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# THE DEVELOPMENT OF WIZER.ME-BASED STUDENT WORKSHEETS TO IMPROVE STUDENTS' MATHEMATICAL CREATIVE THINKING ABILITY

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***ABSTRACT***

This study aimed to develop Wizer.Me-based Student Worksheets (LKS) on trigonometric functions to enhance senior high school students' mathematical creative thinking skills. The research employed a Research and Development (R&D) method using the ADDIE model, which consists of the analysis, design, development, implementation, and evaluation stages. The developed product was validated by a subject-matter expert and a media expert, and subsequently tested for its practicality and effectiveness. The trial subjects consisted of two mathematics teachers and nine twelfth-grade students. The validation results indicated that the worksheets were categorized as highly valid, with a percentage of 89.5% from the subject-matter expert and 85% from the media expert. The practicality test showed that the worksheets were considered highly practical, with an average percentage of 88.5%. The effectiveness test, based on students' response questionnaires, indicated a highly effective category with a percentage of 87.33%. In addition, the results of the mathematical creative thinking skills test demonstrated improvement, with the N-gain scores falling within the moderate to high categories, particularly on the indicators of fluency and elaboration. Based on these findings, it can be concluded that the developed Wizer.Me-based Student Worksheets are valid, practical, and effective in improving students' mathematical creative thinking skills. Therefore, the Wizer.Me-based worksheets are feasible to be used as an alternative instructional medium in mathematics learning, particularly on trigonometric function topics at the senior high school level.

**Keywords:** Student's Worksheet, Wizer.Me, Creative Mathematical Thinking.

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## PRELIMINARY

Mathematics is a fundamental discipline that serves as a primary foundation for the advancement of modern technology. It is positioned not merely as subject matter to be understood, but also as a conceptual framework for constructing and reconstructing knowledge, as well as for developing the thinking skills required to solve real-life problems (BSKAP, 2025). The essential role of mathematics as a foundational science is reflected in the high demand for mastery of mathematical skills in addressing the challenges of the 21st century (Putri et al., 2022). Higher-order thinking skills constitute a

crucial foundation in various aspects of life, particularly in solving complex problems that arise across different fields.

One of these essential skills is creative thinking, defined as the ability of an individual to generate ideas in solving problems and to produce new solutions that have not previously been proposed by others (Anditiasari et al., 2021). Mathematical creative thinking ability refers to the capacity to generate and discover new, distinct, and original ideas that are uncommon, yet accurate and well-founded in their outcomes (Dalilan & Sofyan, 2022). Thus, mathematical creative thinking can be understood as an individual's ability to develop new and original ideas to obtain solutions to mathematical problems. This skill is highly aligned with the graduate profile dimensions emphasized in the Merdeka Curriculum, which highlights critical and creative reasoning as essential characteristics of meaningful and contextual learning.

The Merdeka Curriculum provides opportunities for students to explore and construct their knowledge through activities involving problem-solving, collaboration, and reflection, as the implemented instructional approach encourages active student engagement in flexible contexts that are relevant to their needs (Fadhil & Gusmaneli, 2025). Such a learning pattern is aligned with the development of mathematical creative thinking skills, as students are encouraged to discover various approaches to solving problems, propose new ideas, and connect mathematical concepts in original and meaningful ways. Therefore, mathematical creative thinking ability is not merely a curricular demand but also an essential competence that enables students to adapt and compete amid increasingly rapid and complex global changes. Efforts to develop students' creative thinking skills must be carried out continuously in order to improve academic achievement in their respective fields. In line with this perspective, contemporary mathematics learning should no longer focus solely on obtaining procedurally correct answers, but also emphasize the thinking processes that allow students to construct new ideas, develop alternative strategies, and explain solutions in original and contextual ways. Zaiturrahmah et al. (2024) describe that students who are engaged in solving contextual problems through various creative stages, such as those proposed in Wallas' theory, are able to expand their cognitive flexibility and generate more diverse solutions.

