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TEST INSTRUMENT DEVELOPMENT WITH LOCAL WISDOM CONTEXT ASSISTED BY THE ISPRING APPLICATION IN MATHEMATICS COURSE

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Abstrak

Meskipun pembelajaran daring terus berkembang, masih terdapat kekurangan alat evaluasi yang andal untuk menilai kemampuan matematika mahasiswa secara akurat. Penelitian ini bertujuan untuk mengatasi kesenjangan ini dengan mengembangkan instrumen tes, yang didukung oleh aplikasi iSpring, untuk mengukur kemampuan ini secara efektif. Penelitian ini termasuk dalam kategori *Penelitian dan Pengembangan* (R&D), sebuah proses sistematis yang bertujuan untuk menciptakan dan menguji solusi inovatif untuk mengatasi tantangan khusus dalam bidang pendidikan. Instrumen penelitian terdiri dari lembar validitas, kuesioner tanggapan dosen dan mahasiswa, serta tes. Analisis lembar penilaian ahli kemudian dilakukan, termasuk analisis tanggapan siswa dan dosen, validitas pertanyaan, uji reliabilitas, uji tingkat kesulitan, dan uji perbedaan pertanyaan. Proses pengembangan mengikuti empat tahap: analisis awal, evaluasi diri, pembuatan prototipe, dan uji lapangan. Instrumen yang dihasilkan menunjukkan validitas dan reliabilitas yang tinggi, dikategorikan sebagai praktis, dan terdiri dari item dengan tingkat kesulitan mudah dan daya beda sedang. Sedangkan rata-rata kemampuan matematika mahasiswa berada pada kategori sedang.

Kata kunci: Aplikasi iSpring; Instrumen Tes; Kearifan Lokal

Abstract

While online learning continues to expand, there remains a lack of reliable evaluation tools to accurately assess students' mathematical abilities. This study aims to address this gap by developing a test instrument, supported by the iSpring application, to effectively measure these abilities. This study falls under the category of 'Research and Development' (R&D), a systematic process aimed at creating and testing innovative solutions to address specific challenges within the field of education. The research instruments consist of validity sheets, lecturers, student response questionnaires, and tests. An analysis of the expert assessment sheets was then carried out, including an analysis of the responses of students and lecturers, the validity of the questions, the reliability test, the level of difficulty test, and the different tests of the questions. The development process followed four stages: preliminary analysis, self-evaluation, prototyping, and field testing. The resulting instrument demonstrated high validity and reliability, was categorized as practical, and consisted of items with an easy difficulty level and moderate discrimination power. Meanwhile, the average mathematics ability of students is in the moderate category.

Keywords: iSpring Application;Test Instrument; Local Wisdom

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INTRODUCTION

Technological advances have drastically altered how people communicate and disseminate information. The digital revolution, initiated by the development of Internet-based technology, has impacted almost every aspect of life, including education (Moore et al., 2011; Engelbrecht et al., 2020; Villa-Ochoa et al., 2022; Timotheou et al., 2023). This impact is not limited to how we access information but has fundamentally changed the ways we learn and teach. For example, the application of ICT in mathematics education has facilitated interactive and learner-centered approaches, enabling students to explore mathematical concepts through digital tools and simulations (Phuong et al., 2022; Majid et al., 2024). Empirical studies have demonstrated that the effective integration of technology in education can significantly enhance student engagement and academic performance. For instance, García-Hirschfeld et al. (2025) found that students' perceptions of the use of assistive devices increased from 4.11 to 4.23. Li et al. (2025) also showed that the use of AI can improve students' understanding.

