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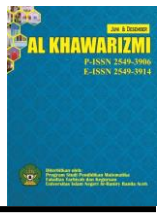

DEVELOPMENT OF CREATIVE THINKING EVALUATION TOOL UTILIZING MICROSOFT SWAY APPLICATION IN THE CONTEXT OF PYTHAGOREAN THEOREM MATERIAL

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Abstrak

The aim of this research is to develop an evaluation tool utilizing the Microsoft Sway application to assess the creative thinking abilities of eighth-grade students in comprehending the Pythagorean Theorem material. This study is a development research with a development model that includes measuring instrument specifications, statement or question writing, statement or question review, instrument compilation, trial, instrument selection and assembly, instrument administration, and scale and norm writing. The data analysis method used involves expert validation and student responses through questionnaires. The validity results indicate that all test items have been categorized as valid. The evaluation tool's reliability level reached 0.611, indicating a sufficient level of reliability. The average difficulty level of the questions is 0.66, classified as moderate, while the average discrimination power is 0.35, indicating a sufficient discrimination power. The results of this research, which have been validated by media experts with a final percentage of 84.82%, are classified as highly suitable. Content experts provided a final percentage of 79.00%, indicating feasibility. Student responses to this evaluation tool reached a final percentage of 93.17%, indicating a very high level of interest. Thus, it can be concluded that the development of a creative thinking evaluation tool based on the Microsoft Sway application for the Pythagorean Theorem material is suitable for use as an evaluation instrument in mathematics learning.

INTRODUCTION

Three crucial skills such as problem-solving, critical thinking, and creative thinking are essential prerequisites that must be possessed by the younger generation in the 21st century (Fadhila et al., 2022). As revealed by the Kasneci et al. (2023) and Urooj & Farooq (2023), the younger generation must have the ability to think critically, think creatively, and make good decisions to solve problems; these functions are crucial in the 21st century. Meanwhile, (Tohani & Aulia, 2022) states that to adapt to the 21st century, the ability to solve problems and creative thinking are highly needed. For instance, in the process of problem-solving, both critical and creative thinking are required, due to the challenges and problems posed by the rapid development of science and technology in this century, which are becoming increasingly complex for humans (Kooli, 2023; Salsabila et al., 2022)

In the 21st century, the rapid development of science and technology will also accompany the rapid development of technology in learning (Salsabila & Safira, 2021). The use of technology is no longer unfamiliar in learning, and indeed, all societal activities will not be far from the utilization of technology (Bibri, 2022; Hennessy et al., 2022). Mindset and behaviour can change for anyone who frequently uses technology (Siswanto et al., 2024). Based on this, modern technological developments can influence the field of education, such as planning, process, and evaluation of learning, as well as reducing costs and facilitating all human activities.

In the field of education, especially in the stage of learning evaluation, the government minimizes the use of a certain budget to apply practicality. Students become more enthusiastic and active in taking exams if teachers utilize technology in the process of evaluating learning outcomes. As intended by Flores-Aguilar et al. (2023), where with the use of IT by teachers, students are more interested and happy to participate. Furthermore, Bi et al. (2023) state that with the practical use of technology, it can facilitate students' learning. Additionally, Cerbito (2024), Harefa (2023) and Siswanto & Peni (2023) suggest that to achieve a high level of education, students need a strong understanding of mathematics.

Mathematics learning conducted by teachers so far mostly does not meet expectations. For example, the lack of variety during learning or when conducting evaluations with learning outcome questions (Lumbantoruan & Simorangkir, 2023). Not only that, Amalina & Vidákovich (2023) and Klingbeil et al. (2024) state that students experience difficulties in understanding a mathematical concept when solving problems, daily assessments, multiple-choice exercises, or other forms.

During the teaching and learning process of mathematics, such as in the Pythagorean theorem material, students feel difficulties not only in solving problems but also in the theorem itself, definitions, and other proofs related to the Pythagorean theorem material (Wittmann, 2021). In line with Martín-Sómer et al. (2024), who reveals that the use of conventional learning models leads to feelings of boredom felt by students. Classroom management techniques must be mastered by teachers so that the classroom atmosphere can be enjoyable, and students become active and creative during the learning process. Therefore, teaching methods and forms of learning evaluation utilizing competent learning media are needed (Anggraeni et al., 2023; Nur et al., 2023).