According to Kadir et al. (2022), there are four indicators used to measure creative thinking ability: fluency, flexibility, originality, and elaboration. These four indicators constitute essential components in fostering students' creative thinking patterns in solving mathematical problems in a deep and contextual manner. However, classroom realities

indicate that most students have not yet mastered these four aspects optimally. For instance, the findings of Handayani et al. (2021) revealed that students' creative thinking skills in science learning, as measured by these four indicators, were still categorized as low.

The low level of students' achievement in mathematical creative thinking skills cannot be separated from instructional approaches that have not sufficiently provided opportunities for students to freely explore ideas, develop their own strategies, and independently identify connections among concepts. When instruction is overly oriented toward memorizing formulas and obtaining single correct answers, students are not accustomed to evaluating multiple possible solution alternatives. The findings of Nurdiana & Caswita (2024) indicate that students' creative thinking ability in trigonometry remains relatively low and requires more exploratory learning approaches. Similarly, Maryati & Parani (2021) emphasize the importance of instructional practices that encourage students to explore concepts in depth in order to generate diverse, creative, and meaningful alternative solutions. In addition, the instructional materials used by teachers must be capable of facilitating the development of students' mathematical creative thinking skills.

Instructional materials constitute a crucial component of the learning process, functioning as a medium for communication and for facilitating meaningful learning experiences. Materials designed in accordance with students' characteristics can enhance active engagement and support the development of higher-order thinking skills, including mathematical creative thinking. Research has shown that problem-based and contextual instructional materials, such as PBL-based student worksheets and those developed using a realistic approach, are effective in improving students' learning activities and conceptual understanding (Setiawati & Pixyoriza, 2024; Bimansah et al., 2025). Therefore, the development of instructional materials should be directed toward the presentation of open-ended and reflective problems that stimulate students' creativity and critical thinking.

One of the instructional materials widely used in mathematics learning is the Student Worksheet (LKS). Student worksheets function as guides for students' learning activities, containing a series of tasks, questions, and instructions designed to help students gradually construct conceptual understanding. Well-designed worksheets can encourage students to actively engage in the learning process, conduct explorations, participate in discussions, and reflect on their learning outcomes (Nurdin et al., 2019). However, conventional printed worksheets often have limitations in terms of interactivity, visualization, and feedback, making them less optimal in facilitating the development of

students' mathematical creative thinking skills. Therefore, innovation in worksheet development that integrates digital technology is necessary to create more dynamic, interactive, and meaningful learning experiences (Tsani & Sumargiyani, 2025)..

The development of information and communication technology has created new opportunities for the advancement of digital instructional materials that are more flexible, interactive, and adaptive to students' needs. One digital platform that can be utilized to develop interactive student worksheets is Wizer.Me. Wizer.Me is an online interactive platform that enables teachers to design worksheets enriched with visual and participatory elements. Its features—including interactive questions, multimedia integration (images, videos, and audio), and an automatic assessment system—provide a more dynamic and reflective learning experience. By utilizing this platform, students not only interact with the content but are also encouraged to explore ideas, test their understanding, and develop creative solutions to mathematical problems. This is in line with (Kopniak, 2018), who states that Wizer.Me is a practical and user-friendly learning platform that is effective in developing digital student worksheets that support active engagement and creative thinking.

The features available in Wizer.Me (https://www.wizer.me) have significant potential to enhance students' mathematical creative thinking skills, as they are designed to stimulate active, reflective, and collaborative thinking processes in accordance with the principles of meaningful learning in the Merdeka Curriculum. In general, Wizer.Me is implemented by allowing teachers to create interactive digital worksheets, distribute them to students through links or virtual classrooms, and subsequently monitor and provide direct feedback on students' responses. The platform offers various item types, such as open-ended questions, drag-and-drop activities, and matching tasks, which enable students to explore diverse problem-solving strategies and thereby develop fluency in thinking. Furthermore, multimedia support—including images, videos, and audio—assists students in understanding abstract concepts in a more visual and contextual manner, thereby strengthening flexibility in thinking. According to Syafira & Erita (2025), the use of Wizer.Me-based interactive worksheets provides teachers with flexibility in designing adaptive learning activities while simultaneously encouraging students' active engagement in exploring multiple possible solutions.