In the context of mathematics education, the use of technology has gained significant attention (Fan et al., 2022). The Internet has facilitated a major transformation in math classroom (Engelbrecht et al., 2020; Zakaria et al., 2024). The use of technology provides a more interesting and effective learning experience due to its various features (Marín-Vega et al., 2024) and can encourage positive emotions that encourage achievement in mathematics (Saccardo et al., 2024). Providing feedback in assessments is also effective with the use of technology (Annuš & Kmeť, 2024; Goyal et al., 2023; McCracken et al., 2024; Uwineza et al., 2023). It is undeniable that the use of technology in mathematics learning provides many benefits, both in delivering material and in assessment.

Assessing learning in a digital environment is complex, necessitating reliable and effective evaluation tools. Technology-assisted test instruments are critical for learning assessments (Dalby & Swan, 2018; Clark-Wilson et al., 2020). These instruments help evaluate cognitive changes and present student learning outcomes (Mudrikah et al., 2021; Azizah et al., 2024). Online assessments allow assessments to be carried out more quickly and efficiently (Vivek et al., 2023) and track student progress (Antoniuk & Chernysh, 2023) making it easier to determine follow-up actions to improve student abilities. Several previous studies have developed test instruments with technology, such as Irfandi et al. (2022) developing a test instrument to measure scientific literacy skills and Kielo-Viljamaa et al. (2020) developing a test instrument to measure the competencies of nursing students and podiatrists. Therefore, educators need to innovate in carrying out assessments. This approach is considered inefficient, as students need additional time to submit their answers via the Learning Management System (LMS). Consequently, there is an urgent need for developing evaluation tools that can be utilized online, such as the iSpring application.

iSpring is a promising solution in this context. It is a multimedia learning medium that leverages information and communication technology (ICT) to create online and offline questions, quizzes, and tests (Nurwijayanti et al., 2019; (Ramadhani & Liwayanti, 2021; Rhomadhoni & Sulaikho, 2022). iSpring Quiz Maker, a component of this application, can manage various types and levels of question difficulty, including true/false, multiple choice, essays, matching, sorting, numerical, fill-in-the-blank, multiple response, inserting words into paragraphs, and pinpointing locations in images (Zakaria et al., 2017). Thus, iSpring has great potential to enhance the evaluation process in online learning, including mathematics subjects.

Several studies have demonstrated the benefits of using iSpring in mathematics education. For instance, Anwar et al. (2019) reported that iSpring-based interactive mathematics learning increased student interest. Kosareva et al., (2021) found that iSpring improved student performance by promoting better and faster learning. Additionally, Cahyanti et al. (2019) noted that iSpring Suite 8 could create effective online and offline mathematics tests.

However, despite these positive findings, previous studies have not fully explored the integration of local wisdom in the development of iSpring-assisted test instruments. While local wisdom is acknowledged for its potential to enrich students' learning experiences and make learning materials more contextually relevant (Burkhardt, 2009; Fahrurrozi et al., 2020), there remains a gap in incorporating these elements into digital educational tools. Incorporating local wisdom into mathematics education could help students connect mathematical concepts to their cultural contexts, facilitating a deeper understanding (Khaerunnisa & Pamungkas., 2018; Maryati & Prahmana, 2019). This study seeks to fill this gap by developing mathematics test instruments that integrate local wisdom, using the iSpring application, particularly in the Mathematics I course for the PGMI program at UIN Alauddin Makassar. Notably, the PGMI program at UIN Alauddin Makassar relies solely on written tests for online midterm exams (UTS), which are supervised via Zoom meetings, highlighting a need for more interactive and culturally relevant assessment methods.

This research aims to empirically explore how integrating local culture into mathematics learning materials can enhance student interest and performance, while also aligning with the PGMI program's roadmap to develop culturally relevant and effective mathematics education.

By developing iSpring-based mathematics test instruments that incorporate elements of local cultural wisdom, this study aims to offer novel insights and practical solutions. Empirically, it will explore how cultural integration can improve student comprehension and engagement. Integration with local cultural context can help students see the relevance of mathematical concepts to everyday life. Policy-wise, it aims to support the development of more contextual and inclusive evaluation methods in mathematics education, contributing to the PGMI program's research priorities. The development of test instruments using the iSpring application is also an effort to encourage innovation in culture-based learning technology.

