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Development of E-LKPD Wizer: A Solution to Improve Problem Solving Skills and Ecological Attitude in Junior High School Students

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Abstract: The objective of this study was to develop and assess the impact of Wizer E-LKPD on the problem-solving skills and ecological attitudes of 28 VIIC class students at SMP Negeri 1 Wita Ponda. The study employed the ADDIE model as its research framework and utilized a one-group pretest-posttest design with purposive sampling. The research instruments included validation sheets, response questionnaires completed by teachers and students, tests of problem-solving abilities, and an ecological attitude questionnaire. The findings indicated that Wizer E-LKPD was highly valid, with an average rating of 94.12%. The results demonstrated that the Wizer E-LKPD effectively enhanced problem-solving skills, achieving a medium effect size of 0.65, and improved ecological attitudes with a simple effect size of 0.30. Therefore, it can be concluded that the Wizer E-LKPD is a valid, practical, and effective tool for improving students' problem-solving abilities and fostering ecological attitudes in science learning at SMP Negeri 1 Wita Ponda.

Keywords: ADDIE; E-LKPD wizer; Ecological attitude; Problem solving skills

Introduction

In today's increasingly interconnected world, there is a growing need for human resources with expertise in science and technology. It would be wise for education to equip students with adaptable STEM skills to remain competitive, as 65% of children currently in primary school are expected to work in jobs that don't yet exist (Tran et al., 2020). This highlights the importance of developing innovative curricula and learning tools that can prepare students for an uncertain future.

It would be beneficial for education, as the foundation of human resource development, to consider incorporating innovative tools with the aim of enhancing the effectiveness and engagement of the learning process. Research indicates that the incorporation of technology may potentially enhance student engagement and participation by up to 30% (Jaiswal, 2020). It would be beneficial, then, to consider the creation of engaging and effective learning tools as a way of enhancing the teaching and learning process.

Learner Worksheets (LKPD) are valuable educational tools that have the potential to enhance students' understanding through structured exercises. Studies have indicated that well-designed LKPDs have the potential to enhance concept comprehension by up to 25% (Biggs, 1999). This suggests the possibility of developing innovative LKPDs that could potentially

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enhance the quality of education and better prepare students for future challenges (Aisy & Dwiningsih, 2024; Juliana et al., 2024; Suryanti & Festiyed, 2023).

It seems that interactive LKPDs, especially those incorporating technology, may have the potential to increase student engagement and focus. Research suggests that gamified LKPDs and digital worksheets may have the potential to enhance learning motivation and reduce confusion (Marshel & Ratnawulan, 2020; Lee et al., 2023; Ghaisani & Setyasto, 2023). This study aims to develop a Wizer.me-based E-LKPD to enhance problem-solving skills and ecological attitudes in science learning, addressing a gap in existing research on digital learning tools.

Method

This research is a research and development (R&D) study that focuses on the development of E-LKPD assisted by Wizer.me (E-LKPD Wizer) with the ADDIE model. The study was conducted at SMP Negeri 1 Witaponda, Central Sulawesi, Indonesia, with a population of 126 seventh-grade students. The sample was selected from among the students in Class VIIC through the use of purposive sampling, with the students in Classes VIIA through VIID serving as the population. The sample was determined based on the assumption that the students in the population were homogeneous and within the geographical range set by the government. The research subjects totaled 28 people, consisting of 13 boys and 15 girls, with an age range of 13-14 years.

The research instruments included the Wizer E-LKPD product validation sheet. The validation was conducted by two expert validators. The validation instruments included an unstructured interview guide, a problem-solving skills test, an environmental literacy questionnaire, and a questionnaire of teacher and learner responses to Wizer E-LKPD. The Wizer E-LKPD product validation sheet includes aspects of appearance, presentation, and readability, with a four-option Likert scale rating: "very good" = score 4; "good" = score 3; "less good" = score 2; and "not good" = score 1. The unstructured interview guidelines were utilized to explore the characteristics of students and the characteristics of learning conducted by science teachers in class VIIC. The Problem-Solving Skills Test comprises four essay questions on the subject of ecology and biodiversity, with a scoring rubric ranging from one to four. The Ecological Attitude Questionnaire comprises 15 items, grouped into three indicators: awareness of the environment, knowledge of ecology, and attitudes towards conservation.