Furthermore, the reflection and collaboration features, which allow students to respond to their peers' work or review their own responses, encourage the emergence of new and unique ideas that differ from the majority, thereby contributing to the

development of originality in thinking. This is consistent with research findings indicating that technology-based collaborative activities and structured group learning can enhance students' creativity by providing opportunities to exchange ideas, communicate, and critically evaluate one another's perspectives (Situmorang, 2024; Nursaya'bani et al., 2025). Meanwhile, the automatic feedback and immediate formative assessment features provide students with opportunities to revise, expand, and deepen their explanations. This process strengthens elaboration skills, as students are encouraged to articulate their ideas in a coherent and argumentative manner.

By integrating these various features, Wizer.Me directly supports learning oriented toward the development of higher-order thinking skills, including mathematical creative thinking. Aisyah & Supriyo (2024) also state that the Wizer.Me platform is feasible to be used as a mathematics learning medium and is capable of increasing students' learning motivation. Based on these considerations, this study was conducted to develop Wizer.Me-based Student Worksheets aimed at producing instructional materials that are valid, practical, and effective in enhancing students' mathematical creative thinking skills. The novelty of this study lies in the design of Wizer.Me-based worksheets specifically structured to foster mathematical creative thinking. Therefore, this research is expected to generate instructional materials that are not only feasible but also empirically validated in terms of validity, practicality, and effectiveness.

## METHODS

This study employed a Research and Development (R&D) approach using the ADDIE model, which consists of the Analysis, Design, Development, Implementation, and Evaluation stages (Sugiyono, 2019). This approach was selected because the study aimed to produce a feasible and effective digital learning medium to enhance both the quality of the learning process and students' mathematics learning outcomes, particularly their mathematical creative thinking skills. The ADDIE model was chosen due to its systematic development procedures and its suitability for product-based educational research.

At the analysis stage, a needs analysis was conducted, including an examination of students' characteristics, curriculum requirements, and mathematics content relevant to mathematical creative thinking skills. The design stage focused on structuring the learning media, organizing the sequence of activities, formulating indicators of mathematical creative thinking, and developing assessment instruments. Subsequently, during the development stage, the learning media were produced in accordance with the established

design, validated by experts, and revised based on the validators' feedback. The implementation stage involved applying the developed media to students in order to obtain data on practicality and user responses. Finally, the evaluation stage aimed to assess the effectiveness of the media based on students' learning outcomes and user feedback, resulting in a final product deemed suitable for use in mathematics instruction.

The product developed in this study was a Wizer.Me-based Student Worksheet (LKS) on trigonometric functions, designed to stimulate the indicators of mathematical creative thinking skills, namely fluency, flexibility, originality, and elaboration. The research instruments included expert validation sheets, practicality questionnaires for teachers and students, and a mathematical creative thinking skills test to measure the effectiveness of the developed product. After undergoing the development process, the worksheets were validated by experts, revised according to their feedback, and subsequently implemented in a trial phase. Each stage of the procedure is described as follows:

1. Expert Validation

The evaluation data obtained from the subject-matter expert and media expert, in the form of comments and suggestions, were processed and analyzed descriptively by converting them into interval data using a Likert scale. To calculate the validity percentage of the collected data based on the assessment item scores, the following formula was used:

$$V_s = \frac{Total\ score\ for\ each\ indicator}{Maximum\ possible\ score\ per\ indicator} \times 100\%$$

$V_s$ calculation indicates the proportion of the instrument's validity. The resulting percentage values were then interpreted using qualitative criteria, as presented in Table 1.