METHOD

This study employed a Research and Development (R&D) approach to design, implement, and evaluate a technology-assisted test instrument. The R&D method is suitable for systematically creating educational products, particularly when iterative validation and refinement are required. Tessmer's formative research model (preliminary, self-evaluation (curriculum analysis, material analysis, student analysis, and design), prototyping (validation, evaluation, and revision), and field testing) were used in the development process (field tryout). Tessmer’s formative research model is used in developing test instruments because it is iterative, allows for repeated evaluation, involves expert evaluation and user trials, and can be adapted to specific contexts, in this case local wisdom. Figure 1 illustrates the detailed stages of the development process following Tessmer’s formative evaluation model as applied in this study. The process begins with the preliminary stage, where the initial design of the learning product is prepared. This is followed by self-evaluation, in which the developer independently reviews and improves the draft before involving external parties. The next phase is the development of Prototype I, which undergoes two types of evaluation: expert review (where content accuracy and relevance are assessed by experts) and one-to-one evaluation (involving individual users to identify usability issues).

Based on the feedback from this stage, the product is revised to produce Prototype II, which is then tested in a small group to evaluate its clarity, appeal, and functionality. After further revisions, Prototype III is created and subjected to a field test, assessing the overall effectiveness and reliability of the product in a real-world setting. If the test results are satisfactory and the product is deemed reliable, it is finalized as the final prototype. Otherwise, additional revisions are made based on the test findings. Throughout this process, the product moves from low resistance to revision to high resistance to revision, indicating increasing stability and refinement of the development.

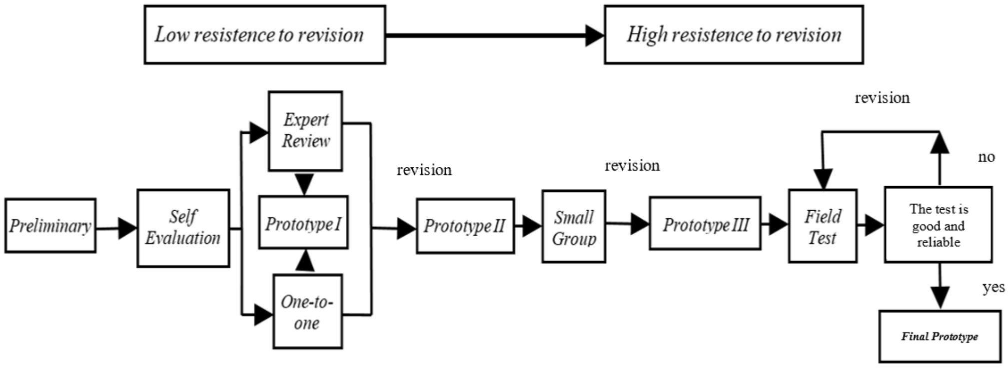

Figure 1. Model for Formative Research Development (Tessmer)

In the Mathematics 1 course of the PGMI study program, the product developed in this study is a test instrument in the form of multiple-choice questions aided by the iSpring application. The sample was selected using purposive sampling, a non-probability sampling technique chosen to ensure the participants possessed specific characteristics relevant to the study. In this case, the selected participants were 16 PGMI students from the Faculty of Tarbiyah and Teacher Training at UIN Alauddin Makassar, all of whom had previously completed the Mathematics 1 course. This criterion was applied to ensure that the participants had adequate background knowledge and experience with the subject matter being studied. The data collection was conducted using three main instruments: test instrument validation sheets, student and lecturer response questionnaires, and test instruments. Each instrument served a specific purpose in evaluating the quality and effectiveness of the developed materials.

The data analysis process involved several techniques (Arsyad, 2016). First, expert assessment sheets were used to validate the content and structure of the learning materials. Then, responses from students and lecturers were analyzed to evaluate the practicality and acceptability of the materials.

