Validity And Practicality of Newton's Law Interactive E-Worksheet With The Assistance of Liveworkshet

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Abstract *- The demand for independent learning, both at home and in school, highlights the importance of providing instructional materials in the form of interactive student worksheets (e-Worksheets) to support continuous scientific learning activities. This study aims to develop an interactive electronic worksheet (e-Worksheets) utilizing the Liveworksheets platform, specifically designed for high school students studying Newton's Laws, and to evaluate its validity and practicality. The research employed the Alessi and Trollip development model, which consists of three phases: planning, design, and development. Content validity was assessed through expert judgment using Aiken's V, while practicality was measured using student response questionnaires. The research subjects were students from Class XF at Senior High School 1 Muara Padang. Data analysis results indicated that the developed interactive e-Worksheets is both valid and practical, with a validity score of 95.3% and a practicality score of 83.8%. These results categorize the e-Worksheets as highly valid and highly practical, making it suitable for classroom implementation. However, this study only addresses the validity and practicality aspects and does not assess the effect of the e-Worksheets on students' learning outcomes.*

Keywords*: e-worksheet; Interactive; Newton's Law; Validity; Practicality*

INTRODUCTION

The use of Liveworksheets in the development of interactive e-worksheets offers numerous advantages that significantly contribute to improving educational practices. One of the most notable benefits is the enhancement of student engagement and motivation. Studies have shown that the interactive features embedded in Liveworksheets—such as diverse question formats and multimedia integration—effectively capture students' attention and increase their enthusiasm for learning. Compared to conventional worksheets, students demonstrate greater focus, satisfaction, and a stronger willingness to participate in the learning process when using Liveworksheets (Salam et al., 2023; Azzahra & Kowiyah, 2022; Sumanik et al., 2023).

Furthermore, Liveworksheets empower educators to design personalized and interactive learning experiences. The platform accommodates a variety of worksheet formats, enabling teachers to create dynamic assignments that appeal to different learning preferences. For example, tools that support listening and speaking exercises enhance interactivity and promote collaborative learning environments (Meilina & Andriani, 2023; Yusuf & Ali, 2022; Fauzi et al., 2021). Additionally, the option to download worksheets in PDF format ensures offline accessibility, increasing their utility across diverse instructional contexts (Meilina & Andriani, 2023; Fauzi et al., 2021).

Another significant advantage of using Liveworksheets is its capacity to enhance students' critical thinking skills. Research has demonstrated that interactive worksheets, especially when embedded within inquiry-based learning frameworks, encourage deeper cognitive engagement and foster the development of students' problem-solving abilities (Sa'adah et al., 2023;

Widianti et al., 2024; Febryanti & Rusmini, 2022). The platform's flexibility allows students to interact with complex concepts more meaningfully, facilitating the cultivation of analytical thinking skills through active construction and resolution of problems (Susilawati et al., 2023; Febryanti & Rusmini, 2022).

In addition to cognitive development, Liveworksheets have been shown to improve academic performance across a range of subject areas. Numerous studies report notable gains in students' comprehension and achievement levels when interactive worksheets are used in place of traditional methods. The active learning environment promoted by Liveworksheets leads to increased retention and deeper understanding, particularly in subjects such as mathematics and science (Faaiqoh & Ratnaningrum, 2024; Ghaisani & Setyasto, 2023; Nirmayani, 2022). Moreover, the platform's ability to integrate multimedia components—including video and audio—further enhances learning by supporting both auditory and visual learning styles (Nirmayani, 2022).

In summary, the integration of Liveworksheets into the development of e-worksheets fosters a dynamic and interactive learning environment. This approach is marked by increased student engagement, personalized learning experiences, enhanced critical thinking skills, and improved academic performance. These benefits position Liveworksheets as a valuable instructional tool for modern educators aiming to deliver effective and enriching education in an increasingly digital landscape.

Appropriate and well-designed student worksheets have a significant impact on student achievement (Yaden, 2017). However, in the context of ongoing educational challenges following the COVID-19 pandemic, there is a growing need to develop more efficient and accessible learning tools. One promising solution is the transition from traditional paper-based worksheets to electronic worksheets (e-worksheets), which offer greater flexibility and adaptability to diverse learning environments (Ladamay et al., 2021).

