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Exploration of Technology-assisted Summative Assessment Instruments in Differentiation Learning

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Abstract: This research aims to determine the feasibility, produce a design, and assess the practicality of using IT-based summative assessment in differentiated physics learning. The developed product consists of an IT-based summative assessment in Quizizz for questions and Google Forms for assessment rubrics (poster and video). The research adopts the ADDIE model. The valid user practicality response sheet has an average of 0.93 and a reliability coefficient of 80%. The student practicality response questionnaire results indicate an average of 88.06% with a convenient category. The summative assessment in the form of test items yields an average of 77.77, with 45% of students achieving this score. The summative assessment in the form of a poster yields an average of 82.86, with 35% of students achieving this score. In contrast, the innovative video summative assessment results in an average of 88.75, with 20% of students achieving this score.

Keywords: Differentiated learning; Information and technology; Summative assessment

Introduction

Education is crucial for human beings to develop their potential and quality for advancing science and technology. As science and technology progress, education becomes essential for humans to embrace these developments. The role of education is to foster and develop the existing potential within human resources through teaching and learning activities. Through education, individuals can cultivate innovative and creative attitudes and behaviours and bring about positive changes in knowledge, behaviour, and skills, realising high-quality human resources. Education is a conscious and planned effort to create a pleasant learning atmosphere and compelling learning experiences. It enables learners to develop their potential to possess spiritual strength, self-control, personality, intelligence, noble character, and the necessary skills for themselves and society. Education encompasses teaching specific expertise and something more profound which cannot be seen, such as imparting knowledge, consideration, and wisdom (Pristiwanti et al., 2022). The importance of this research is done because to improve the learning process and to obtain feedback. Feedback is an important element in the assessment.

Carol Ann Tomlinson and Moon stated that differentiated learning is not a new concept in education. Differentiated learning is an approach that accommodates, serves, and recognizes the diversity of students in their learning based on their readiness, interests, and learning preferences (M. Marlina, 2020). Marlina (2019) mentioned that differentiated learning involves adjustments to students' interests, learning preferences, and readiness to achieve improved learning outcomes. Additionally, teachers should utilize students' preferences regarding how they demonstrate their learning preferences (related to the content, process, product, and learning environment). Thus, when teachers continuously learn about the diverse potentials of their students, professional, efficient, and effective learning can be realized. Herwina (2021) stated that all students' learning needs are accommodated according to their interests or learning profiles through

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differentiated learning activities. Teachers should recognize that students have diverse and distinct learning needs in a classroom that implements differentiated learning.

Principles of differentiated learning include attending to students' needs, adapting instructional materials and methods, providing choices, offering feedback, and developing metacognitive skills. By following these principles, teachers can help students learn effectively and meet their needs and preferences. Once teachers have assessed students' outcomes, they can assist in their learning process. Differentiation involves assessment outcomes of three components: readiness, interests, and learning preferences. According to Marlina (2019), when teachers and students collaborate to understand students' readiness, learning preferences, and interests, students also gain a better understanding of themselves. Teachers should recognize that students have diverse and distinct learning needs in classrooms that implement differentiated learning. This is supported by research conducted by Nurnaifah et al (2022), which found a positive and significant influence of visual learning style on physics learning outcomes.

Assessment in learning is a process conducted by teachers to enable students to understand their achievements and progress in learning to determine learning targets. Providing information to students regarding the extent of their achievements and progress in learning is done through feedback. Implementing assessments can serve as a reference for teachers to improve the applied learning process. Summative assessment is conducted at the end of a learning period or instruction to measure students' learning outcomes. This assessment holds high importance for the assessed students, the educators, and the overall education program. The summative assessment results can be used for various purposes, such as assessing teaching effectiveness, improving course quality, and evaluating educational programs. Summative assessments often have significant consequences, such as determining students' final grades or making important decisions in an educational context (Kibble, 2017).

Student-centred education emphasizes how students learn and the influence of the learning process on their development, particularly in the context of physics education (Azis, 2018; Suwartiningsih, 2021). Physics learning involves the active participation of students, both physically and mentally, and focuses on students based on their everyday experiences. Physics emphasizes direct skills in seeking and acting to scientifically explore and understand the natural world. Students have meaningful learning experiences during the learning process, allowing them to develop physics learning values (L. Marlina et al., 2022). Riswanto (2018), states that physics is a science that discusses various forms of natural phenomena using mathematical language. All natural events are always related to physics concepts, so practical and effective teaching aids or learning media are needed to facilitate students' understanding of physics concepts. In achieving high-quality learning assessments, technology plays an important role. With the rapid development of technology, the internet has become familiar to us. Internet technology can be modified to enhance students' interest (Ananda et al., 2023).