Furthermore, the test instruments underwent analysis, including item validity tests to ensure each question accurately measured the intended construct. Reliability tests were conducted to assess the consistency of the test results. Additionally, index difficulty tests were used to determine the level of difficulty of each item, and item discrimination tests were carried out to evaluate how well each item could distinguish between high- and low-performing students. The following are the criteria for validity, reliability, level of difficulty and differentiating power used:

Table 1. Analysis Criteria

Analysis Techniques	Quality of Test Items
Item Validity	$r_{pbis} = \sqrt{\frac{M_p - M_t}{SD_t} . \frac{p}{q}}$ (Wiersma & Jurs, 1990)
Item Reliability	$\alpha = \left(\frac{k}{k-1}\right)\left(\frac{1 - \sum s_{Y_i}{}^2}{s_{X_{total}}}\right)$ (Cronbach, 1951)
Index Difficulty	$p = \frac{N_p}{N}$ (Thorndike & Hagen, 1969)
Item Discrimination	$D = P_A - P_B$ (Supranto, 2012)

RESULT AND DISCUSSION

The results obtained from the research have to be supported by sufficient data. The research results and the discovery must be the answers, or the research hypothesis stated previously in the introduction part.

The preliminary stage revealed that online assessments in the PGMI program were still conducted using conventional methods, primarily written exams monitored through video conferencing applications such as Zoom or Google Meet. This approach was found to be inefficient and lacked interactivity, making it less effective in evaluating student understanding in an online learning context. Additionally, the review of related literature highlighted the potential of digital tools, particularly iSpring in enhancing the development and delivery of test instruments. These findings underscored the need for a more integrated and autonomous digital assessment solution. As a result, the mathematics 1 course in the Madrasah Ibtidaiyah Teacher Education (PGMI) Study Program was selected as the focus of the study, with students enrolled in the program serving as the research subjects.

The second stage, self-assessment, resulted in the development of a test instrument prototype grounded in local wisdom. Through material and student analysis, the researchers successfully produced a structured test blueprint, which included detailed question grids, initial item drafts, and corresponding answer keys. In addition, observation sheets and response questionnaires were designed to support further evaluation. The outcome of this stage was Prototype 1, consisting of 20 multiple-choice questions that aligned with the identified learning objectives and reflected the integration of local cultural contexts into the assessment content.