Teachers can use solutions that utilize Android as an intermediary, to increase understanding and attract students' attention, so that the learning and evaluation process becomes more varied and interesting. The use of android is one form that teachers have followed the developments in the education world in the 4.0 era, and students independently can access material, where there are already many applications that are easily accessible to students anytime and anywhere (Sembiring et al., 2022; Utami et al., 2023). Not only that, teachers can more easily provide notes, exercises, or materials to students, especially in the Pythagorean theorem material (Devi et al., 2023; Jatisunda et al., 2021; Shofiyyah & Qohar, 2022).

By using android, students can focus on questions in the Pythagorean theorem material on their androids. Based on observations and interviews with mathematics teachers at Dr. Wahidin Mlati Junior High School, most students have personal androids and are allowed to bring them to school for learning. In line with the research conducted by (Makhdum et al., 2023), which is the use of the Kahoot application to design effective mathematics learning evaluation tools in class X with research focusing on test instrument development. The difference lies in the test instrument in the research conducted by Sundari & Izzati (2020) comes from the book, while the researcher compiled their own test instruments and then tested their validity, reliability, difficulty level, and discrimination power of the test items.

Based on the explanation above, the researcher is interested in conducting research with the title "Development of Creative Thinking Evaluation Tool Based on Microsoft Sway Application for Pythagorean Theorem Material". In this study, a question is considered good overall if it has good display design validity on the Android platform, adequate item validity, high reliability, adequate discrimination power, and most questions have a moderate level of difficulty.

RESEARCH METHODS

The type of research conducted is research and development, which is one of the research methods to produce a specific product and test its effectiveness (Nurhikmah et al., 2021). The research was conducted at Dr. Wahidin Mlati Junior High School and applied with the Microsoft Sway application on the Pythagorean theorem material with eighth-grade students as the subjects of this study. The steps in research and test development can be illustrated in the following diagram (Firdaus, 2013; Cahyanti et al., 2019).

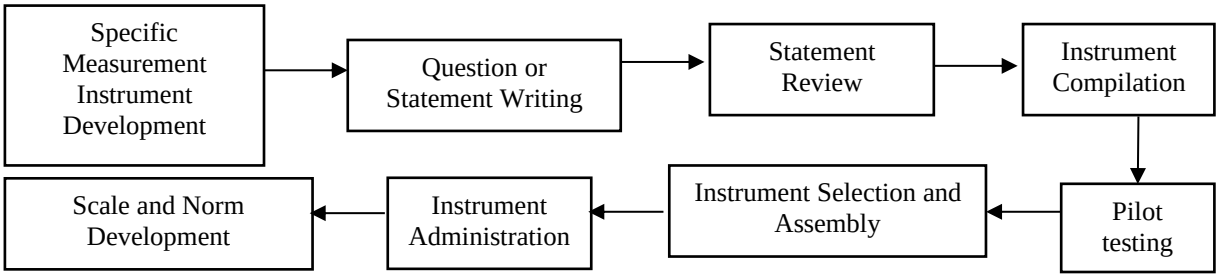

Figure 1. The Steps of Test Instrument Development Research

The data collection technique in this research used tests distributed to students containing questions on mathematics material from semester II, class VIII, as well as giving questionnaires as additional student responses. Responses from students, user questionnaires, and validation from media and content experts are collected. The research instruments include test instruments using mathematics learning competencies for class VIII semester II, as well as questionnaire instruments to measure perceptions, attitudes and thinking results of individuals or groups.

The data analysis techniques used are quantitative and qualitative. Qualitative data acquisition occurs during the validation stage based on input from several experts. Quantitative data describe the results of product development in the form of evaluation tools using Microsoft Sway, and the use of statistical experiments to analyze data. The quality of the product created by the researcher is then analyzed based on the results of evaluation questionnaires filled out by the experts.

RESEARCH RESULTS AND DISCUSSION

RESEARCH RESULTS

The research results consist of an assessment tool utilized with Microsoft Sway application for mathematics learning in grade VIII. The research and development model involved several stages in developing the evaluation tool, which are as follows.

Development of Measurement Tool Specifications

This research was conducted at Dr. Wahidin Junior High School. The researcher chose this school because it does not utilize Wi-Fi facilities that are already being used by teachers for assessing mathematics learning. Based on observation results, it was found that teachers still employ conventional assessment methods, such as paper-based tests. The objective of developing this product is to enhance teacher evaluation and student learning motivation. The developed product is an assessment tool using the Microsoft Sway application for mathematics learning in grade VIII. The information analysis regarding the needs at this stage is obtained through a questionnaire given to the students to evaluate the assessment tool.

