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Developing Contextual Physics Worksheets through the 7E Learning Cycle on Topics Parabolic Motion

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ABSTRACT

Complex abstract physics concepts, especially parabolic motion, often challenge students, necessitating the development of innovative, engaging instructional materials. This study aims to evaluate the feasibility of a student worksheet designed with a contextual approach and integrated into the 7E learning cycle model. Utilizing the Research and Development framework, this study follows the 4D model (Define, Design, Develop, and Disseminate). Data were collected through indirect communication techniques, involving structured questionnaires administered to three experts (internal validation), and 22 eleventh-grade students at SMAN 3 Sungai Kakap, Kalimantan Barat to get students' responses to the implementation of the worksheet. The media validation results, focusing on visuals, layout, and usability, produced an average score of 78%, with a very good category. Furthermore, material expert validation regarding content accuracy, linguistic clarity, and pedagogical presentation achieved a score of 89%, categorized as very appropriate. Students' response trials indicated that students showed high levels of interest and positive attitudes toward the worksheet, with an average score of 90% (strongly agree). These findings demonstrate that the developed worksheet is not only valid but also supports the learning process. Contextual-oriented worksheet is recommended as posible teaching tool to enhance student engagement and conceptual understanding in physics education.

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INTRODUCTION

Physics is often considered a very difficult and intimidating subject by the majority of students. This negative perception arises from the many complex, abstract concepts that are difficult to visualize in everyday learning. As a result, this condition decreases interest in learning and weakens their conceptual understanding of the material being taught. This phenomenon of declining quality is clearly reflected in the learning process at SMAN 3 Sungai Kakap. Based on initial interviews with the school, the average student score on parabolic motion only reached 74.

This score indicates that students' learning mastery is still suboptimal and requires immediate improvement. Therefore, an in-depth analysis is needed to identify the root cause of this low achievement.

The main problem in this case lies in the learning process, which fails to provide real meaning to the physics material. Teachers tend to convey material theoretically without connecting it to the realities of students' lives. However, the essence of education should be an effective means to develop the full potential and noble character of students. This principle of character and potential development aligns with the educational philosophy enshrined by Ki Hajar Dewantara (Masitoh & Cahyani, 2020). Unfortunately, the lack of real meaning in the learning process severely weakens students' conceptual understanding. A direct impact of this weak conceptual understanding is low cognitive learning outcomes in the classroom. This low learning outcome is evident in the classical completion rate, which only reaches 54% (Narestuti, Sudiarti, & Nurjanah, 2021).

These low cognitive learning outcomes are triggered by the use of conventional teaching materials that lack student motivation (Narestuti, Sudiarti, & Nurjanah, 2021). On the other hand, current curriculum demands require the availability of learning tools that support character development (Rahmadayanti & Hartoyo, 2022). However, the reality on the ground shows the limited availability of printed textbooks in schools in the region. This limited availability of printed materials is exacerbated by the implementation of innovative learning models, which are often ineffective. Many innovative models are difficult to implement due to large class sizes and the relatively long time required. Therefore, a transition to a much more structured and efficient learning model is urgently needed. These complex problems in schools must be resolved immediately through alternative solutions, such as writing new teaching materials.

To address these issues, this research developed contextually oriented Student Worksheets. The development of these worksheet was also directly integrated with the 7E Learning Cycle model. The contextual approach was deliberately chosen and integrated to bridge rigid physics theory with real-world phenomena. Through this approach, students can directly relate physics theory to everyday life (Amaral, Freitas, & Dewa, 2024). Meanwhile, the 7E Learning Cycle model is implemented to provide a much more systematic learning structure. This model, consisting of Elicit, Engage, Explore, Explain, Elaborate, Extend, and Evaluate, has its own advantages. The implementation of these structured phases is specifically designed to stimulate students' curiosity and critical thinking skills.