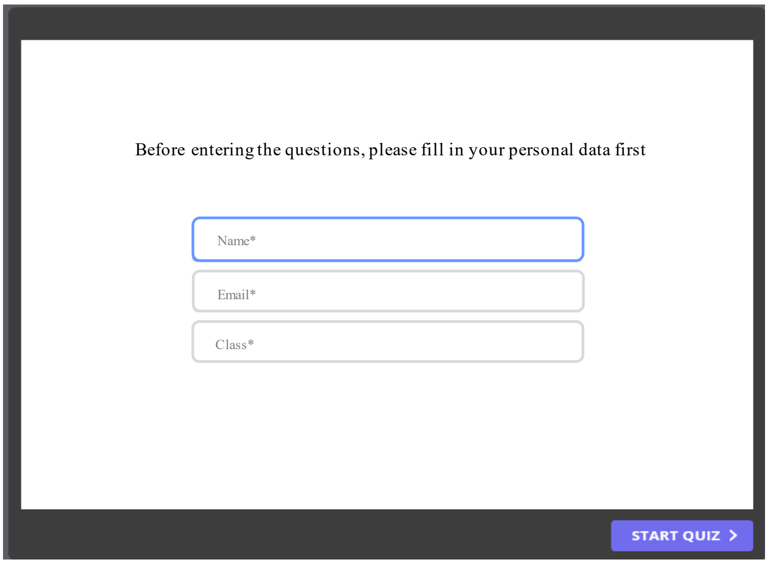

Figure 2. Quiz Home Page

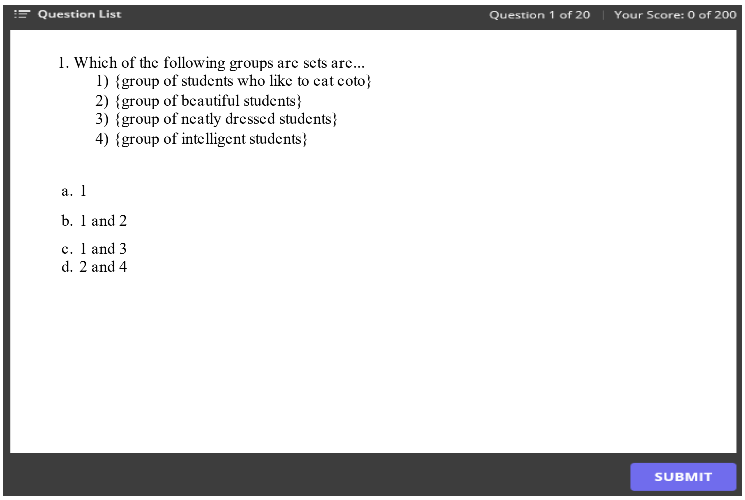

Figure 3. Test Example Number 1

The prototyping stage resulted in several key improvements to the test instrument based on expert validation and user trials. Feedback from a linguist, material expert, and media expert led to specific revisions in question and instructions.

Following these revisions, one-on-one trials were conducted with individual students, who reported improved comprehension and ease of use, resulting in Prototype 2. Subsequent small group testing further confirmed the instrument's practicality and reliability, culminating in Prototype 3 with 20 refined and validated question items. The revisions, including specific changes in question content and instructions, are summarized in the following table.

Table 2. Revision of Test Instruments during the Prototyping Stage

Revision Focus	Before Revision	After Revision
Question number 4	There are 36 students in class 9B; after being recorded, 15 students like the game Mappadendang, 18 students like the game Makkadaro, and 7 students do not like both. Many students enjoy both.	There are 36 students in class 9B; after being recorded, 15 students like the game Mappadendang, 18 students like the game Makkadaro, and 7 students like both. Many students dislike these games (Mappadendang and Makkadaro).
Instructions for working on the question	Answer the questions in 40 minutes.	1. Answer all questions in 40 minutes. 2. The correct answer is worth ten points. 3. The wrong answer is zero. 4. After answering the question, click submit to move on to the next one. 5. Questions that have already been answered cannot be changed.

The validation by experts revealed the following results: 1) the average assessment of linguists was 95; 2) the average assessment of material experts was 90; and 3) the average assessment of media experts was 86.25, all of which were "very suitable." Consequently, additional field tryout was conducted.

A field test was conducted in the fourth stage. Field tryout was conducted on the research subjects, namely, all PGMI students in class A. Based on the results of the tryout, the following findings were identified and interpreted to assess the effectiveness and quality of the test instruments developed.

Table 3. Analysis Results of Student Response Questionnaire

Indicator	Percentage	Category
Interesting	76.22	Positive
Content Quality	78.12	Positive
Language	74.48	Positive
Facilities	64.06	Positive
Average	73.22	Positive

According to Table 3, The average student response rate to the iSpring-assisted test was 73.22%, indicating a generally positive reception. This level of acceptance suggests that the iSpring application effectively supports digital assessment practices that are user-friendly and engaging for students. Such positive student responses reflect the importance of technological usability and learner engagement in digital learning environments. This aligns with findings from Akpen et al. (2024), who emphasized that the quality of digital tools and student motivation are critical factors influencing the effectiveness of online learning platforms.