This is supported by research findings (Bahri et al. (2022), stating that the use of web-based e-modules has a positive impact on improving learning motivation. The progress of information technology is inevitable in our lives because technological advancements go hand in hand with the development of scientific knowledge. The obtained data, with an average percentage of 86.13%, indicates that learning media is highly suitable for teaching and learning (Kusumastuti et al., 2022). This condition aligns with observations that summative assessment is developed to determine students' progress and learning outcomes, providing feedback to students to improve and refine the learning program. Summative assessments are developed in IT-based formats for practicality.

One of the factors for success in learning is the role of instructional media as a medium for delivering learning content and information to learners. This is closely related to the role of an educator. To overcome misperceptions in communication, a tool called media is needed in the learning process (Rompegading et al., 2022). According to Nisa et al. (2021), Quizizz is a game-based educational application that can be used as a medium for educational evaluation. Classroom learning activities can become boring for students if teaching and evaluation are conducted solely through lectures and reading texts. Educators can enhance learning by using Quizizz as a varied evaluation medium to make it more engaging for students. Nur'amanah et al. (2020) stated that Quizizz is a web tool for creating interactive quiz games for classroom learning, such as formative assessments. It is user-friendly, allowing interactive quizzes with up to 4 answer choices, including the correct answer.

One easily accessible, user-friendly, and highly adaptable web tool for educators and students in the learning process is Google Forms (Parinata et al., 2021). Google Forms is well-suited for collecting opinions from geographically dispersed individuals, managing event or school registrations online, gathering data, creating impromptu quizzes, simplifying questionnaires, and more (Bulan et al., 2020). According to Mulatsih (2020),

Google Forms or Google Formulir is useful for event planning, conducting surveys, administering quizzes to students or others, or efficiently collecting information. Nashrullah (2021) states that Google Forms is a practical and efficient platform for office use and learning, particularly in the evaluation process. The use of Google Forms in education has the impact of streamlining student task management. Additionally, it can be utilized to create worksheets (LKS) according to the preferences and needs of teachers (Iqbal et al., 2018). Google Forms is one such software that is easily accessible, free to use, simple to operate, and can be effectively developed to evaluate student satisfaction with services. All individual responses and answers are automatically collected, organized, analyzed, and securely stored by the Google Forms application (Sianipar, 2019).

Information literacy skills and the learning outcomes students achieve will result in their knowledge and understanding, which will drive them to achieve different learning outcomes (Setyoko et al., 2023). Information Technology (IT) has become an alternative assessment medium because it assists us in creating, modifying, storing, communicating, or delivering information. IT encompasses all integrated methods or tools used to capture, process, transmit, or present data electronically in various valuable formats for users. This technology utilizes a set of computers to process data, network systems to connect computers according to needs, and telecommunications technology to distribute and globally access data. The efficiency and critical points of IT in education are undoubtedly unquestionable. So in that case the holding of an assessment can be a teacher's reference in improving the learning process that is applied. To realize a learning assessment that has good quality, not far from the role of technology.

Method

This research adopts the ADDIE (Analyze, Design, Development, Implementation, and Evaluation) development model because ADDIE consists of five components. One of the functions of ADDIE is to serve as a guideline in building effective, dynamic, and supportive training program devices and infrastructure that enhance the performance of the training itself. It comprises five steps: analysis, related to the analysis of work situations and the environment so that what products need to be developed can be found, design, is a product design activity in accordance with the needs. The product designs made are tests in the form of questions and an assessment rubric in the form of posters and videos.

Development, is the activity of making and testing products. After completing the product creation (questions, poster assessment rubric, and video assessment rubric), then a validation test was carried out by experts (2 lecturers and 1 teacher). After the product is declared, the next step is to conduct a product trial in the field, implementation, is an activity using the product. The product is distributed to students to be used as a learning assessment, and evaluation, is an activity to assess whether each step of the activity and product that has been made is in accordance with the specifications or not. At this stage there is a criticism and suggestions from product users, so that the product that has been developed can be improved.