Writing Questions and Statements

Relevant statements or questions are written in the form of mathematics problems related to the Pythagorean theorem. In the product development process, the researcher developed the assessment tool using the Microsoft Sway application. The questions developed are based on the Core Competencies/Basic Competencies of the Mathematics subject in grade VIII of Junior High School. The questions are presented in the form of an online survey.

Reviewing Questions or Statements

The aim of this research is to identify the item grid for each item's theoretical and structural relevance. To ensure that the points made for each individual can be correctly implemented in the web-based evaluation according to key figures and continued in the development stage. The item grid for the test questions can be presented in the following table.

Table 1. Grid of Test Question Instruments

Indicator of Creative Thinking Ability	Indicators of Competence Achievement	Question Indicator	Question Number
Fluency	Applying the Pythagorean theorem as a way of solving problems	Given a problem, students are able to apply the Pythagorean theorem as a problem solving	1, 2, 3
Flexibility	Generate various answers to solve problems related to the application of the Pythagorean theorem	Given a problem, students are able to apply the Pythagorean theorem as a problem solving	4
Originality	Determines the ratio of the sides of a right triangle with the application of the Pythagorean theorem	Given a problem, students are able to determine the ratio of the sides of the isosceles right triangle that is implemented in the problem	5

Instrument Compilation

Question Design

The question design consists of an online test format where the questions are grouped according to categories displayed in the application. The review of the test items that have been examined and the initial design of the questions are arranged in the test interface according to online test categories using the Microsoft Sway application with the assistance of Google Forms.

Expert Media Validation

The validation of the questions is carried out by experts to test the validity of the online assessment tool. The media expert validation is conducted by Dr. Andriyani, M.Sc., a Mathematics Education lecturer at Ahmad Dahlan University, as Validator 1 (V_1), and Mrs. Siti Atwano Pisriwati, S.Si., M.Pd., a Mathematics teacher at Dr. Wahidin Junior High School, as Validator 2 (V_2). The validation of the questions is performed using a checklist questionnaire as follows.

Table 2. Percentage on Media Expert Assessment Indicators

Assessment Indicator	Criteria	V_1	V_2	V_{total}	Percentage	Information
Presentation Eligibility	1	3	3	6	75%	Suitable
	2	3	3	6	75%	Suitable
	3	3	4	7	87,5%	Highly Suitable

Language	4	4	4	8	100%	Highly Suitable
	5	3	3	6	75%	Suitable
	6	3	4	7	87,5%	Highly Suitable
	7	3	4	7	87,5%	Highly Suitable
Graphics	8	4	4	8	100%	Highly Suitable
	9	3	3	6	75%	Suitable
	11	3	4	7	87,5%	Highly Suitable
	12	3	4	7	87,5%	Highly Suitable
	13	3	3	6	75%	Suitable
	14	3	4	7	87,5%	Highly Suitable
	15	3	4	7	87,5%	Highly Suitable
Average		3,14	3,64	6,78	84,82%	Highly Suitable

Based on the table above, it can be seen that the media expert survey results obtained an average score of 84.82% in the "Highly Suitable" interpretation category.

Expert Content Validation

The validation of the questions is carried out by three experts to test the validity of the online assessment tool. The content expert validation is conducted by Dr. Andriyani, M.Sc., a Mathematics Education lecturer at Ahmad Dahlan University, as Validator 1 (V_1), Mr. Padrul Jana, M.Sc., a Mathematics Education lecturer at PGRI University Yogyakarta, as Validator 2 (V_2), and Mrs. Siti Atwano Pisriwati, S.Si., M.Pd., a Mathematics teacher at Dr. Wahidin Junior High School, as Validator 3 (V_3). The validation of the questions is performed using a checklist questionnaire as follows.

Table 3. Percentage on Material Expert Assessment Indicators

Assessment Indicator	Criteria	V_1	V_2	V_3	V_{total}	Percentage	Information
Content Eligibility	1	3	3	3	9	75%	Suitable
	2	3	4	3	10	83%	Highly Suitable
	3	3	3	3	9	75%	Suitable
Language	4	3	2	4	9	75%	Suitable
	5	3	4	3	10	83%	Highly Suitable
	6	3	3	3	9	75%	Suitable
	7	3	3	4	10	83%	Highly Suitable
	8	3	3	4	10	83%	Highly Suitable
Eligibility of Presentation	9	3	3	3	9	75%	Suitable
	10	3	3	3	9	75%	Suitable
	11	3	3	4	10	83%	Highly Suitable
	12	3	3	4	10	83%	Highly Suitable
Compatibility with creative thinking	13	3	3	4	10	83%	Highly Suitable
Average		3,00	3,08	3,46	9,54	79,00%	Suitable

Based on the table above, it can be seen that the results of the survey processing of media experts obtained an average score of 79.00% in the criteria for interpretation of the "Suitable " category.