Furthermore, the integration of interactive elements in iSpring aligns with constructivist learning principles, which emphasize active student involvement and autonomy in the learning process. Zin et al. (2024) highlights that modern Learning Management Systems (LMS) designed with constructivist approaches incorporating features like gamification and personalized learning paths to enhance student engagement and knowledge construction.

These findings imply that digital tools like iSpring not only facilitate the administration of assessments but also contribute to creating a learning experience that is more motivating and aligned with 21st-century educational demands. By fostering an environment that supports active learning and student autonomy, such tools can play a significant role in enhancing formative assessment practices within digital learning contexts.

Table 4. Analysis Results of Lecturer Response Questionnaire

No	Statement	Value
1	The test instruments used in the context of local wisdom, which is aided by the iSpring application, have an attractive design.	3
2	As an evaluation tool, test instruments in the context of local wisdom assisted by the iSpring application are simple to use.	3
3	Students can be motivated by test instruments in the context of local wisdom, aided by the iSpring application.	3
4	The questions were presented under the basic competencies and indicators.	4
5	The iSpring application makes it simple to access the test instruments in the context of local wisdom.	3
6	This assessment tool can be used both individually and in groups.	3
7	Local wisdom test instruments aided by the iSpring application are practical and efficient evaluation tools.	3
8	The iSpring application menu and button features were simple to grasp.	3
	Total	25
	Percentage	78.13

As shown in Table 4, the percentage of positive responses from lecturers was 78.13 percent.

Table 5. Question Item Quality Recapitulation

Question Number	Validity	Reliability	Difficulty Level	Differentiation	Info
1	0,47 (Valid)	Reliable	0,5 (Medium)	0,5 (Very good)	Used
2	0,28 (Invalid)	Reliable	0,4 (Medium)	0,25 (Fair)	Not Used
3	0,40 (Invalid)	Reliable	0,7 (Medium)	0,38 (Good)	Not Used
4	-0,15 (Invalid)	Reliable	0,8 (Easy)	0,13 (Poor)	Not Used
5	0,61 (Valid)	Reliable	0,8 (Easy)	0,38 (Good)	Used
6	0,31 (Invalid)	Reliable	0,9 (Easy)	0,13 (Poor)	Not Used
7	0,86 (Valid)	Reliable	0,8 (Easy)	0,38 (Good)	Used
8	0,50 (Valid)	Reliable	0,9 (Easy)	0,25 (Fair)	Used

Question Number	Validity	Reliability	Difficulty Level	Differentiation	Info
9	0,34 (Invalid)	Reliable	0,4 (Medium)	0,5 (Very good)	Not Used
10	0,82 (Valid)	Reliable	0,8 (Easy)	0,38 (Good)	Used
11	0,78 (Valid)	Reliable	0,9 (Easy)	0,25 (Fair)	Used
12	0,82 (Valid)	Reliable	0,8 (Easy)	0,38 (Good)	Used
13	0,74 (Valid)	Reliable	0,9 (Easy)	0,25 (Fair)	Used
14	0,74 (Valid)	Reliable	0,9 (Easy)	0,25 (Fair)	Used
15	0,69 (Valid)	Reliable	0,9 (Easy)	0,25 (Fair)	Used
16	0,78 (Valid)	Reliable	0,9 (Easy)	0,25 (Fair)	Used
17	0,70 (Valid)	Reliable	0,9 (Easy)	0,13 (Poor)	Used
18	0,45 (Valid)	Reliable	0,8 (Easy)	0,13 (Poor)	Used
19	0,69 (Valid)	Reliable	0,9 (Easy)	0,25 (Fair)	Used
20	0,24 (Invalid)	Reliable	0,9 (Easy)	0,13 (Poor)	Not Used

Based on the validity analysis presented in Table 5, 14 questions were deemed suitable for use as they met the required criteria, including a satisfactory item-total correlation (rxy) of greater than 0.30, demonstrating their ability to differentiate between students with high and low performance. On the other hand, six questions were not suitable for use, as they failed to meet the minimum threshold for both rxy, indicating they did not adequately measure the intended construct or distinguish between different levels of student performance. As also illustrated in Figure 1, six questions were invalid for use.