The data collection techniques employed included observation, interviews with science teachers, validation, surveys with questionnaires, and written tests. The data were interpreted descriptively with regard to the results of the validation of the Wizer E-LKPD products, the results of the problem-solving ability test, the results of the environmental attitude questionnaire, and the results of teacher responses to certain criteria. The criteria for evaluating the validation of Wizer E-LKPD products are presented in Table 1, as outlined by Atwood et al. (1986).

Table 1. Criteria for Product Validity of the Wizer E-LKPD

Score Percentage	Criteria	Validity level
90.00 – 100.00	Very valid	Usable without revision
80.00 – 89.00	Valid	Usable but needs minor revisions
65.00 – 79.00	Moderately valid	Can be used but needs major revision
55.00 – 64.00	Less valid	Not recommended for use as it needs major revision
≤ 54.00	Not valid	Should not be used

In order to ascertain the practicality of Wizer E-LKPD products, the practicality criteria set forth in Table 2 were employed (Pratiwi et al., 2023).

Table 2. Criteria for Practicality of the Wizer E-LKPD Products

Score percentage	Criteria
81.00 – 100.00	Very practical
61.00 – 80.00	Practical
41.00 – 60.00	Less practical
21.00 – 40.00	Not practical
0.00 – 20.00	Very not practical

The analysis of students' problem-solving skills was conducted through the application of tests, specifically the pretest and posttest questions. The test questions were initially evaluated by a panel of expert lecturers. Following the aforementioned validation process, the subsequent step is to assess the efficacy of the product implementation through the effect size test Cohen (Fritz et al., 2012) with the established criteria outlined in Table 3. To ascertain the effect size of the implementation of this Wizer E-LKPD product, a one-group pretest-posttest design was employed.

Tabel 3. Problem Solving Skills Criteria

Score (%)	Criteria
80.00 – 100.00	Very good
65.00 – 79.90	Good
55.00 – 64.90	Quite good
40.00 – 54.90	Less good
0.00 – 39.90	Very less good

The categories of interpretation of the effectiveness of N-gain (%) are described in Table 4.

Table 4. Categories of Interpretation of Effectiveness of the Wizer E-LKPD

Score Percentage	Interpretation
< 40.00	Not effective
40.00– 55.00	Less effective
56.00 – 75.00	Moderately effective
> 75.00	Effective

The determination of the category size effect of the Wizer E-LKPD on improving problem solving skills is described in Table 5.

Tabel 5. Effect Size Criterion Cohen (Fritz et al. 2012)

Score effect	Interprets
$0.00 < d \leq 0.20$	Weak effect
$0.20 < d \leq 0.50$	Modest effect
$0.50 < d \leq 0.80$	Moderate effect
$d > 0.80$	Strong effect

Result and Discussion

The paper discusses the development the Wizer E-LKPD to enhance problem-solving skills and ecological attitudes in science education at SMP Negeri 1 Wita Ponda. The results and discussion of this research are based on the EDDIE stages.

Analysis Stage

At this stage, a needs analysis was conducted, along with an analysis of learner characteristics and an analysis of learning materials in class VIIC. The results of the analysis are presented in Table 6. The results of the needs analysis indicate that the use of paper-based LKPDs is perceived as monotonous and less engaging by students, while teachers encounter challenges in integrating IT into the learning process. In accordance with Piaget's constructivist theory, learners construct knowledge through active interaction with their environment. This is corroborated by the findings of (Taylor & Parsons, 2011), which demonstrate that the utilisation of technology in learning can enhance students' engagement and comprehension of concepts.