The urgency of integrating these methods is further reinforced by the results of a novelty analysis using VOSviewer software. Based on a VOSviewer analysis (2023–2024) of 968 scientific articles, interesting facts regarding this research trend were uncovered. The density visualization results show that the contextual approach and the 7E Learning Cycle model are in separate clusters. This cluster separation indicates that the area of scientific publications combining these two concepts is still very limited. Furthermore, the Overlay Visualization results also confirm the importance of revitalizing the trend of contextual learning based on digital media. Meanwhile, schools currently desperately need innovative learning resources to boost learning outcomes on challenging material. One challenging topic that requires this innovative media intervention is the topic of parabolic motion.

This research aims to bridge the theoretical gap in the literature while meeting practical needs in schools. The primary objective of this research is to integrate the contextual approach into the Learning Cycle-based Student Worksheet. This integration step is based on a strong foundation of several relevant previous studies. Previous researchers have shown that the use of valid student worksheetshas been proven effective in improving student learning outcomes _(Ndruru, Panggabean, & Tambunan, 2025). The validity of teaching materials is key to ensuring the quality of the classroom learning process. The success of the 7E Learning Cycle model in improving students' cognitive understanding has also been scientifically demonstrated _(Kinanti, Permadani, & Ramadani, 2024)(Bahri & Adiansha, 2020; Kustianingsih & Muchlis, 2021).. The combination of these two instruments is believed to have a massive positive impact on improving academic quality.

The effective use of contextual-based worksheet can shift the learning paradigm to become much more student-centered. Students are no longer passive subjects simply listening to the teacher's lecture. This model has been proven to increase student active engagement in constructing their own knowledge during learning. Through a series of directed activities, students are guided to deeply and independently internalize the relevance of the subject matter. They can see how the laws of physics operate in the realities of their daily lives in a fun way. This internalization process ultimately makes the physics learning experience much more meaningful for students _(Widiastuti & Priantini, 2022). Thus, the development of the 7E Learning Cycle contextual worksheet is expected to be a cutting-edge solution for SMAN 3 Sungai Kakap.

METHODS

1. Research Procedures

This study uses Research and Development with 4D model consisting of four phases: Defining, Designing, Developing, and Disseminating _(Thiagarajan, Semmel, & Semmel, 1974). In the defining phase, initial analysis was conducted using bibliometric analysis with VosViewer and interviews at SMAN 3 Sungai Kakap Kalimantan Barat to identify learning gaps. The Designing phase involved the creation of contextually oriented worksheets integrated with the 7E Learning Cycle. The Developing phase focused on validation and user response testing to ensure the feasibility of the product. Finally, the Disseminating phase involved the limited distribution of the finalized worksheets to target students. The research procedure is presented in Figure 1.

2. Research Subject

This research was conducted at SMAN 3 Sungai Kakap Kalimantan Barat, providing a real-world context for the limited availability of printed teaching materials. The research subjects were 22 11th-grade students of SMAN 3 Sungai Kakap, representing end users. Expert Validators were two Physics Education Lecturers and one 11th-grade Physics Teacher.

3. Techniques and Data Collection Tools

The data collection technique used indirect communication through a questionnaire designed with a Likert scale to obtain validity and student responses to the application of the worksheet. The use of this validated instrument is crucial for quantifying expert intuition regarding product feasibility.