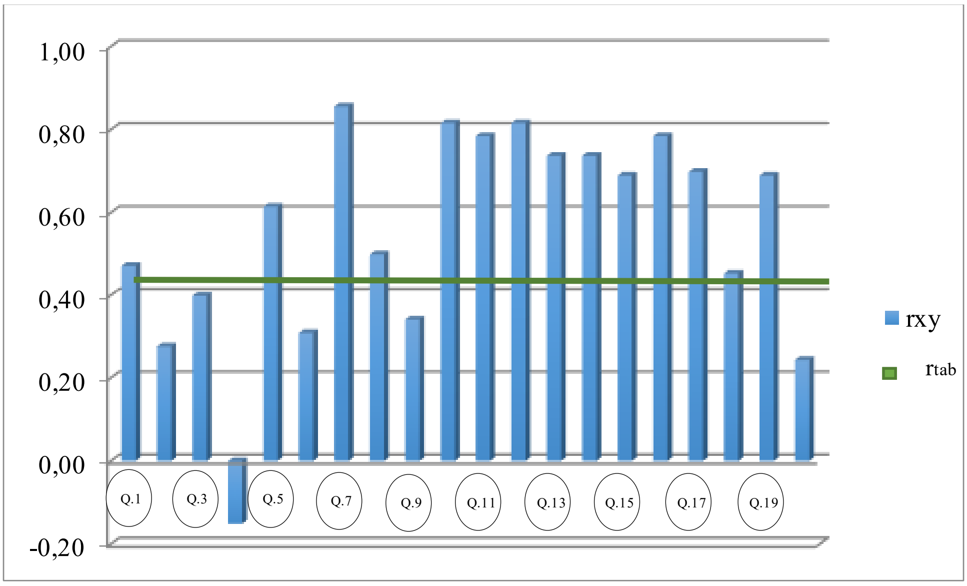

Figure 4. Validity of Question Items

Based on the evaluation of three expert validators, the validity of the test instrument in the context of local wisdom assisted by iSpring is classified as "very feasible." The test instrument refers to the scores of the items in question that conform or align with the total score Sudaryono (2018). This indicates a significant positive correlation between the item's score and its total score in the statistical realm. A question item is valid if its score has been shown to have a significant positive correlation with its total score. This statement is consistent with Hamidah and Wulandari (2021), who discovered that the question is said to be valid if the r count is greater than the r table when the results of the analysis on the point *Biser* table are examined. Thus, the results of the validity test show that the developed instrument effectively measures students' mathematical competence within the context of local wisdom. This high validity indicates that the test items were not only aligned with the intended learning objectives but also relevant to students' real-life experiences and cultural backgrounds. The integration of local contexts appeared to enhance students' conceptual understanding and engagement during the assessment process. These findings suggest that contextually grounded assessments can foster deeper cognitive processing and increase student motivation, as learners are more likely to connect abstract mathematical concepts with familiar situations. Thus, the validity of the test reflects its pedagogical strength in promoting meaningful and culturally responsive learning.

The test instrument developed in this study demonstrated high levels of practicality, as reflected in student feedback indicating ease of use, clarity, and relevance. According to established criteria Khoirunnisak & Rizkianto (2020) and Fahrurrozi et al. (2020), practicality is characterized by student responses that fall within the "interesting" and "easy-to-use" categories both of which were achieved in this study. The integration of the iSpring application significantly facilitated the test administration process, enabling faster deployment and improved operational efficiency. This outcome reinforces prior findings that online platforms can enhance not only the logistics of assessment delivery but also the interactivity and student engagement that are critical to effective learning environments.