The research and development process utilized a data collection instrument in the form of test items. Test items are tools or procedures used to measure and assess learners. Conversely, the questionnaire is a set of written questions or statements used to gather information from respondents. In this context, the questionnaire refers to a validation questionnaire used to assess the suitability of the developed product. The questionnaire consists of an expert validation sheet and user response. The expert validation questionnaire is used to assess the developed product's suitability in terms of test items, content, and media. Meanwhile, the user response questionnaire contains several statements requested to be evaluated by the users.

The data analysis technique used in this research is a technique that is relevant to the research objectives, enabling the analysis of data related to the design, feasibility, and practicality of user responses. This allows the researcher to understand the data and draw conclusions easily. The calculation of percentages for each sub-variable can be performed using the following formula:

$$Percentage = \frac{\Sigma \text{ the score given by the validator}}{\Sigma \text{ maximum score}} x100 \quad (1)$$

Result and Discussion

This research has produced an IT-based summative assessment in differentiated learning on the topic of business and energy.

Creating A Summative Assessment in the Form of Questions Using the Quizizz Application

Creating an IT-based summative assessment in differentiated learning on business and energy involves using the Quizizz application for the questions and Google Forms for the grading rubric. The summative assessment can be accessed by opening the Quizizz website (quizizz.com), logging in using your email (continue with Google), and then typing the quiz file

name "USAHA DAN ENERGI FASE F" in the search bar of Quizizz.

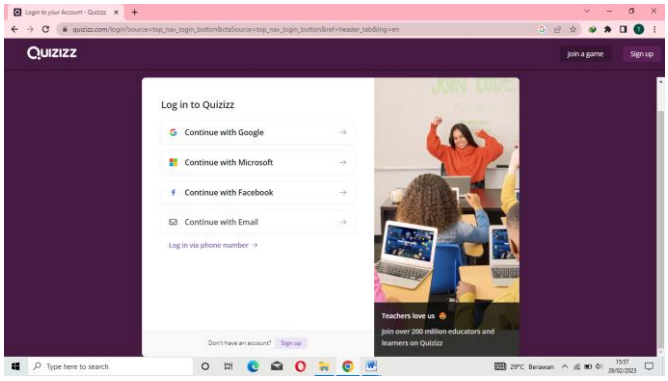

Figure 1. Initial display of the quizizz application

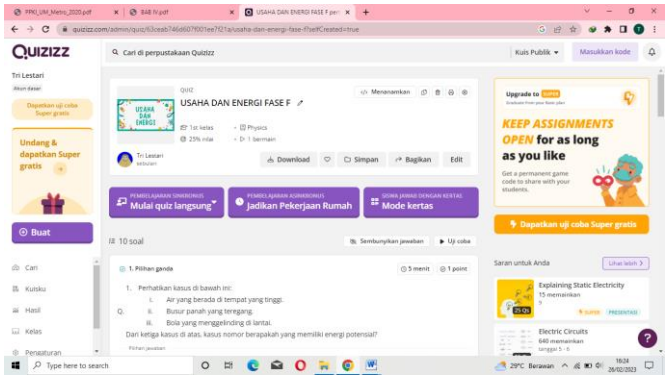

Figure 2. The completed Quizizz editor interface

Creating A Summative Assessment in the Form of an Assessment Rubric for Posters and Videos Using Google Forms

Table 1. Scoring Rubric

Types of Summative Assessment	Summative Assessment Barcode
Poster Scoring Rubric	https://bit.ly/3VymDLE
Video Scoring Rubric	https://bit.ly/3I8P5AW

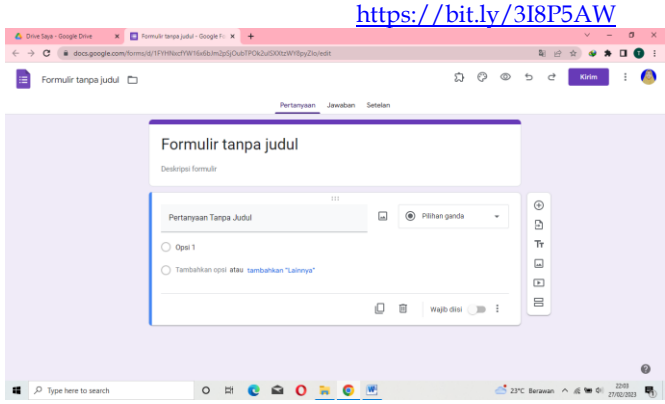

Figure 3. The appearance of google forms for creating scoring rubrics for posters and videos