Based on interviews with a physics teacher at Public Senior High School 1 Muara Padang, it was revealed that students face considerable challenges in understanding physics, particularly in applying Newton's laws to real-world problems. These difficulties are especially evident when students are required to analyze and develop conceptual applications of Newton's laws in various contexts (Ekici, 2016). To address these challenges, the teacher has been using student worksheets to support learning (Erinosho, 2013). However, he emphasized the need to transition to interactive e-worksheets, aligning with the demands of 21st-century learning and the curriculum currently implemented at the school.

Interactive e-worksheets offer a more structured and engaging learning experience, making it easier for students to grasp and apply complex physics concepts (Djamas & Tinedi, 2021). To facilitate the development of such materials, a platform with robust interactive capabilities is required—Liveworksheets being one such platform that supports rich multimedia features and user accessibility (Sanu, 2021). Through the use of Liveworksheets, interactive e-worksheets can be accessed online via mobile devices, enabling flexible and independent learning. This approach is expected to enhance students' cognitive achievement and motivation (Sung et al., 2010), while also serving as a responsive solution for remote

or blended learning scenarios (Pee et al., 2002).

Moreover, interactive e-worksheets specifically designed for Newton's Laws aim to help students better understand the abstract and often challenging physics content (Ryabchikova et al., 2020). Previous research by Andriyani (2020) also supports the effectiveness of worksheets in increasing student participation, self-confidence, and curiosity through active engagement with learning tasks.

In light of these considerations, this study aims to develop interactive e-worksheets using the Liveworksheets platform for Newton's Laws material targeted at high school students.

RESEARCH METHODS

Interactive e-worksheets based on Newton's laws were developed using a research and development approach. The development model employed was the Alessi and Trollip model, which consists of three main stages: planning, design, and development (Por, Fei Ping et al., 2012). During the planning stage, an interview was conducted with a physics teacher at Public Senior High School 1 Muara Padang to identify issues in physics instruction and the current use of student worksheets. The physics syllabus was then analyzed to assess the alignment between the taught content, learning objectives, and expected learning outcomes. Additionally, the existing teaching materials were reviewed to ensure that the designed e-worksheets would effectively address students' learning needs and adhere to the characteristics of high-quality educational research (Lord et al., 2023). A literature review on e-worksheets as instructional materials was also conducted to inform the research design and ensure relevance to current educational practices.

The design stage involved outlining and detailing the features of the e-worksheet product to be developed, including the selection of media, format, and content structure (Evans & Cleghorn, 2022). The e-worksheet format includes a cover page, title page, table of contents, list of figures, list of tables, PhET simulations, and three interactive learning activities (Activity 1, Activity 2, and Activity 3), followed by a closing section and bibliography.

In the development stage, the researcher conducted validation, practicality testing, and effectiveness evaluation to ensure that the developed product and associated instruments functioned as intended. This stage comprised:

1. **Expert validation**, covering pedagogical content and media design;
2. **Practicality testing**, through limited trials and the administration of a student response questionnaire to assess usability;
3. **Effectiveness testing**, to evaluate the impact of the e-worksheet on learning outcomes.

The instruments used in this study included:

1. **Interviews**, conducted with physics teachers at Public Senior High School 1 Muara Padang to identify instructional challenges, particularly in teaching Newton's Laws, and to inform the design of the e-worksheet;
2. **Validity tests**, aimed at evaluating the developed product across material content, media quality, language clarity, and visual design;
3. **Questionnaires**, used to assess the practicality of the e-worksheet from the students' perspective (Taherdoost, 2016).

Data from the expert validation stage were collected using a Likert-scale

instrument and analyzed quantitatively. The results of the validation were calculated using the following equation:

$$P = \frac{\sum \text{score item}}{\sum \text{max score}} x100\% \ (1)$$

(Safitri, 2020)

The following are the validation value categories in the expert review stage, shown at Table 1.

Table 1. Validity Levels

(%) Validity	Category
0 – 25	Invalid
26 – 50	Fairly Valid
51 – 75	Valid
76 – 100	Very Valid

(Safitri, 2020)

Next, practicality test data obtained from the student response questionnaire (small group) in the form of a Likert scale were analyzed quantitatively. The practicality test data were calculated using the following equation:

$$P = \frac{\sum \text{sekorperitem}}{\sum \text{sekormaks}} x100\% \ (2)$$

(Safitri, 2020)

The following are the validation value categories in the expert review stage.