**Table 1. Validity Criteria**

| Interval | Validity Criteria |
|---|---|
| $85\% < V_s \leq 100\%$ | Highly Valid |
| $70\% < V_s \leq 85\%$ | Moderatly Valid |
| $50\% < V_s \leq 70\%$ | Less Valid |
| $0\% < V_s \leq 50\%$ | Invalid |

2. Practicality Assessment

The practicality assessment in this study was conducted using questionnaires administered to two mathematics teachers and nine twelfth-grade students. A closed-ended questionnaire format was employed, in which no open-response column was provided; instead, a rating scale was used to measure respondents' perceptions as their answers. The

collected data were analyzed and the practicality percentage was calculated using the following formula:

$$P = \frac{Total\ score\ of\ all\ student}{Maximum\ score} \times 100\%$$

Where $P$ represents the level of practicality. The percentage scores were then interpreted into qualitative categories, as presented in Table 2.

**Table 2. Criteria for Practicality Assessment**

| Interval | Practicality Criteria |
|---|---|
| $85\% < P \leq 100\%$ | Highly Practical |
| $60\% < P \leq 85\%$ | Moderately Practical |
| $40\% < P \leq 60\%$ | Less Practical |
| $20\% < P \leq 40\%$ | Impractical |
| $0\% < P \leq 20\%$ | Highly Impractical |

3. Effectiveness Assessment

Students' responses and the results of the mathematical creative thinking skills test were used to determine the effectiveness of the developed product, namely the Wizer.Me-based Student Worksheets. A Likert scale technique was employed to analyze the questionnaire response data, which were subsequently calculated using the following formula:

$$E = \frac{Total\ score\ of\ all\ student}{Maximum\ score} \times 100\%$$

Where $E$ represents the level of effectiveness. The resulting percentage values were then interpreted into qualitative categories, as presented in Table 3.

**Tabel 3. Criteria for Effectiveness Assessment**

| Interval | Effectiveness Criteria |
|---|---|
| $80\% < E \leq 100\%$ | Highly Effevtive |
| $60\% < E \leq 80\%$ | Moderately Effevtive |
| $40\% < E \leq 60\%$ | Less Effevtive |
| $20\% < E \leq 40\%$ | Ineffevtive |
| $0\% < E \leq 20\%$ | Highly Ineffevtive |

The mathematical creative thinking skills test was administered to students before and after the learning intervention to determine the improvement in their mathematical creative thinking ability. The assessment was conducted using essay-type questions constructed based on the indicators of fluency, flexibility, originality, and elaboration, with a scoring rubric ranging from 0 to 4 and a maximum total score of 100. The data were analyzed using the normalized gain (N-gain) calculation to measure the improvement in

students' mathematical creative thinking skills after the implementation of the Wizer.Me-based Student Worksheets. The calculation employed the formula developed by Hake (Sundayana, 2025), as follows:

$$N - Gain = \frac{Posttest\ Score - Pretest\ Score}{Ideal\ Score - Pretest\ Score} \times 100\%$$

The N-gain scores can be classified into five categories: decrease, no change, low, moderate, and high.

## RESULT AND DISCUSSION

The Wizer.Me platform was selected as the medium for developing the Student Worksheets due to its interactive features, such as open-ended questions, audio responses, automatic feedback, and multimedia integration, all of which support inquiry-based and collaborative learning. In addition, Wizer.Me enables teachers to monitor students' thinking processes in real time through its dashboard feature. Figure 1 presents an example of the developed Wizer.Me-based Student Worksheet interface, which consists of a problem-orientation page, concept exploration through open-ended questions, group discussion facilitated by digital responses, and individual reflection as the closing activity of the lesson.