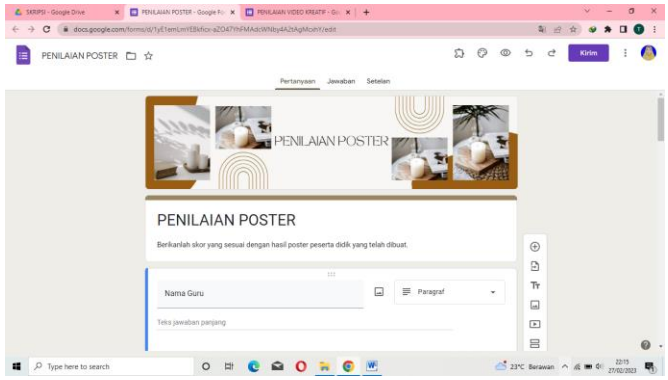

Figure 4. The completed appearance of the poster scoring rubric

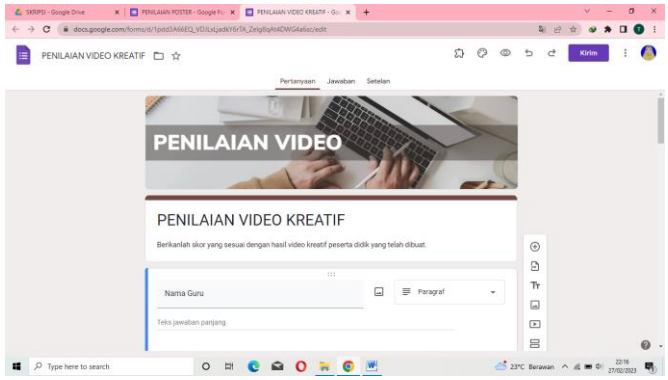

Figure 5. The completed appearance of the video assessment rubric

Feasibility Testing of It-Based Summative Assessment

The validation process occurs after developing the IT-based summative assessment in differentiated learning. The validators of the summative assessment consist of two Physics Education lecturers from the Muhammadiyah University of Metro and one teacher from SMA Kristen 1 Metro.

Analysis of Item Quality

Based on Table 2, the questions are deemed to be highly valid, and the reliability is indicating a very high category.

Table 2. Validity and Reliability Testing of Items

Validity Test		Reliability Test	
Validity	Explanation	V1	V2
0.92	Highly Valid	5	5
0.92	Highly Valid	5	5
0.92	Highly Valid	5	5
1.00	Highly Valid	5	5
0.92	Highly Valid	5	5
1.00	Highly Valid	5	5
0.92	Highly Valid	5	5
1.00	Highly Valid	5	5
0.92	Highly Valid	5	5
0.92	Highly Valid	4	5

Table 3. Item Difficulty and Differential Item Functioning Testing

Difficulty Level Testing		Differential Item Analysis	
Difficulty Level	Explanation	Differential	Explanation
0.35	Normal	0.5	Excellent
0.45	Normal	0.5	Excellent
0.4	Normal	0.4	Quite good
0.4	Normal	0.4	Quite good
0.45	Normal	0.5	Excellent
0.35	Normal	0.5	Excellent
0.4	Normal	0.8	Excellent
0.4	Normal	0.4	Quite good
0.35	Normal	0.5	Excellent
0.3	Normal	0.4	Quite good

Based on the data in Table 3, the difficulty level falls into the moderate category out of the ten tested items, with a coefficient range of 0.31-0.07. The 10 test items showed varying levels of discrimination, ranging from good to very good. Therefore, it can be concluded that the test items are deemed usable.

Analysis of Poster Assessment Rubric Quality

Based on the data in Table 4, the tested aspects of assessment, out of a total of 5, can be deemed highly valid. The reliability is indicating a very high category.

Table 4. Validity and Reliability Testing of Poster Assessment Rubric

Validity Test		Reliability Test	
Validity	Explanation	V1	V2
0.92	Highly Valid	4	5
0.92	Highly Valid	5	5
0.92	Highly Valid	5	5
0.92	Highly Valid	5	5
1.00	Highly Valid	5	5

Based on the data in Table 5, the tested aspects of assessment, out of a total of 5, showed varying levels of discrimination, ranging from good to very good. Therefore, it can be concluded that the poster assessment rubric is deemed usable.