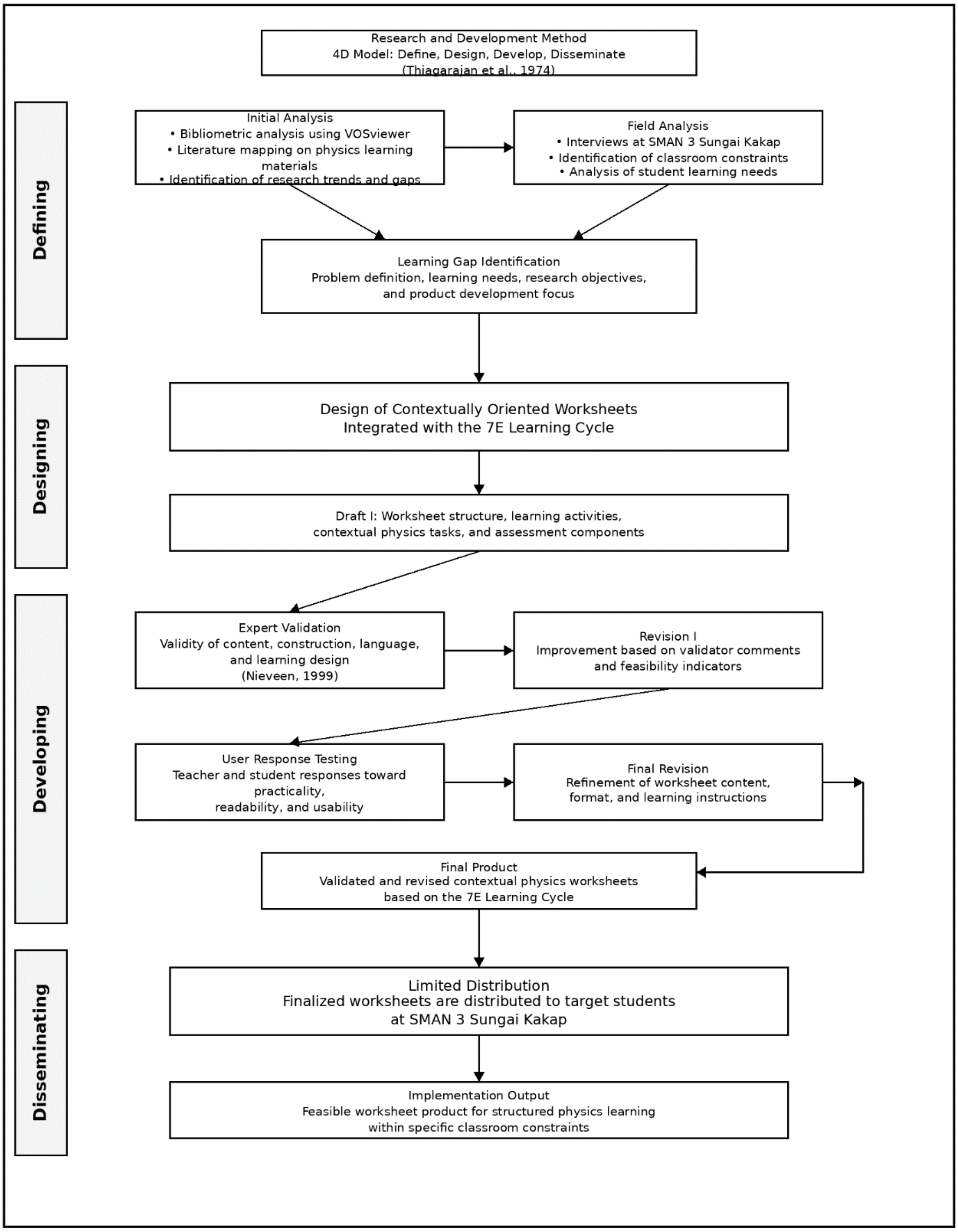

Figure 1. Research flowchart refers to Thiagarajan (1974)

4. Techniques of data analysis

Descriptive data analysis was used to conclude product feasibility by processing the average percentage scores from validators and respondents. The researcher established qualitative criteria based on percentage intervals (Sugiyono, 2022) as shown in Table 1.

Table 1. Qualitative Assessment Criteria

Percentage Interval	Qualitative Criteria
76% – 100%	Very Appropriate / Strongly Agree
51% – 75%	Appropriate / Agree
26% – 50%	Adequate
0% – 25%	Not Appropriate / Disagree

RESULTS AND DISCUSSION

Expert validation is a critical stage in the 4D development cycle (Define, Design, Development, Dissemination) to ensure that the product meets pedagogical, technical, and scientific substance standards. The results of the Media Expert Validation cover visual aspects, layout, and media navigation efficiency. The validation data are summarized in Table 2.