The findings of the analysis of the characteristics of students indicate that their interest in learning is relatively low, which in turn results in a less active engagement in the learning process. This is due to the fact that the learning environment remains predominantly teacher-centered. The learners have no prior experience with electronic or application-based LKPD. The results of the diagnostic test indicated that the students exhibited varying levels of ability, with three groups demonstrating low levels, one group exhibiting a medium level, and one group exhibiting a high level. Additionally, the learning style was identified as audio-visual.

The analysis of students' characteristics revealed that their interest in learning and active involvement in the learning process remained low, and that the learning environment in the classroom was not fully student-centered. Dewey's active learning theory emphasizes the significance of direct student involvement for attaining optimal outcomes. Guthrie et al. (2003) research demonstrates that interactive and technology-based learning methods markedly enhance student learning outcomes in comparison to traditional methods. Consequently, the implementation of E-LKPD is anticipated to address this issue by offering a more engaging and interactive learning experience.

The results of the material analysis throughout the curriculum indicate that the material "ecology and biodiversity" is an appropriate subject for teaching in order to enhance problem-solving skills and ecological literacy. This may be achieved by using digital or application-based LKPD and PBL models. The material is constructed of three sub-materials as the influence of the environment on organisms, the influence of humans on ecosystems, and the conservation of biodiversity. The theory of problem-based learning (PBL) as put forth by Taylor et al. (2011) and Verdamil et al. (2024) indicates that this approach is an effective means of developing critical thinking and problem-solving abilities. The findings of Sihaloho et al. (2017) support the assertion that PBL is an effective method for fostering deep understanding and higher-order thinking skills.

Design Stage

The design of LKPD, based on the results of the analysis, is E-LKPD assisted by wizer.me. This LKPD is designated as the Wizer E-LKPD. The design results are presented in the form of a draft, comprising the following elements: title, material, content outline, instructions for use, cover, instructions for filling out the LKPD, learning videos, and questions designed to enhance problem-solving skills and promote ecological attitudes. The draft was designed with Canva application. The Wizer E-LKPD draft was validated by two media and material expert validators. Several studies have designed E-LKPDs using wizer.me to improve learner learning outcomes, such as critical thinking skills, learning motivation, and problem solving skills, but not related to the environment like this study (Aprilia & Triwahyudianto, 2023; Arsyisyah et al., 2023).

Table 6. Analysis of E-LKPD Needs for Students and Teachers

Indicators	Result of analysis
Use of E-LKPD on Ecology & biodiversity material	The use of paper-based LKPDs by teachers and students has not facilitated the development of IT-based learning tools, which in turn has limited the capacity to present material in a more engaging and diverse manner.
Use of E-LKPD to improve problem solving skills	Teachers are concerned about students' low problem-solving skills.
Use of E-LKPD to improve ecological attitudes	Environmental awareness among students is relatively low, it can be seen from students still throwing garbage in the classroom, not caring about sorting waste even though the school facilitates separate trash bins.
Learners' response to the worksheet used.	Learners are largely unfamiliar with the concept of environmental conservation and are less responsive to environmental issues in their area.
Use of Wizer.me-assisted electronic E-LKPDs	Learners have difficulty understanding learning so that they are less actively involved, need interactive and interesting stimulation.
	Both teachers and learners have expressed interest and enthusiasm for the potential application of this approach in the classroom.
	Learners express a desire for E-LKPDs that can be accessed via mobile devices or school-issued laptops

Development Stage

The development stage is carried out to complete the LKPD draft into an E-LKPD product uploaded to wizer.me. The developed product consists of three LKPDs in accordance with three sub-learning materials on ecology and biodiversity. Wizer E-LKPD products are also equipped with an evaluation of problem-solving skills and ecological attitudes. The cover page and instructions for using the Wizer E-LKPD are presented in Figure 1. In the Wizer E-LKPD, the biodiversity material is presented in an illustrative and engaging style using Canva, accompanied by a learning video that highlights the importance of conservation in environmentally sustainable practices, as illustrated in Figure 2.