Table 5. Test of Different Power of Poster Assessment Rubric

Differential	Information
0.4	Quite good
1.6	Excellent
0.4	Quite good
1	Excellent
1.6	Excellent

Quality Analysis of Video Grading Rubric

Based on the data in Table 6, the tested aspects of assessment, out of a total of 5, can be deemed highly valid. The reliability is indicating a very high category.

Table 6. Test the Validity and Reliability Test of the Video Assessment Rubric

Validity test		Reliability Test	
Validity	Information	V1	V2
1.00	Very Valid	5	5
0.92	Very Valid	4	5
0.92	Very Valid	5	5
0.92	Very Valid	5	5
0.92	Very Valid	5	5

Based on the data in Table 7, the tested aspects of assessment, out of a total of five, showed varying levels of discrimination, ranging from good to very good. Therefore, it can be concluded that the video assessment rubric is deemed usable. The types of summative assessments (questions, poster assessment rubric, and video assessment rubric) are aligned with the learning outcomes (LOs) and the flow of learning objectives (FLO). The flow of learning objectives includes analyzing the relationship between various forces and work, work and energy change, and the law of energy conservation, as well as demonstrating the application of problem-solving related to kinetic energy and potential energy in daily life.

Table 7. Test of Different Power of Video Assessment Rubric

Difference Power	Information
1.8	Very good
2.4	Very good
0.4	Quite good
0.4	Quite good
2.4	Very good

The implementation stage involves implementing the IT-based summative assessment in differentiated learning that has been developed, and it is carried out with the 20 students of class XI MIA 1 at SMA Kristen 1 Metro. The implementation takes place within the classroom setting. After the learning session, the students must complete a respondent questionnaire to provide feedback on the IT-based summative assessment.

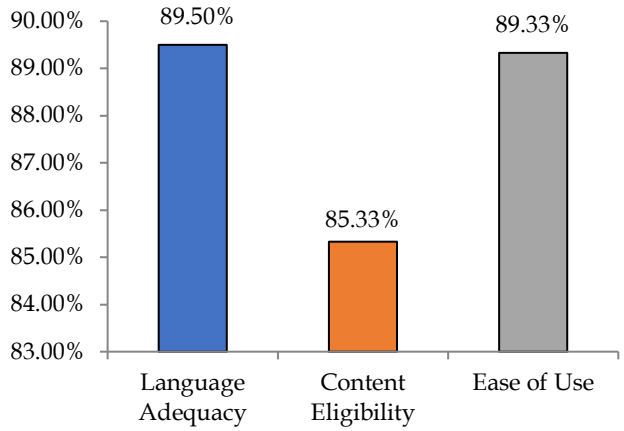

Figure 6. Summary of student practicality response questionnaire

Based on Figure 6, a summary of the student practicality questionnaire reveals three aspects. The language suitability aspect obtained a score of 358 with a percentage of 89.50% and fell under the category of very practical. The content suitability aspect obtained a score of 256 with a percentage of 85.33% and is categorized as very practical. The ease of use aspect obtained a score of 268 with a percentage of 89.33% and fell under the category of very practical. The practicality test conducted by the students yielded an average score of 88.06% across all three aspects, indicating a convenient category.

The results of this study are in line with research that has been conducted by Hidayah et al. (2023) that Information and Communication Technology (ICT)-based education is a means of interaction that can be utilized by educators, educational staff, and students to increase effectiveness, quality, productivity and access to education. Students will benefit from ICT integration when they are not constrained by limited curricula and resources and instead are able to direct activities in technology-based courses intended to help them stimulate their understanding of the subject. In addition, assisting teachers in developing interesting, innovative and interesting learning plans to encourage students' active learning (Wijayanti, 2022).

In addition, it is also in line with research conducted by Handayani et al. (2022) that information and communication technology supports innovative learning and creates a learning environment to develop student competencies in the 21st century. The average percentage of students' ICT literacy scores reached 76.06% in the high category. The results of this study can be used as a basis development of science learning materials integrated with ICT to facilitate students in learning. ICT literacy is influenced by the availability of devices, ease of access, frequency of use, and duration of use ICT tools. Therefore, the aspect of resources and ICT accessibility needs attention (Siahaan et al., 2021).