Table 2. Media Expert Validation Results

Indicator	Percentage	Category
Visual	84%	Very Appropriate
Layout	75%	Very Appropriate
Usability	75%	Very Appropriate
Average	78%	Very Appropriate

Table 3. Results of Material Expert Validation

Indicator	Percentage	Category
Content accuracy	94%	Very Appropriate
Linguistic clarity	88%	Very Appropriate
Pedagogical presentation	86	Very Appropriate
Average	89%	Very Appropriate

The assessment was conducted to test the accuracy of the concepts and the relevance of the curriculum. The validation results are presented in Table 3. The data shows that the subject matter expert's score (89%) was higher than the media expert's (78%). The high score demonstrates academic appreciation for the novelty of combining contextual and 7Es in addressing the abstract nature of physics concepts. Meanwhile, the 85% score indicates that this product is highly relevant to the field needs and student characteristics. These results indicate that the product meets the eligibility standards for user trials.

The effectiveness of an educational innovation depends heavily on the perceptions of end-users. Respondents were measured to assess the appeal and usefulness of the worksheets in the independent learning process. Detailed student responses to the worksheets are presented in Figure 2.

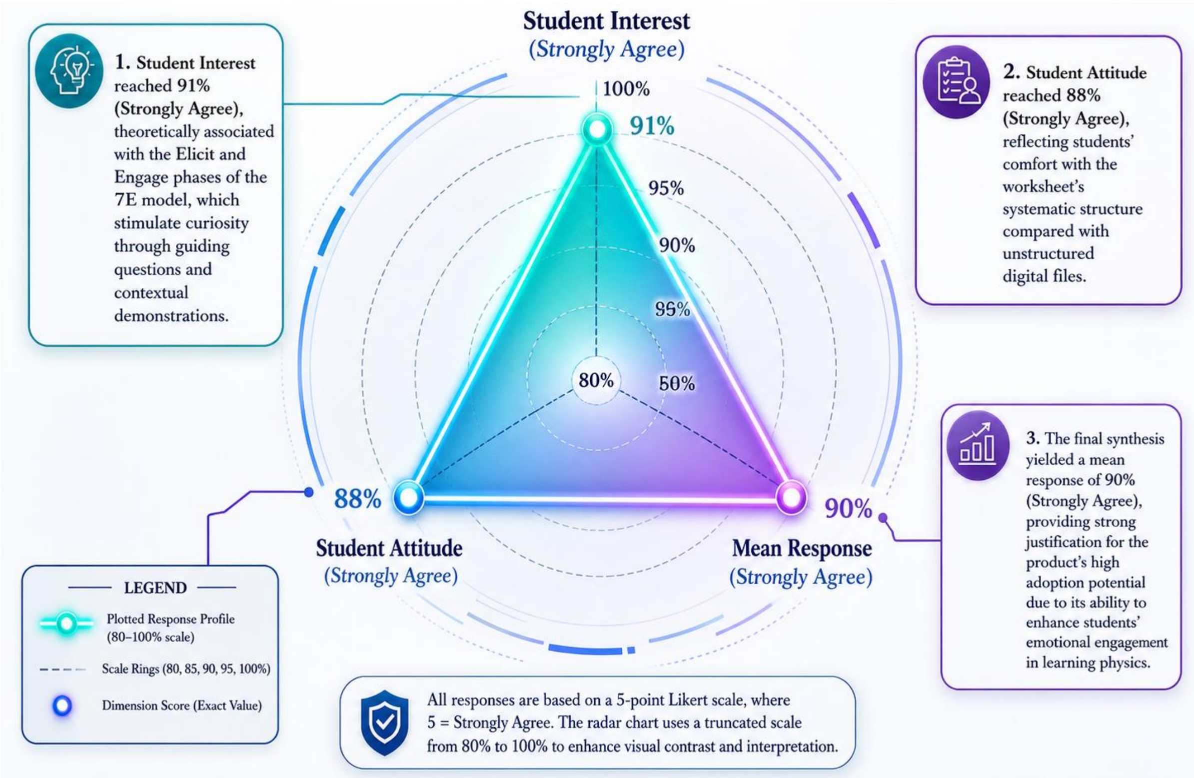

Figure 2. Student respons toward the Contextual Physics Worksheets (Source: Researcher Processed Results, 2026)

Student interest reached a score of 91% (Strongly Agree). This achievement is theoretically closely related to the Elicit and Engage phases of the 7E model, which can spark student curiosity through provocative questions and contextual demonstrations. Student attitudes reached a score of 88% (Strongly Agree), reflecting students' comfort with the systematic structure of student worksheets compared to using unstructured digital files. This indicates that the product has high adoption potential because it can increase student emotional engagement in learning physics.