The results of the Wizer E-LKPD development were validated by media and material expert validators. The average validation percentage was 94.12 with a very valid category with minor revisions regarding word and sentence errors. Thus, the Wizer E-LKPD product can be implemented.

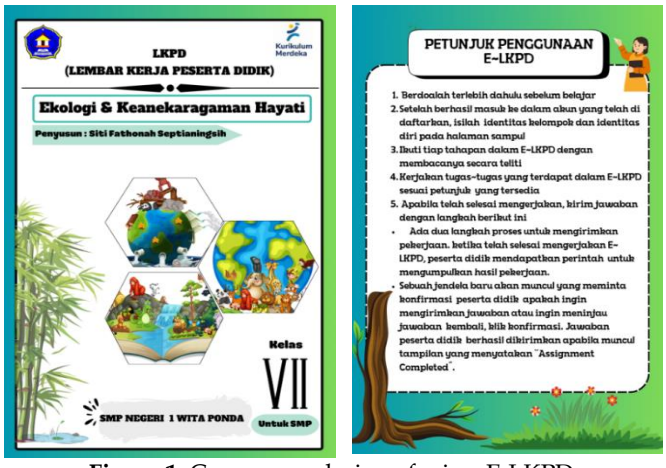

Figure 1. Cover page design of wiser E-LKPDs

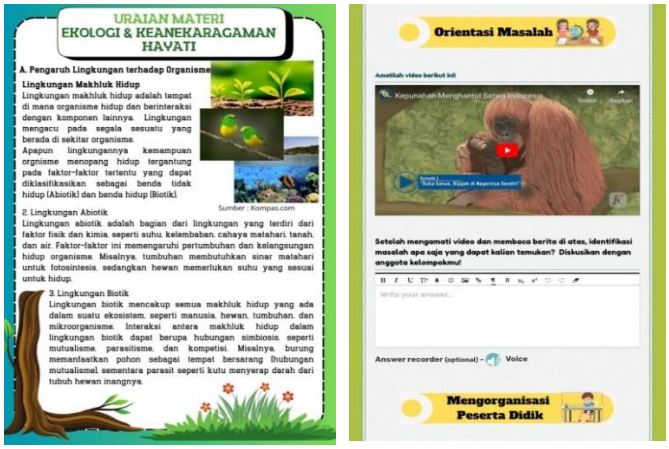

Figure 2. Illustrates the content component of the wizer E-LKPD in conjunction with canva

The use of applications in E-LKPDs offers the advantage of facilitating interactive learning through the incorporation of engaging features, such as videos, animations, and quizzes. This can enhance students' interest and motivation to learn because it can be accessed via a smartphone (Andriana et al., 2022; Saputra et al., 2021). Moreover, E-LKPD applications allow for the customization of material according to the needs and abilities of each learner, thus facilitating students' comprehension of the material (Khotami et al., 2023; Sugianto et al., 2022).

During this phase of development, instruments were also created to assess problem-solving abilities and ecological literacy. The results of the validation of problem-solving skills were found to be highly valid, with an average score of 92.71%. Similarly, the ecological attitude questionnaire was declared valid following revision, with an average score of 85.00%. Revisions were made to correct errors in wording and to improve the structure of sentences.

Implementation Stage

The implementation was conducted on VIIC class students using E-LKPD Wizer-1 to 3 in accordance with the sub-material. At the meeting, a pretest and posttest of problem-solving and ecological attitudes were conducted. Each E-LKPD was utilized for a period of three consecutive days. The results of the problem-solving ability test are presented in Table 7.