Pilot Testing

The next stage is the pilot testing phase. After the online assessment tool has been validated by experts, it is then piloted to assess its effectiveness. The pilot testing is conducted at Dr. Wahidin Junior High School, specifically in grade VIII. A total of 21 students are selected as participants for the pilot testing. Once the students have completed the online test, the researcher distributes a questionnaire to gather feedback from the students regarding the Microsoft Sway assessment tool. After all the data is collected, the students' online test results are analyzed to determine the validity, reliability, difficulty, and various performance tests to determine which questions are suitable for the final product. A summary of the pilot testing results can be seen in the following table.

Table 4. Summary of Pilot Testing Results

Question Number	Validity ($r_{table} = 0,4329$)		Reliability (*Cronbach's Alpha*)		Item Difficulty		Item Discrimination		Information
	r_{count}	Criteria	Results	Criteria	Results	Criteria	Results	Criteria	
1	0,770	Valid	0,611	Sufficiently	0,76	Easy	0,31	Sufficiently	Revised
2	0,536	Valid			0,54	Moderate	0,31	Sufficiently	Used
3	0,561	Valid			0,79	Easy	0,21	Sufficiently	Revised
4	0,774	Valid			0,63	Moderate	0,21	Sufficiently	Used
5	0,597	Valid			0,60	Moderate	0,20	Sufficiently	Used
Average					0,66	Moderate	0,25	Sufficiently	Used

Based on the table above, it can be observed that Question number 1 has a valid validity result, a satisfactory reliability result, an easy difficulty index, and an acceptable item discrimination, indicating that the question needs revision. Question number 2 has a valid validity result, a satisfactory reliability result, a moderate difficulty index, and an acceptable item discrimination, indicating that the question can be used. Question number 3 has a valid validity result, a satisfactory reliability result, an easy difficulty index, and an acceptable item discrimination, indicating that the question needs revision. Question number 4 and 5 have valid validity results, satisfactory reliability results, moderate difficulty indexes, and acceptable item discrimination, indicating that the questions can be used.

Instrument Selection and Assembly

After the product has been validated and tested, it is accepted by the validators to ensure that the product can be presented effectively to students, supporting evaluation and implementation in schools. The results obtained are as follows.

Table 5. Improvements by Material Experts

Suggestion	Revision Results
Revised matter	The question has been revised
Add questions with the fluency category	It is already done

Table 6. Improvements by Media Experts

Suggestion	Revision Results
The order of questions is adjusted to the material	The order of questions is correct
The title of the test is adjusted	The title of the test is appropriate

Instrument Administration

The development of the evaluation tool in the form of an Android-based test, which was piloted using the Microsoft Sway application, received feedback from students in grade VII at Dr. Wahidin Junior High School. The assessment results of the piloted instrument involved 21 students, as follows.

Table 7. Student Assessment Results

Indicator	Percentage	Criteria
Eligibility of Presentation	98,81%	Highly Engaging
Content Eligibility	91,67%	Highly Engaging
Graphic Eligibility	93,25%	Highly Engaging
Language Qualification	89,29%	Highly Engaging
Compatibility with the ability to think creatively	92,86%	Highly Engaging
Average	93,27%	Highly Engaging

Based on the table above, the initial assessment by students in developing the assessment tool using Microsoft Sway yielded the following evaluation indicators: presentation suitability with a percentage of 98.81%, content suitability with a percentage of 91.67% - highly engaging, graphic suitability with a percentage of 93.25% - highly appealing, language suitability with a percentage of 89.29% - highly engaging, and alignment with creative thinking abilities with a percentage of 92.86% - highly engaging. Thus, the average percentage obtained is 93.17% - highly engaging.

The test results obtained from the learning test conducted with 21 students at Dr. Wahidin Junior High School, with a minimum passing grade of 65, indicate the percentage of creative thinking abilities as shown in the following table.

Table 8. Percentage of Creative Thinking Ability Tests

Creative Thinking Indicator	Score Obtained	Max Score	Percentage
Fluency	175	252	69,4%
Flexibility	105	168	62,5%
Orisinality	127	210	60,5%

Based on the table above, it can be seen that the percentage of fluency indicators reached 69.4%, flexibility reached 62.5%, and originality reached 60.5%. Can be seen in the following figure 2.