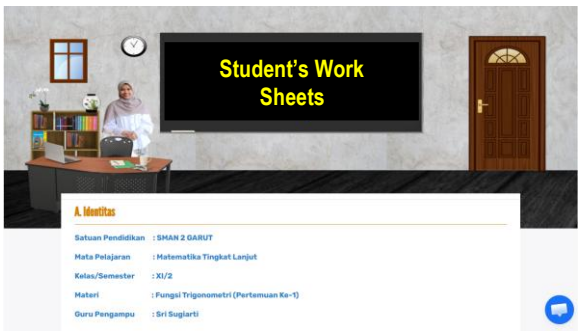


**Figure 1.** Interface of the Wizar.Me-Based Student Worksheet

The validity assessment was conducted by a subject-matter expert and a media expert on the developed Wizer.Me-based Student Worksheets. The evaluation by the subject-matter expert covered aspects of content feasibility, indicators of mathematical creative thinking, the quality of creative problem instruments, as well as the appropriateness of language and terminology. Meanwhile, the evaluation by the media expert included aspects of visual design and media functionality. The analysis results

indicated that the average validity percentage obtained from both the subject-matter expert and the media expert fell within the highly valid category, as presented in Tables 4 and 5.

**Table 4. Result of Subject-matter Expert Validation**

| Aspek | Presentase (%) | Kriteria |
|---|---|---|
| Content Feasibility | 90% | Highly Valid |
| Indicators of Mathematical Creative Thinking | 87% | Highly Valid |
| Quality of Creative Problem Instruments | 85% | Moderately Valid |
| Language and Terminology | 96% | Highly Valid |
| Overall Average | 89,5% | Highly Valid |

**Tabel 5. Result of Media Expert Validation**

| Aspek | Presentase (%) | Kriteria |
|---|---|---|
| Visual Design Quality | 84% | Moderately Valid |
| Media Functionality and Usability | 86% | Highly Valid |
| Overall Mean Score | 85% | Moderately Valid |

These findings indicate that the Wizer.Me-based Student Worksheets have met the criteria in terms of content feasibility, construction, and presentation, and are therefore suitable for use in instruction after revisions were made based on the validators' feedback. Following the expert validation process and completion of revisions, the next stage involved conducting a practicality assessment. The practicality assessment was carried out through response questionnaires administered to two mathematics teachers and nine twelfth-grade students. The evaluated aspects included ease of use, clarity of instructions, attractiveness of the interface, and the extent to which the worksheets facilitated students' understanding of trigonometric function concepts.

**Tabel 6. Result of Prakticality Assessment**

| Responden | Presentase (%) | Kriteria |
|---|---|---|
| Teachers | 87% | Highly Practical |
| Students | 90% | Highly Practical |
| Overall Mean Score | 88,5% | Highly Practical |

The analysis results indicated that the practicality percentage fell within the highly practical category. Teachers reported that the Wizer.Me-based Student Worksheets were easy to implement in classroom instruction, while students stated that the worksheets were easy to understand and assisted them in exploring concepts independently and collaboratively. These findings were supported by the systematic interface design of the

worksheets, clear navigation, and the presentation of contextual activities and open-ended tasks that were digitally accessible, as illustrated in Figure 2.