Table 2. Levels of Practicality

(%)Practicality	Category
0 – 25	Impractical
26 – 50	Quite Practical
51 – 75	Practical
76 – 100	Very Practical

(Safitri, 2020)

Furthermore, practicality test data (in larger groups) were obtained from student response questionnaires in the form of a Likert scale and analyzed descriptively. Practicality test data were calculated using the following equation:

$$P = \frac{\sum \text{sekorperitem}}{\sum \text{sekormaks}} x100\% \ (3)$$

The following are the effectiveness value categories in the expert review stage.

Table 3. Levels of Effectiveness

(%) Effectiveness	Category
100 – 51	Effective
50 – 0	Ineffective

(Ardiansah, 2022)

RESULTS AND DISCUSSION

Results

1. Results of the Planning Stage

The planning stage began with interviews conducted with physics teachers at the target school, Public Senior High School 1 Muara Padang. The interview results revealed that the instructional media used during physics lessons lacked variety. Although the school provides textbooks to support learning, the instructional approach remains predominantly traditional, involving question-and-answer sessions, group discussions, and textbook-based explanations. The school is equipped with adequate facilities and infrastructure, including laboratory equipment and digital media tools; however, these resources are rarely utilized in classroom activities. Furthermore, students rely on a single textbook, which is insufficient to meet diverse learning needs. Teachers noted that Newton's laws, particularly their applications in real-world physics problems, pose significant challenges for students. Limited instructional time and the infrequent use of engaging, interactive media were also identified as contributing factors to students' difficulties in understanding the material.

An analysis of the physics syllabus for Grade X revealed that the Newton's Laws topic includes clearly stated learning outcomes and instructional objectives. The purpose of this syllabus analysis was to identify the scope and sequence of the learning material, as well as to evaluate the alignment between the content delivered by

teachers and the expected learning outcomes.

In addition, an evaluation was conducted on the physics textbook used by Grade X students at Public Senior High School 1 Muara Padang. The textbook follows the independent (Merdeka) curriculum, which emphasizes student-centered learning, where teachers function primarily as facilitators. However, this approach has not been effectively implemented due to the limited availability of teaching materials. The school library lacks a sufficient number of textbooks, resulting in a situation where two students must share one book. This limited access makes it difficult for students to study independently or review materials at home.

Given these constraints, an alternative solution is the development of interactive e-worksheets, which can provide accessible, engaging, and cost-effective support for students—particularly in mastering Newton's Laws in Grade X physics.

A review of the literature on the use of e-worksheets highlights their role as one of the key learning resources employed by teachers acting as facilitators and guides in the learning process. Student worksheets function as complementary tools alongside textbooks, supporting the delivery of instructional content during classroom activities. The integration of e-worksheets is expected to enhance students' ability to learn both independently and collaboratively in group settings. The structure of the developed e-worksheets aligns with content standards and includes a foreword, clearly defined learning outcomes and objectives, a table of contents, a list of figures and tables, as well as instructional material covering Newton's First, Second, and Third Laws. In addition, the e-worksheets incorporate interactive elements such as physics simulations, instructional videos, conceptual questions, and practice problems. Each question is accompanied by appropriate logical reasoning to guide students toward correct understanding and solutions.

2. Design Phase Results

Interactive physics-based e-worksheets were developed by referring to learning materials about Newton's laws. The following describes the characteristics of the developed interactive physics-based e-worksheets.

a. E-worksheets was developed in accordance with the independent curriculum analysis, and is interactive based which contains learning outcomes and learning objectives
b. This e-worksheets was developed after analyzing needs in schools
c. This interactive physics-based e-worksheet is prepared for Newton's Law material and packaged so that it can be accessed online via the internet.
d. The e-worksheets were developed according to the following components: e-worksheet title/cover, foreword, table of contents, list of figures, list of tables, content standards (learning outcomes and learning objectives), material explanation, phet simulation, activity 1, activity 2, activity 3, and bibliography.

4. Development Stage Results

a. Validity Stage

The developed e-worksheets were validated by a team consisting of two physics lecturers from Sriwijaya University and one physics teacher from Public Senior High School 1 Muara Padang. According to Ardiansyah (2022), the validation of e-worksheets is carried out in two stages: material validation and media validation.

The first stage, material and pedagogical validation, includes four key indicators: (1) content appropriateness, (2)

linguistic quality, (3) presentation structure, and (4) pedagogical aspects. The second stage, media validation, involves three aspects: (1) graphic design, (2) linguistic clarity, and (3) presentation layout.