Table 7. Description of Pre-test and Post-test Results of Problem-Solving Skills

Description	Pre-test	Post-test
Sample	28	28
Means	45.76	78.13
Idealized score	100	100
SD	9.75	9.70
Sig. (2-tailed)		0.000
Effect Size		0.65
Interpretation		Moderate effect

As evidenced in Table 7, the two-tailed t-test yielded a p-value of 0.000, which is less than 0.05. This indicates a statistically significant discrepancy between the pre-test and post-test results. The effect size was found to be 0.65, which can be considered a medium effect. It can thus be concluded that the Wizer E-LKPD product has an effect on improving problem-solving skills by 65%. These findings are corroborated by prior research (Pratiwi & Nuraini, 2024; Sugianto et al., 2022; Khotami et al., 2023) yet the specific learning materials and effect size under consideration differ. Figure 3 illustrates the enhancement of problem-solving proficiency in accordance with the established indicators.

As illustrated in Figure 3, the greatest increase was observed in the indicator "carrying out the plan," which demonstrated a 36.61% growth, while the smallest increase was noted in the indicator "understanding the problem," which exhibited a 26.78% change. These results appear to be incongruous, as the implementation of a problem-solving plan necessitates an understanding of the problem. Nevertheless, the level of understanding of the problem demonstrated by the students exhibited the greatest percentage increase in relation to the other indicators. These results demonstrate that the implementation of Wizer's E-LKPD has a positive impact on students' comprehension of ecological issues and biodiversity. This finding is corroborated by the results of previous research Pratiwi et al. (2024), Sugianto et al. (2022), and Mayasari et al. (2023) which indicate that the Wizer E-LKPD has a positive effect on problem understanding, thereby enhancing critical thinking skills and science process skills. Nevertheless, the implementation of Wizer E-LKPR has been observed to have a beneficial impact on a range of other academic disciplines, including mathematics, language, and social studies. In addition to digitally integrated LKPDs, e-books, e-assessments, e-modules, worksheets, have also been widely used and proven suitable for implementation in learning (Rahmanto & Wilujeng, 2024; Rafidah et al., 2024; Aisy & Dwiningsih, 2024; Satriawati et al., 2023), both for improving problem solving skills, and other skills.