Furthermore, both students and lecturers perceived the instrument as engaging, accessible, and relevant qualities regarded as essential for educational tools in contemporary digital learning settings (Akpen et al., 2024). This aligns with the growing body of literature advocating for user-centered design and intuitive usability as foundational elements in the development of technology-enhanced assessment systems (Meccawy et al., 2023; Zin et al., 2024). The success of this instrument underscores the importance of aligning technological innovation with pedagogical practicality, ensuring that digital tools not only function efficiently but also enrich the overall learning and assessment experience.

In the context of local wisdom assisted by iSpring, the quality of the question items is a) the average validity of the question items, namely $r_{xy} > r_{tabel} (0.55 > 0.43)$ is in the valid category; b) the reliability test is $r > r_{tabel} (0.87 > 0.43)$, then the test is declared reliable; c) the average difficulty test of 0.79 is in the easy category; and 4) the average test of the difference in the question items is 0.28 or is in the good enough category. Based on these findings, 14 questions were chosen to assess the students' mathematical learning outcomes. According to Meccawy et al. (2023); Rachmawati and Kurniawati (2020), the advantages of online mobile test assessment for learning evaluation include reduced errors in correction, and faster and more accurate results. The results suggest that online applications can be used to assess classroom learning. In addition, the customization of questions with varying levels of difficulty ensures that the instrument can effectively measure students' various levels of understanding, ranging from basic comprehension to more complex analytical skills.

Therefore, 14 questions developed in the context of local wisdom and assisted by the iSpring application in mathematics courses met the eligibility criteria for use in measuring students' mathematics learning outcomes in this study. According to Khaerunnisa and Pamungkas (2018), mathematical proficiency questions developed based on local cultural wisdom have a good potential effect on student test results, as evidenced by students' mathematical proficiency test results falling into the good category. According to Zulfah and Insani (2020), students are interested in mathematical problems in the context of local wisdom, because they can see the problems to be solved in real terms. Learning that integrates local wisdom also increases interest and motivation to learn (Suzana et al., 2021). So, local culture can be used as a context in developing other mathematics teaching materials, such as teaching modules or mathematics learning media.

The use of local wisdom in learning instruments not only increases the relevance and attractiveness of the material but can also be a means to preserve and appreciate local culture through the educational process. This is because the local wisdom approach can contribute by presenting a way that is inclusive and culturally sensitive (Asmayawati et al., 2024). Local wisdom reflects the cultural identity of a region and offers constructive ideas to support the welfare of the community (Pornpimon et al., 2014). By integrating traditional values into education, this approach allows students to understand and appreciate their cultural heritage, while still preparing for global challenges.

Internationally, contextually grounded digital assessment tools have proven effective across disciplines. For instance, Kielo-Viljamaa et al. (2020) demonstrated that discipline-specific and culturally responsive instruments, such as those in healthcare education, yield valid and practical outcomes. Similarly, integrating local culture into educational assessments enhances not only relevance but also fosters cultural identity and appreciation of global diversity (Sakti et al., 2024). This approach enables the creation of authentic, adaptive, and inclusive assessments that reflect real-world contexts and support meaningful student engagement.

CONCLUSION

This study concludes that the iSpring-assisted test instrument incorporating local wisdom is empirically valid, reliable, and practical for assessing mathematics learning outcomes. Furthermore, the test instrument can assist lecturers and teachers in the evaluation of learning, identifying skills that need improvement, and making learning more effective. The evaluation process is also quicker and more accurate.

Some limitations in this study are (1) the sample is limited to PGMI UIN Alauddin Makassar students so that further research can expand the sample to provide a more representative picture, (2) limited to mathematics course 1 so that further research can be conducted on other mathematics courses or science courses to see the potential for using test instruments with local wisdom, (3) test instruments with local wisdom are limited to culture so that the concept of local wisdom can be expanded such as social values, traditions of the local community, for further research, (4) development of test instruments using iSpring so that further research can explore the development of test instruments using other technologies or even integrating several technologies.

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