The results of the validation process for the interactive, physics-based e-worksheets—specifically for the material and pedagogical components—are presented in Figure 1.

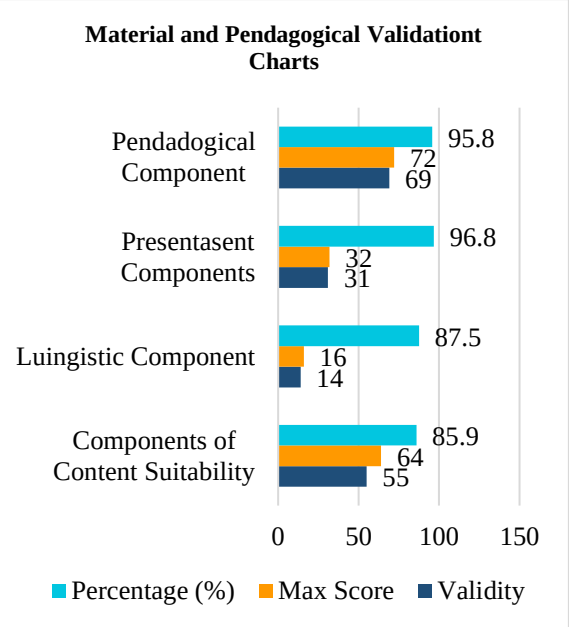

Figure 1. Data from Interactive Based Validation of E-worksheets Material

Based on Figure 1, the results of the material and pedagogical validation questionnaire for interactive-based e-worksheets are classified as very valid or suitable for use, with a percentage of 91.8% of which e-worksheets can be used with revisions/improvements. The results of the interactive physics-based e-worksheet validation data on design and media validation are shown in Figure 2.

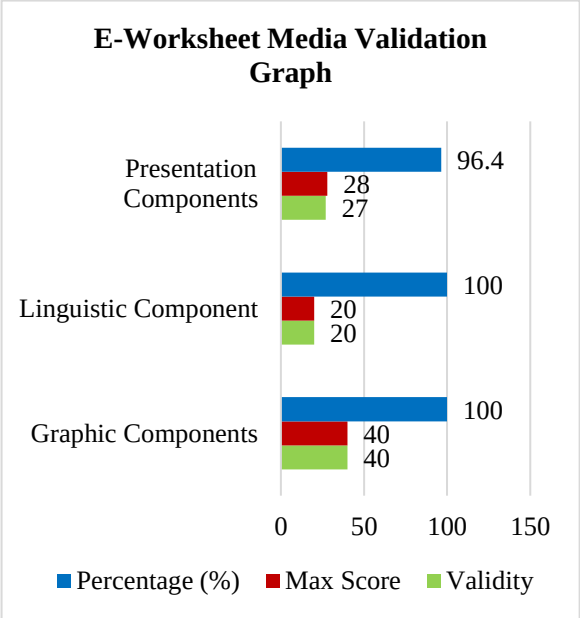

Figure 2. Data from Interactive Based E-worksheets Media Validation Results

Based on Figure 2, the results of the media validation questionnaire for interactive-based e-worksheets were classified as very valid or suitable for use with a percentage of 98.8%, where e-worksheets can be used with slight revisions/improvements.

b. Practicality Stage (Small Group)

To determine the practicality of the e-worksheets being developed, the student response questionnaire can be used. According to Arifin (2012:333) the meaning of practicality is the ease of a test, both in preparing, using, processing, and interpreting or administering data. Several suggestions for improvement were given from validators regarding the practicality of the e-worksheets being developed, namely: The list of images should be made more complete and for writing Newton's laws, it would be better to write Newton's First Law, Newton's Second Law, and Newton's Third Law, instead of writing Newton's 1st Law, Newton's 2nd Law and Newton's 3rd Law.

According to Paramita (2016), there are four aspects in the practicality statement

of student worksheets: materials, presentations, opportunities for implementing teaching materials, and implementation. So after that the researcher obtained the results from the student response questionnaire and can be seen in Figure 3.