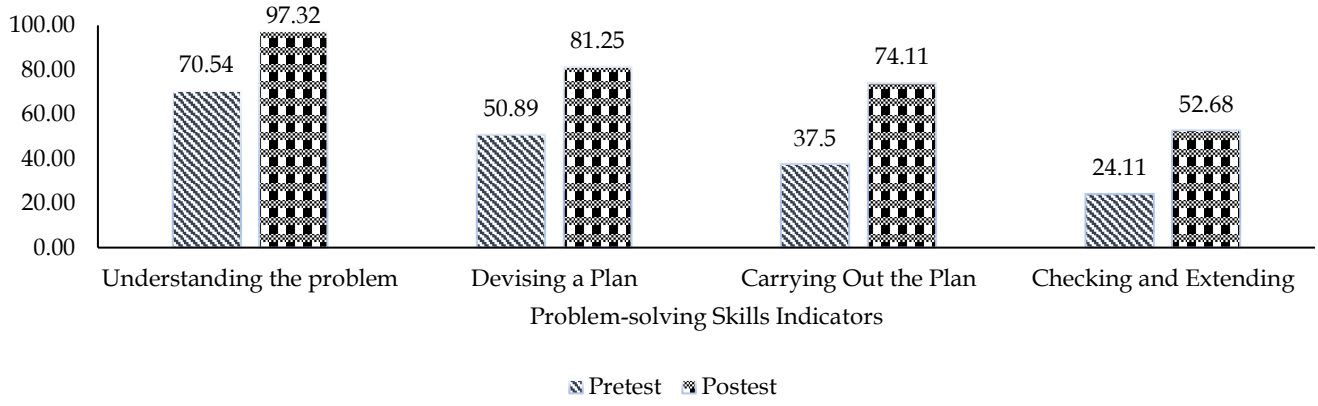

Figure 3. Presentation of problem-solving skills result

The utilization of digital applications is very urgent in today's technological era. In addition to application-based LKPDs, other digital forms have also been proven to improve students' problem-solving skills. The findings of Araiza-Alba et al. (2021) state that students' problem solving ability with Immersive virtual reality (IVR) technology is 77.5% higher than using tablets and board games. In addition to LKPD, the implementation of digital technology integrated learning models and approaches such as PBL, STEM-PjBL, Discovery Learning, also shows better problem solving skills (Purwaningsih et al., 2020; Aslan, 2021; Sari et al, 2021; Simanjuntak et al., 2021; Argelagós et al., 2022).

In this phase of the study, the ecological attitudes of the students were also assessed. The results demonstrated a statistically significant difference in the mean pre-test and post-test scores for ecological attitudes following the administration of the Wizer E-LKPD. The results of the T-test yielded a statistically significant outcome. The two-tailed test yielded a p-value of 0.00, which is less than 0.05, indicating a statistically significant result. The effect size was 0.30, which falls within the simple effect category. This indicates that the impact of the E-LKPD on ecological attitudes can be classified as a simple effect, thereby substantiating the assertion that the use of E-LKPD assisted by Wizer.me has a favorable influence on the enhancement of students' ecological attitudes. The results of the ecological attitude assessment for each indicator are presented in Figure 4. Digital-based LKPDs have been widely implemented in learning and show better attitudes, behaviors, ecological awareness (Artika et al., 2024; Pratiwi et al., 2024; Nabila A., 2023; Wahyuni et al., 2022; Sumarmi et al., 2021).

As illustrated in Figure 4, the growth in each ecological attitude indicator is nearly identical; however, the most pronounced increase is observed in the "environmental knowledge" indicator. The mean score for environmental knowledge is not significantly different from that for environmental awareness. The results demonstrate a correlation between environmental knowledge and environmental awareness. This finding is corroborated by prior research indicating that environmental awareness can be cultivated through environmental understanding (Yeh et al., 2022; Fetiana et al., 2022; Napitupulu et al., 2022; Napitupulu et al., 2020; Zheng et al., 2018). In summary, it can be posited that environmental awareness may be enhanced through the expansion of environmental literacy. Environmental literacy is a key factor in fostering positive ecological attitudes and behaviors, such as reducing littering in academic settings. This is corroborated by research (Napitupulu et al., 2024) indicating the significance of environmental awareness in the context of climate change, which has ramifications for environmental degradation and human health. However, environmental awareness on climate change should be seen as part of critical environmental literacy (Guerrero & Sjöström, 2024).

Evaluation Stage

The final stage of the Wizer E-LKPD development is to conduct an evaluation to assess the feasibility of the Wizer E-LKPD for students. The success of this E-LKPD development will be gauged by the feedback provided to students via a learner response questionary. The results of the analysis of the students response questionary are presented in Table 8.

Table 8. Results of Analysis of Student Response Questionnaire to Wizer E-LKPD

Aspects	Score percentage	Criteria
Display of Wizer E_LKPD	84.82	Very good
Use of Wizer E-LKPD	85.49	Very good
Benefits of Wizer E-LKPD in learning	88.69	Very good
Conclusion	86.33	Very good

Based on table 8, it is obtained that E-LKPD is very good to use in learning ecology and biodiversity in junior high school class VII.