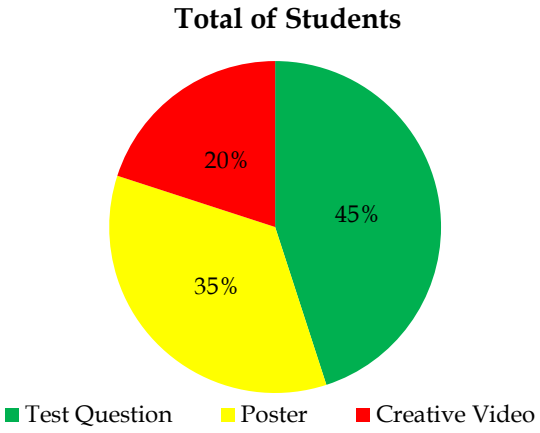

Figure 7. Percentage of Students Choosing Summative Assessment

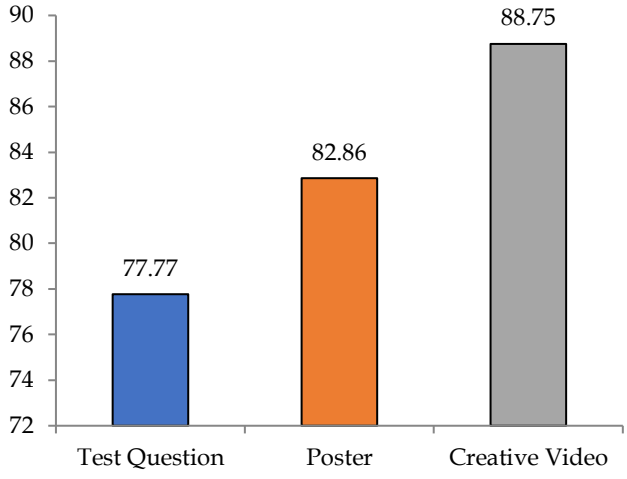

Figure 8. Summary of summative assessment results of students

Based on image 9 shows the summary of the students' summative assessments. The types of summative assessments include questions, posters, and creative videos. The students were free to choose one of the three types of summative assessments based on their differentiated learning products. Table 30 explains that 20 students in class XI IPA 1 have diverse choices of summative assessments. The summative assessment results show that 45% of the students chose the test-type assessment, with an average score of 77.77. 35% of the students chose the poster-type assessment, with an average score of 82.86. Lastly, 20% of the students chose the creative video-type assessment, with an average score of 88.75.

The results of this study are in line with research that has been conducted by Nurnaifah et al. (2022) that there is a positive and significant influence of visual learning styles on physics learning outcomes. In addition, it is also in line with research conducted by Darmawati (2017) which states that an increase in learning styles affects learning achievement. This is also in line with Kusumawardani et al. (2018) that the average value of student learning outcomes using the STAD-type cooperative model assisted by poster media is better and exceeds the KKM of the average student learning outcomes that do not use the STAD-type cooperative model assisted by poster media for students class I SDN Pengulangan. Nawang Sari (2021) states that PJBL can increase the potential of students because project work is carried out according to the interests and talents and potential of students.

Conclusion

Based on the research conducted through several stages, the following conclusions can be drawn: this developmental research has resulted in the production of an IT-based summative assessment product consisting of three types, namely quiz-based questions using Quizizz, poster assessment rubrics using Google Form, and video assessment rubrics using Google Form. The validity level of the question type is deemed valid, with an average score of 0.94, a reliability coefficient of 90%, an average discrimination index of 0.14, and an average difficulty level of 0.38. The poster assessment rubrics are deemed valid, with an average score of 0.93, a reliability coefficient of 80%, and an average discrimination index of 1. The video assessment rubrics are deemed valid, with an average score of 0.93, a reliability coefficient of 80%, and an average discrimination index of 1.48. The user practicality response sheet is deemed valid with an average score of 0.93 and a reliability coefficient of 80%. The IT-based summative assessment in differentiated learning on work and energy is developed to be highly practical for educators and students, with an overall student response score of 88.06%. It falls under the category of very practical.

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Author Contributions
Tri Lestari: original draft-writing preparation, results, discussion, methodology, conclusions, review, and editing; Friska Octavia Rosa, Riswanto, and Dasrieny Pratiwi: analysis and correction.

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Conflicts of Interest
No conflict of interest.

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