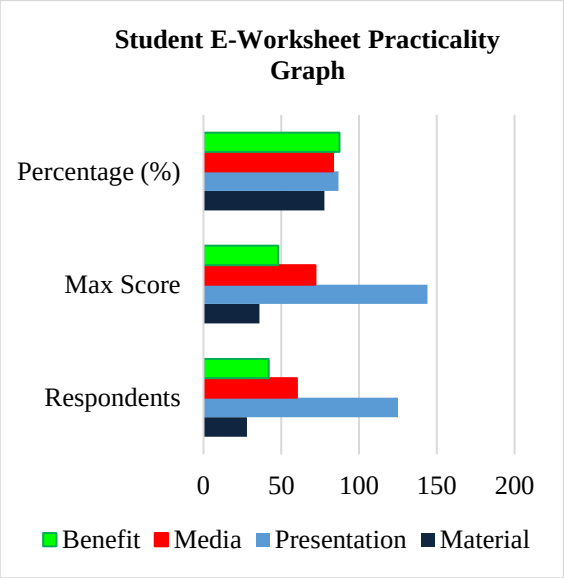

Figure 3. Data from student responses to interactive-based E-LKPD practicals (in small groups)

Based on Figure 3, the results of the student response questionnaire regarding the practicality of interactive-based e-worksheets (in small groups) were classified as very practical, with a percentage of 85.0%, where e-worksheets can be used with slight revisions/improvements.

c. Practicality Stage (large group)

In this stage, the researcher distributed the e-worksheet practicality response questionnaire that the researcher designed to a larger group of students than before, namely in class X at Public Senior High School 1 Muara Padang. This data collection was carried out to determine whether there were differences in the results of the practicality of e-worksheets if it was carried out on a larger group. The results of the student response questionnaire regarding the practicality of e-worksheets in larger groups are shown in Figure 4.

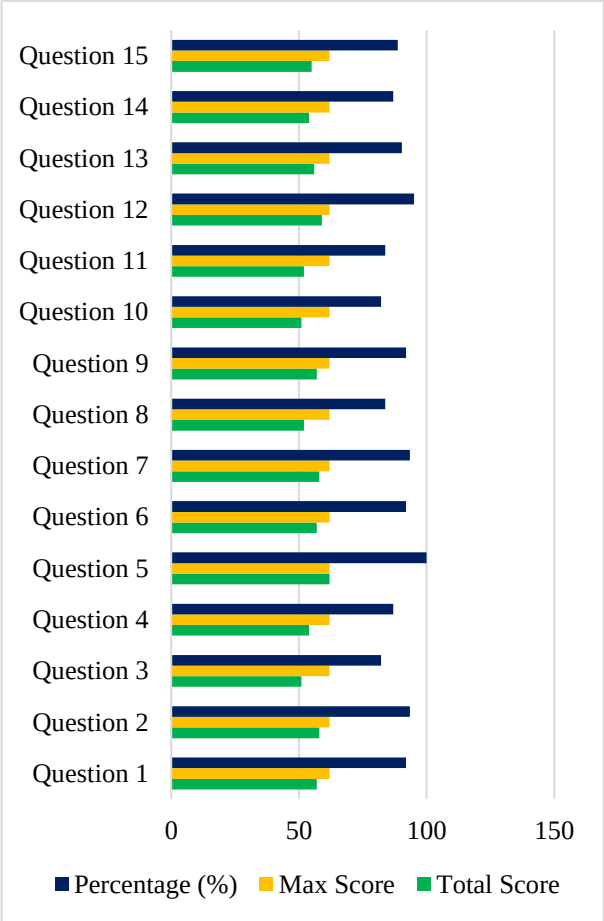

Figure 4. Data from Student Response Results on the Practicality of Interactive-Based E-worksheets (In Large Groups)

Figure 4 shows that the results of the student response questionnaire regarding the practicality of interactive-based e-worksheets (in large groups) are classified as very practical, with a percentage of 82.7% where e-worksheets can be used with slight revisions/improvements.

Discussion

At the planning stage, the researchers conducted interviews with physics teachers at the target schools. The results of observations and interviews with the physics teacher at SMAN 1 Muara Padang school show that physics learning has used student worksheets as a learning resource. This

student worksheet was made directly by the teacher; therefore, there is some material that still does not use student worksheets, especially Newton's law material. The development of e-worksheets is in line with students' desires to have interesting and innovative learning resources, which can be accessed anywhere and anytime. With interactive e-worksheets, it is easier for students to study at home independently or in groups. Furthermore, it is hoped that this interactive e-worksheet will help teachers and students implement learning and can strengthen students' knowledge of physics materials, especially Newton's laws.