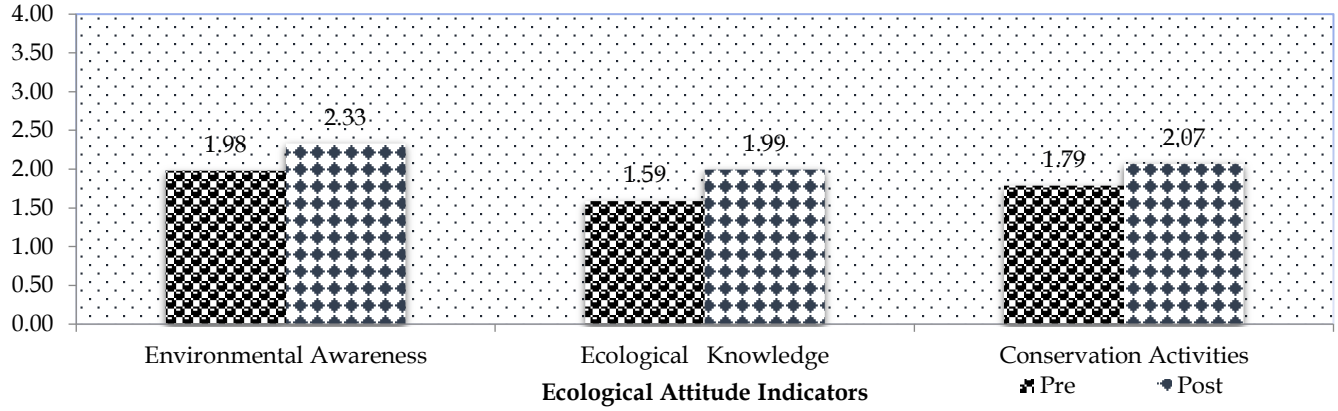

Figure 4. Students' ecological attitudes on each indicator

The integration of the E-LKPD wizer has been shown to facilitate the development of problem-solving abilities and an appreciation for the environment in the context of science education at SMP Negeri 1 Wita Ponda. The electronic learning materials provided by Wizer.me are designed to be engaging and interactive, offering an effective means of enhancing student learning outcomes. Furthermore, the platform offers a range of features, including diverse question types, multimedia support, and accessibility across multiple

devices, which can assist students in cultivating critical thinking skills and problem-solving abilities.

As the result indicates, the formation of ecological attitudes in individuals is influenced by a number of factors, including personal values, social norms, environmental knowledge, direct experiences with nature, and demographic characteristics such as age, gender, and education level. An emphasis on environmental concepts in science education is an effective strategy for fostering students' awareness and concern for the environment. By imparting knowledge about the significance of environmental conservation and sustainability, students develop a deeper understanding of the interconnectivity between human actions and the natural world. The acquisition of knowledge regarding ecological principles and biodiversity facilitates an enhanced awareness of the influence of human activities on the environment, thereby inspiring a commitment to tangible actions aimed at its preservation. Furthermore, incorporating environmental content into science education can facilitate students' comprehension of environmental issues and motivate them to engage in environmental conservation initiatives. For this reason, teachers need to be equipped with various trainings to update environmental knowledge, learning models, and even continuous training to build teachers' ecological character (Zheng et al., 2018).

Conclusion

This study concludes that the Wizer E-LKPD is a valid, practical, and effective tool for improving students' problem-solving skills and ecological attitudes. The analysis shows a significant increase in posttest scores compared to pretest scores, with a medium effect size of 0.65 for problem-solving and a simple effect size of 0.30 for ecological attitudes. The Wizer E-LKPD is also highly viable for educational use, with a validity score of 94.12%, and received positive feedback from both teachers and students. These findings suggest that Wizer E-LKPD not only enhances students' problem-solving abilities and environmental awareness but is also well-suited for broader adoption in various educational settings. Further research and development of technology-assisted E-LKPDs are recommended to continue improving learning outcomes and to explore their impact in different contexts.

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Author Contributions
Conceptualization, S.F.S. and M.N.; methodology, N.D.N.; software, S.F.S.; validation, R. and I.N.K.; formal analysis, S.F.S.; investigation, S.F.S.; resources, S.F.S and M.N.; data curation, N.D.N.; writing—original draft preparation, S.F.S.; writing—review and editing, M.N. and N.D.N.; visualization, S.F.S.; supervision, M.N. and N.D.N.; project administration, S.F.S.; funding acquisition, S.F.S. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest
The authors declare no conflict of interest in this study.

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