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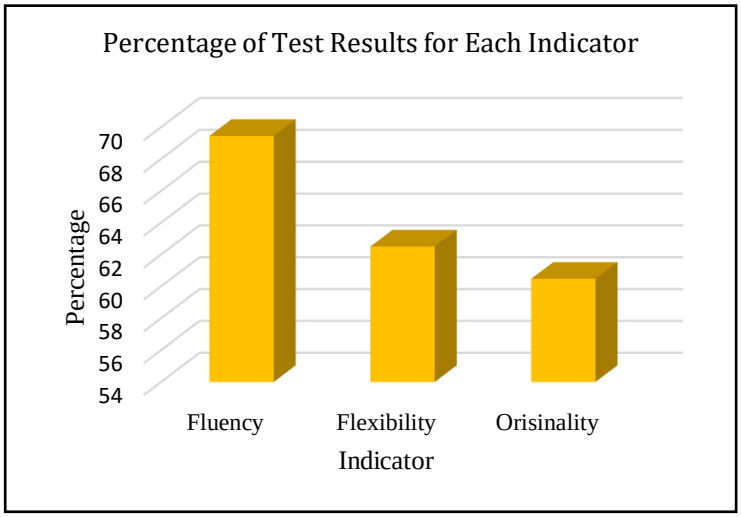

Figure 2
Percentage Chart for Creative Thinking Ability Test

While the test scores of students can be seen in the following figure 3.

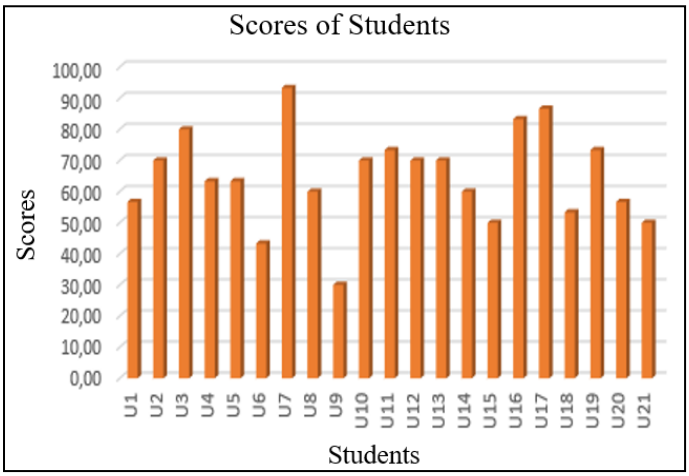

Figure 3
Graph of Student Test Scores

Based on the graph above, it is found that the average value of the test is 64.60, with the highest score obtained is 93.33 and the lowest value obtained is 30.00.

Scale and Norm Development

Table 9. Media Expert Assessment Results

Assessment Indicator	Percentage	Information
Presentation Eligibility	79,17%	Suitable
Language	87,50%	Highly Suitable
Graphics	85,71%	Highly Suitable
Average	84,82%	Highly Suitable

Based on the above image, it can be seen that the suitability of presentation indicator obtained a percentage of 79.17% and falls into the category of "suitable", language suitability obtained a percentage of 87.50% and falls into the category of "highly suitable ", and graphic suitability obtained a percentage of 85.79% and falls into the category of "highly suitable". Based on these results, it can be concluded that the average assessment result from the media experts is 84.82% and falls into the category of "highly suitable".

Table 10. Results of Material Expert Assessment

Assessment Indicator	Percentage	Information
Content Eligibility	83,33%	Highly Suitable
Language	77,50%	Suitable
Eligibility of Presentation	78,13%	Suitable
Compatibility with creative thinking	75,00%	Suitable
Average	78,85%	Suitable

Based on the image above, it can be seen that the feasibility assessment indicator has a percentage of 83.33% and falls under the category of "highly suitable". The language indicator has a percentage of 77.50% and falls under the category of " suitable ". The presentation feasibility indicator has a percentage of 78.13% and falls under the category of "suitable". Lastly, the suitability indicator for creative thinking has a percentage of 75.00% and falls under the category of suitable. Based on these results, it can be concluded that the average assessment result by media experts is 78.85% and falls under the category of suitable.