At the design stage, the material presented in this interactive e-worksheet refers to the independent curriculum for class X in high school and also refers to the components or elements of the e-worksheets. This interactive physics-based e-worksheet was designed using Microsoft Word 2019, with the first step being to determine the identity of the e-worksheets being developed, such as lesson material, learning outcomes, learning objectives, and title. The next step was to collect materials for the phet simulation, learning videos, questions, and questions made in Times New Roman font size 11-14. Each learning material is equipped with physical phenomena that are appropriate to the material and material that is in accordance with Newton's First Law, Newton's Second Law, and Newton's Third Law. Simple experiments were conducted according to the material packaged with the help of audio media and by conducting experiments directly in the physical simulation. The final step was to package the physics e-worksheets that were developed into a live worksheet. At this stage, product assessment instruments, such as validation instruments, were also created.

At this development stage, the focus is on three results, which include the results of the validation and revision of the e-worksheets and the results of the practicality of the e-worksheets. The validation results showed that the interactive-based e-worksheets designed by the researchers were valid, with improvements suggested by the validator. Some suggestions and inputs from two validators are as follows:

- Validators 1:
  - Writing titles does not need to be electronic
  - Fix less visible writing
  - In the definition of style, a guide to pictures A and B is given
  - The writing of laws 1, 2 and 3 was changed to Roman
  - Add alloys to the simulation

- Validators 2:
  - The questions in the questions are still very easy, try looking for deeper questions

Results of interactive-based physics e-worksheet validation. To answer the question in the problem formulation, "What is the validity of interactive e-worksheets using live worksheet on Newton's law material?" This can be answered based on a validation questionnaire administered to two material experts and one media expert. The validation results were completed by physicists; in this case, two physics lecturers at Sriwijaya University and one senior physics teacher at SMAN 1 Muara Padang show that the e-worksheets developed are valid and ready to be tested for practicality with students. The results of material and pedagogical validation showed a percentage of 91.8% with a very valid category, and for media validation, 98.8% was obtained with a very valid percentage. The developed interactive physics-based e-worksheets are

easy to use, have material content that is appropriate for the expected learning objectives, and have an attractive appearance and design.

Results of practicalizing interactive physics-based e-worksheets. To answer the question in the problem formulation, "What is the practicality of interactive e-worksheets using live worksheets on Newton's law material?" This question can be answered using a student response questionnaire. The results of the questionnaire filled out by physics students show that the e-worksheets developed are practical for learning physics on Newton's laws. The interactive physics-based e-worksheets that were developed are easy to use, have material content that is appropriate to the expected learning objectives, and have an attractive appearance and design. Based on an analysis of students' responses to the practicality of interactive physics-based e-worksheets (small group) with Newton's law material, they obtained a percentage of 85.0% in the very practical category. Furthermore, based on the questionnaire, students' responses to the practicality of e-worksheets (in larger groups) can be seen after conducting a limited trial with 31 class XF students at Public Senior High School 1 Muara Padang. Based on the analysis of students' responses to the practicality of interactive physics-based e-worksheets with Newton's Law material, the percentage was 82.7% in the category of very practical to use. According to a survey by Sania, Syuhendri, and Akhsan (2021), an average score of 81.39% was obtained, which is classified as practical teaching material. The results of this research are in line with research by Safitri (2020) that in the e-worksheets practicality stage survey, the average was 84.92% in the very practical category.

CONCLUSION

The validity and practicality of the interactive e-worksheet on Newton's Laws, developed using the Liveworksheets platform, were assessed through research conducted at Public Senior High School 1 Muara Padang. Validity data were obtained through expert validation involving two physics lecturers from Sriwijaya University and one senior physics teacher from the same high school. Practicality data were collected through limited trials involving students, using a questionnaire to assess their responses regarding the usability and functionality of the e-worksheets.

Based on expert evaluations and student feedback from the limited trial, the interactive e-worksheet developed in this study was categorized as both valid and practical for classroom use. However, this development is currently limited to Newton's Laws material and has not yet undergone comprehensive product effectiveness testing.

Therefore, future research is recommended to include product trials to evaluate the effectiveness of the e-worksheet in improving learning outcomes. In addition, the current research can serve as a reference for the development of interactive e-worksheets for other physics topics or subject areas.

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