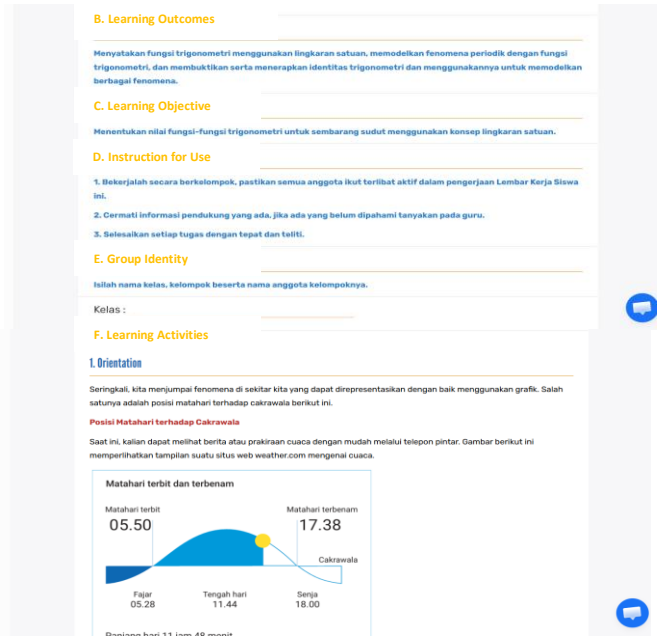


**Figure 2.** Learning Structure in The Worksheet

The effectiveness assessment was reviewed from two aspects, namely students' responses to the use of the worksheets and the results of the mathematical creative thinking skills test, as presented in Tables 7 and 8. Students' responses were used to determine the level of acceptance, interest, and ease of use of the worksheets in the learning process. Meanwhile, the test results were employed to measure the improvement in students' mathematical creative thinking skills after participating in learning activities using the Wizer.Me-based Student Worksheets. These two aspects provide a comprehensive overview of the product's effectiveness in supporting mathematics instruction.

**Table 7. Students' Responses to The Wizer.Me-Based Student Worksheets**

| Aspek | Presentase (%) | Kriteria |
|---|---|---|
| Facitiltates Conceptual Exploration | 90% | Highly Effective |
| Encourages Collaborative Discussion | 88% | Highly Effective |
| Enhances Conceptual Understanding | 84% | Effective |
| Overall Mean Score | 87,33% | Highly Effective |

The results of the student response questionnaire regarding the use of Wizer.Me-based worksheets showed a very high level of effectiveness. The aspect of facilitating concept exploration obtained a percentage of 90% with a very effective criterion, which indicates that the interactive features in Wizer.Me are able to encourage students to explore

the concept of trigonometric functions independently through various forms of activities, such as open-ended questions, visual-based exercises, and direct feedback. This shows that students do not only receive information passively, but are actively involved in the process of discovering and building conceptual understanding.

**Table 8. Result of Creative Mathemathical Thinking Test**

| Respondent | Mean N-Gain | Criteria |
|---|---|---|
| *Fluency* | 0,72 | High |
| *Flexibility* | 0,65 | Moderate |
| *Originality* | 0,58 | Moderate |
| *Elaboration* | 0,76 | High |
| Overall Mean Sccore | 0,68 | Moderate |

The N-gain calculation results indicated that the improvement in students' mathematical creative thinking skills fell within the moderate to high categories after using the Wizer.Me-based Student Worksheets. These findings are in line with previous studies stating that the use of digital learning media and active learning models can significantly enhance students' mathematical creative thinking skills (Vistara et al., 2024; Suherman & Vidákovich, 2025). Specifically, the fluency and elaboration indicators reached the high category, indicating that students were increasingly able to generate a wide range of ideas and develop solutions in detail. These results are consistent with the findings of Permatasari et al. (2024) and Maryati & Nurkayati (2021), who reported that exploration- and open-problem-based activities can improve students' fluency and depth of reasoning.

Meanwhile, the flexibility and originality indicators were categorized as moderate, showing that students began to employ diverse strategies and produce relatively unique solutions, although further reinforcement is still needed. This achievement pattern aligns with the study by Indrapangastuti et al. (2025), which found that students' flexibility and novelty in mathematical ideas tend to develop more slowly compared to fluency and elaboration, particularly when learning activities do not explicitly require exploration of multiple solution approaches. Thus, this study reinforces empirical evidence that technology-based learning interventions and higher-order thinking activities are effective in improving students' mathematical creative thinking skills, although additional support is necessary for flexibility and originality.

