

The improvement in scientific literacy indicates that the digital worksheets are capable of facilitating more structured and efficient learning. The systematic presentation of content, supported by step-by-step exercises and feedback, helps students develop a deeper understanding. This finding is consistent with previous research, which suggests that well-structured instructional design based on digital technology can enhance the quality of learning and improve students' learning outcomes (Tondeur et al., 2017). Moreover, the disparity in results between the small-group and large-group trials indicates that the effectiveness of the digital worksheets increased following iterative revisions and refinements. The higher mean post-test scores and N-Gain values in the large group demonstrate that the product achieved greater optimization after improvements were implemented. This is in line with research and development principles that underscore the importance of continuous revision in generating high-quality learning products (Pribadi, 2016).

Furthermore, these findings are supported by previous studies from Syafnan et al. (2022) which demonstrates a significant correlation between digital literacy and students' learning outcomes ($r = 0.495$; $p = 0.04$). This result underscores that the use of digital instructional media, such as Canva-based worksheets, not only enhances academic performance but also supports the continuous development of scientific literacy.

Conclusion

The objectives of this study were successfully achieved through the development and evaluation of Canva-based digital physics worksheets on motion concepts using the ADDIE development model. The

findings demonstrate that the developed product is valid, practical, and effective in improving students' scientific literacy. The expert validation results indicated that the digital worksheets achieved a validity score of 93.80%, which falls within the "Very Valid" category, confirming that the product is appropriate in terms of content, media design, and language. Furthermore, the practicality assessment showed highly positive responses from both teachers and students, with practicality scores of 94.00% from teachers, 90.50% from the limited field testing group, and 94.50% from the large field testing group. These findings indicate that the worksheets are easy to use, attractive, and supportive of classroom learning activities. The effectiveness results revealed significant improvements in students' scientific literacy. The limited field testing group achieved an N-Gain score of 0.71, while the large field testing group achieved an N-Gain score of 0.75, both categorized as high. These results indicate that the developed worksheets effectively address the low scientific literacy identified during the analysis phase. The improvement in students' scientific literacy was facilitated by the integration of interactive Canva features, contextual learning activities, scientific literacy tasks, and visual representations such as kinematic graphs that helped students understand abstract motion concepts more effectively. This study contributes to the development of digital learning innovations by integrating scientific literacy dimensions from the OECD PISA 2025 Science Framework into Canva-based physics worksheets. Therefore, the developed worksheets are recommended for broader implementation in physics learning and may serve as a reference for developing similar digital learning resources for other physics topics and science subjects.

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Author Contributions
The study was conducted by a research team with contributions in conceptualization, methodology, data analysis, manuscript preparation, and research administration. E.S.N. contributed to conceptualization, validation, supervision, and manuscript review and editing; R.S., S.U.K.M.S., K., and F.A.H. was responsible for the development of Canva-based digital worksheets, data collection and analysis, visualization, and also contributed to validation and manuscript editing. All authors have read and approved the final manuscript.

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The authors declare no conflict of interest.

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