DISCUSSIONS

This research was specifically conducted in the environment of Dr. Wahidin Mlati Junior High School, which was chosen as the research location due to its minimal utilization of Wi-Fi as a means of assessing mathematics learning. During the observation, it was found that the assessment approach applied by teachers in this school is still conventional, using paper-based tests as a measurement tool to assess students' achievements. The objective of developing this evaluation tool is to stimulate the improvement of creative thinking skills and motivate students' learning enthusiasm, in line with the research by Conradty & Bogner (2020), Merta et al. (2023), Nahar et al. (2022), Tang (2024) and Tashtoush et al. (2023). In an effort to achieve these objectives, an innovative assessment tool was designed using Microsoft Sway, specifically for eighth grade. Microsoft Sway is one of the cloud-based media storage applications, in other words, users store content in such a way that it is connected to the user's device or social network (Herliza & Nirwana, 2023; Mishra & Tyagi, 2022; Unlu & Kiray, 2022; Utami et al., 2022). Sway presents content in a modern style and has functions similar to applications (Suherman et al., 2019). According to Hanika & Guspatni (2023), Merliana et al. (2021) and Vicentini et al. (2022), Microsoft Sway can be considered a tool used for presentations using the internet and has various features, so that when the presentation is run, it can combine images, text, audio, and even video.

This development process began with needs analysis through the administration of questionnaires to students, which included writing relevant mathematics questions related

to the Pythagorean theorem material. This approach was designed to ensure that the developed assessment tool is truly responsive to the needs and understanding of students regarding the material taught. In the context of product development, the researcher focused on developing mathematics questions for eighth grade. As a further step, an online survey was used to ask relevant questions, which then became an integral part of the assessment tool development process. Subsequently, the question designs were packaged in an online test format with categorization based on categories, and the item review process and initial design were arranged in an online-based test display, with the support of the Microsoft Sway application.

The validation of the questions was carried out by experts, including Mathematics Education Lecturers from Ahmad Dahlan University as validator 1 and Mathematics Teachers at Dr. Wahidin Mlati Junior High School as validator 2. The processing of media expert survey results showed an average score of 84.82% categorized as "Very Suitable", while the processing of media expert surveys resulted in an average score of 79.00% categorized as "Suitable". The next step involved the pilot testing phase, where the online evaluation tool that had been validated by experts was tested in eighth-grade classes at Dr. Wahidin Mlati Junior High School. A total of 21 students participated as trial respondents, and after completing the online test, the researcher distributed questionnaires to collect in-depth assessments regarding the experience of using the Microsoft Sway assessment tool. With all the data and feedback collected, the results of the students' online tests were processed to find validation, reliability, difficulty, and various performance tests. This analysis aimed to determine which questions are suitable for use in the final product. The results showed that some question numbers needed revision, such as question numbers 1, 3, and 5, while question numbers 2, 4, and 5 can be considered effective and can be used. This final product then underwent the final stage, which was validated by validators to ensure its quality before being presented to students. From this process, valuable suggestions were obtained from validators for further improvement. In line with Liu et al. (2023), Meisuri & Manik (2023), Oo et al. (2023) and Rahman et al. (2022) who stated the importance of instrument validation to ensure its quality before being presented to students.

As the culmination stage, the development of the evaluation tool involved an Android-based test that was tested using the Microsoft Sway application. The results of this test showed positive responses from students in seventh-grade classes at Dr. Wahidin Mlati Junior High School. The assessment results of the trial instrument involving 21 students obtained an average percentage of 93.17%, indicating it as highly appealing. Indicator percentages, such as fluency reaching 69.4%, flexibility 62.5%, and originality 60.5%, provide a comprehensive picture of the product's success in meeting user needs and expectations. Overall, this evaluation proves that this product is suitable for use in educational environments and can be a valuable contributor to improving the effectiveness of mathematics learning at Dr. Wahidin Mlati Junior High School.

CONCLUSIONS

The evaluation tool using the Microsoft Sway application has been developed through a series of steps in the development of test instruments. The validity results show that all question numbers are categorized as valid, with a reliability of 0.611, meeting the criteria for reliability sufficiency. The average difficulty level of the questions is 0.66, categorized as

moderate difficulty level, and the average discrimination power is 0.35, meeting sufficiency criteria. This evaluation tool has undergone validation by media experts, with a final percentage of 84.82%, categorized as very suitable. Validation was also conducted by content experts, who gave a final percentage of 78.85%, categorized as suitable. Students' responses to the assessment of the evaluation tool based on the Microsoft Sway application on the Pythagorean theorem material reached an average percentage of 93.17%, indicating it is highly appealing, thus concluding that the evaluation tool based on the Microsoft Sway application for the Pythagorean theorem material is suitable for use.

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