The validity test results indicated that the Wizer.Me-based worksheets were highly valid in terms of content feasibility, integration of mathematical creative thinking indicators, quality of test instruments, and accuracy of language and terminology. This suggests that the developed material aligns with learning outcomes, the conceptual

structure of trigonometry, and the characteristics of inquiry-based learning, as emphasized in previous e-LKPD development studies, which state that high content and construct validity are essential prerequisites for the feasibility of digital learning media (Febiola & Azhar, 2025; Rahmi, 2025). In addition, the aspects of visual design and media functionality were also categorized as highly valid, indicating that the interface layout, navigation, and interactive features support the effective implementation of learning. These findings are consistent with Tsani and Sumargiyani (2025) and Ramlah (2025), who concluded that graphic quality, interactivity, and ease of use are critical components in determining the validity of digital learning media. Therefore, the Wizer.Me-based worksheets were considered feasible for classroom use after minor revisions based on expert feedback, as recommended in studies on the development of educational technology-based media.

The practicality test results showed that the worksheets were highly practical according to both teachers and students. Teachers reported that the worksheets were easy to implement and facilitated systematic classroom management, while students stated that the instructions were clear, the interface was attractive, and the presented activities helped them understand trigonometric function concepts independently and collaboratively. These findings indicate that the integration of digital media via Wizer.Me can enhance the efficiency and convenience of classroom learning.

The effectiveness of the worksheets was demonstrated by students' responses, which fell into the highly effective category, and by the improvement in mathematical creative thinking skills, which ranged from moderate to high based on N-gain scores. These results are consistent with STEM-PjBL development research showing that worksheets effectively enhance students' creative thinking skills, as evidenced by differences in pretest and posttest scores and students' highly positive responses to the worksheets (Mulyaningrum et al., 2025). Furthermore, other studies on interactive multimedia-based worksheets reported that validated and practical worksheets contribute effectively to students' mathematical creative thinking, particularly through active engagement in the learning process (Riwayati et al., 2025).

Specifically, the fluency and elaboration indicators reached the high category, indicating that students were increasingly able to generate numerous ideas and develop solutions in detail. This is consistent with meta-analytic evidence showing that the use of worksheets has a significant effect on enhancing students' creative thinking skills in the domains of fluency and elaboration compared to other methods (Ahzari et al., 2026).

Meanwhile, the flexibility and originality indicators fell into the moderate category, suggesting that students were beginning to employ diverse strategies and produce relatively unique solutions, although further reinforcement is necessary. This achievement pattern aligns with the characteristics of deep learning, which emphasizes exploration, group discussion, and concept reflection as means to develop higher-order thinking skills, as also reported in project- and inquiry-based learning studies that gradually improve students' creativity.

Overall, the findings of this study demonstrate that the Wizer.Me-based worksheets are not only valid and practical but also effective in improving senior high school students' mathematical creative thinking skills. The integration of digital media with guided inquiry approaches has been shown to create meaningful, interactive learning that fosters higher-order thinking skills, particularly in the topic of trigonometric functions. These worksheets can serve as an innovative alternative learning medium to support mathematics instruction in accordance with the demands of the Merdeka Curriculum.

## CONCLUSION

This study resulted in the development of Wizer.Me-based Student Worksheets on trigonometric functions that met the criteria of being highly valid and highly practical, based on expert validation and practicality testing conducted by teachers and students. The worksheets were deemed feasible for use due to their strong content quality, linguistic clarity, visual design, and media functionality, thereby supporting the implementation of effective and meaningful mathematics instruction.

The effectiveness of the worksheets in improving students' mathematical creative thinking skills was demonstrated by the increase in N-gain scores, which fell within the moderate to high categories, particularly on the indicators of fluency and elaboration. These findings indicate that the use of Wizer.Me-based worksheets facilitates students in generating diverse ideas and developing solutions in a more detailed and systematic manner. Therefore, these worksheets are suitable to be used as an alternative instructional medium to enhance senior high school students' mathematical creative thinking skills, especially on the topic of trigonometric functions.

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