The synergy between the 7E Learning Cycle model and the Contextual Approach has been empirically proven to eliminate the weaknesses of less effective learning models for large classes. Through seven structured stages—Elicit, Engage, Explore, Explain, Elaborate, Evaluate, and Extend—students are guided toward meaningful learning. The Contextual approach plays a crucial role in visualizing abstract concepts. Real-world phenomena such as missile trajectories, rocket motion, golf games, and basketball shots are strategically integrated in the Engage phase for initial motivation, and the Extend phase to broaden students' insights into the practical applications of physics. The learning syntax and content of Contextual in worksheet are presented in Figure 3.

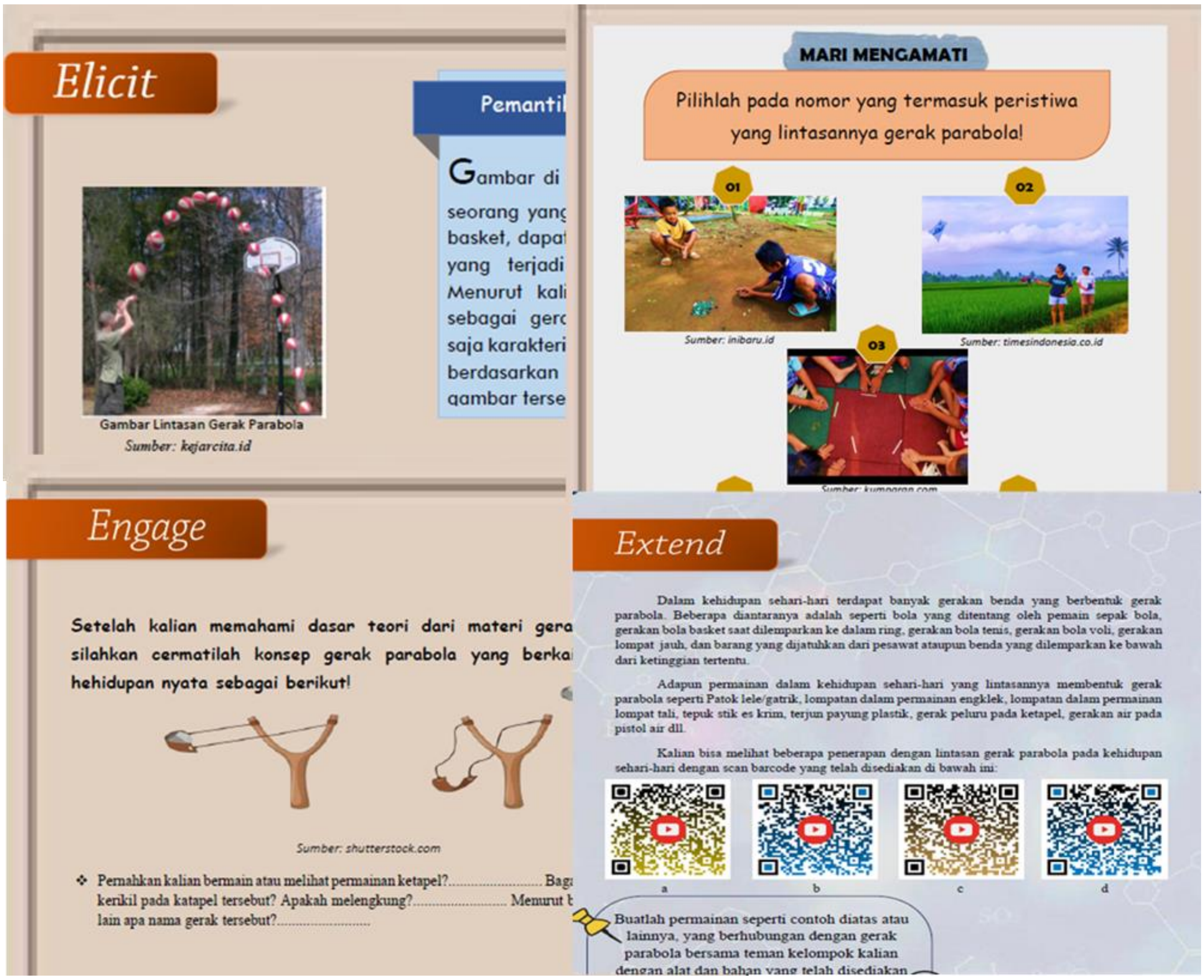

Figure 3. Contextual learning with 7E Learning cycle on the topic of parabolic motion

Thinking skills are honed through the Explain and Evaluate phases, where students describe scientific concepts and analyze data. Independence is developed in the Elicit and Evaluate phases through objective assessments of personal understanding. Collaboration is strengthened in the Explore and Elaborate phases through collaboration in simple experiments and group discussions.

The findings of this study align with several studies, who demonstrated that learning media such as student worksheets are effective in improving student learning outcomes, attitudes, and skills (Aslam, Adnan, & Azis, 2021) (Ariani & Meutiawati, 2019). The use of contextual-based worksheets has been shown to create more meaningful learning experiences because students can internalize the relevance of the material to everyday realities (Firdausi, Rizqi, & Suchayo, 2021) (Widiastuti & Priantini, 2022). Furthermore, the integration of visual elements such as images and colors in the media plays a significant role in stimulating cognitive imagination and strengthening students' working memory (Hanifah, Afrikani, & Yani, 2020). Parabolic Motion material has a high level of abstraction because it requires students to understand two-dimensional motion, so the contextual approach in the worksheet acts as scaffolding. The worksheet presents contextual phenomena, making it easier for students to understand abstract concepts before they engage in complex mathematical reasoning in the Explain phase. This synergy of visuals and real-world context prevents difficulties when students solve motion vector problems.

Operationally, worksheets serves as a systematic guide that facilitates instructional interactions between educators and students (Suwastini, Agung, & Sujana, 2022). The absorption of material concepts and process skills training in this study is supported by the 7E Learning Cycle model, a manifestation of constructivist theory (Oktavia & Puspitawati, 2021). This theory emphasizes student-centered learning through reflection on experiences and observations to build independence and problem-solving skills (Holilah, Nurfadhillah, & Sa'odah., 2020).

The application of a contextual approach to the Parabolic Motion material not only improves cognitive mastery of concepts but also integrates Character Education Strengthening. This approach encourages stuThe successdents to be more active, creative, and innovative by recognizing that the laws of physics can be applied empirically (Aminah, Hairida, & Hartoyo, 2022). The development of this Student Worksheet represents the essence of physics as a whole, encompasses aspects of product (facts and laws), process (scientific methodology and experimentation), and attitude (curiosity and collaboration) (Murdani, 2020). This integration proves that the character dimensions (independence and mutual cooperation) are not just direct instructional effects, but rather nurturing effects that arise naturally when the learning climate is conditioned in a constructivist manner.

CONCLUSION

The contextual approach-oriented student worksheet using the 7E Learning Cycle model for parabolic motion was declared highly suitable for use in learning. This was based on validation results from media experts (78%) and material experts (89%), which were categorized as highly suitable. Furthermore, this product received a very positive response from students, with an average score of 90%, indicating that the worksheets is highly practical and relevant for implementation in the learning process at school. This product has met R&D quality standards for use as an innovative teaching tool at the high school level. Widespread implementation is highly recommended, especially in schools with characteristics similar, to support the transformation of physics learning to be more applicable, systematic, and aligned with the curriculum

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