Griya Journal of Mathematics Education and Application
Volume 5 Nomor 3, September 2025
e-ISSN 2776-124X| |p-ISSN 2776-1258
https://mathjournal.unram.ac.id/index.php/Griya/index

Validity and Practicality of Manarang Module Based on Preservice Mathematics Teachers

Sri Wardani[1]*, Mira[1], Nurtaqiya[1], Nursyam Anaguna[2]

[1] *Mahasiswa Pendidikan Matematika, FKIP, Universitas Sulawesi Barat, Majene*
[2] *Dosen Pendidikan Matematika, FKIP, Universitas Sulawesi Barat, Majene*

*sriwardani0503@gmail.com

Diterima: 20-09-2025; Direvisi: 27-09-2025; Dipublikasi: 30-09-2025

Abstract
This research aims to develop and evaluate the validity and practicality of the Manarang module, an innovative digital teaching module based on ethnomathematics and Augmented Reality (AR) designed for prospective mathematics teacher students. This study employs the Borg and Gall model research and development methodology, which includes restricted trials, expert validation, initial product development, and planning. 32 students enrolled in the University of West Sulawesi's mathematics education studies program served as the study's subjects. Student response surveys to gauge practical features and validation sheets from media and material experts are among the research tools. The results of the study showed that the Manarang module was declared very valid with an average validation score of 90.67% for media experts and 90% for material experts. Furthermore, the practicality test resulted in an average score of 87.07 which falls into the category of very practical. These results show that the developed e-modules are valid, practical, and feasible to use as an innovative learning medium that not only presents mathematical concepts interactively and contextually through the integration of local cultures, but also utilizes AR technology to visualize abstract concepts to make them easier to understand. The Manarang module will help prospective teachers visualize geometric objects in geometric transformation learning.

Keywords: e-module; ethnomathematics; augmented reality; validity; practicality

Abstrak
Penelitian ini bertujuan untuk mengembangkan dan mengevaluasi validitas dan praktikalitas Modul Manarang, sebuah modul pembelajaran digital inovatif yang mengintegrasikan etnomatematika dan *Augmented Reality* (AR) bagi calon guru matematika. Model Penelitian dan Pengembangan (R&D) Borg and Gall digunakan, yang meliputi tahapan perencanaan, pengembangan produk awal, validasi pakar, dan uji coba terbatas. Partisipan penelitian ini adalah 32 mahasiswa Program Studi Pendidikan Matematika Universitas Sulawesi Barat. Instrumen penelitian yang digunakan meliputi lembar validasi dari ahli media dan materi, serta angket respons mahasiswa untuk mengevaluasi praktikalitas modul. Hasil penelitian menunjukkan bahwa Modul Manarang dinyatakan sangat valid dengan skor rata-rata validasi ahli media sebesar 90,67% dan ahli materi sebesar 90%. Selanjutnya, uji kepraktisan menghasilkan skor rata-rata 87,07 yang termasuk dalam kategori sangat praktis. Hasil ini menunjukkan bahwa e-modul yang dikembangkan valid, praktis, dan layak digunakan sebagai media pembelajaran inovatif yang tidak hanya menghadirkan konsep matematika secara interaktif dan kontekstual melalui integrasi budaya lokal, tetapi juga memanfaatkan teknologi AR untuk memvisualisasikan konsep abstrak agar lebih mudah dipahami. Dengan adanya modul Manarang ini akan membantu calon guru dalam memvisualisasikan objek geometri dalam pembelajaran transformasi geometri.

Kata Kunci: e-modul; etnomatematika; augmented reality; validitas; praktikalitas

1. INTRODUCTION

Education students, particularly those in mathematics education programs, play a dual role: they are both learners and future educators who will be at the forefront of improving educational quality (Nurhalimah et al., 2021). As 21st-century educators, they are expected to master not only pedagogical competencies but also the ability to innovate in creating effective and technology-integrated learning environments (Trihantoyo et al., 2023; Isnarinazah et al., 2024). Thus, higher education should not only focus on knowledge transfer but also on equipping future teachers with the skills to provide meaningful learning experiences.

However, prospective mathematics teachers face challenges beyond mastering mathematical concepts (Haji & Yumiati, 2021). They must also learn how to connect these concepts to effective and contextual teaching strategies (Rahim et al., 2025). Many still struggle with abstract materials and their real-world applications (Lestari et al., 2025). In addition, conventional teaching methods such as lectures and repetitive exercises remain dominant, leading to reduced student motivation and difficulties in achieving deeper conceptual understanding (Narpila et al., 2025; Indah, 2024).

The low utilization of learning technology and minimal integration of cultural contexts also weaken the quality of the teaching and learning process, which should be able to foster creativity, collaboration, and critical thinking (Hanifah & Sapti, 2023). According to research by Syaekhan et al. (2025), the gap between the competencies expected of prospective 21st-century mathematics teachers and current real-world conditions is a serious challenge. Therefore, the development of innovative teaching materials that are not only valid in content but also practical for use in learning is necessary (Elfiranur & Hariyani, 2025).

Several previous studies demonstrate that digital technology-based and ethnomathematics-based innovations offer promising alternatives. For instance, modules based on Augmented Reality (AR) have been shown to be valid and practical for improving student motivation and learning outcomes (Rohim et al., 2024), in line with research by Rizal et al. (2021) who also found that digital modules linked to ethnomathematics are feasible and practical in increasing student motivation and engagement in learning. Research by Raisa et al. (2024) also shows that research on the development of Augmented Reality (AR)-based mathematics modules has proven to be very feasible to use to help students construct mathematical concepts and make learning more interesting (Ananda et al., 2024). E-modules have also been found effective in enhancing student competencies (Ananda & Usmeldi, 2023), while ethnomathematics-AR-based modules significantly improved students' functional numeracy and independent learning (Anwar & Umami, 2025). Research by Saumi et al. (2022) also shows that AR-based e-modules can be used and are feasible as learning media with an average score of close to 4 and categorized as very good. Furthermore, ethnomathematics and AR-based learning can

improve students' numeracy skills (Nurhami et al., 2024) and enhance students' spatial skills (Fatma et al., 2025). Most of these studies focus only on elementary and secondary school students, while their application in the context of prospective mathematics teachers has rarely been researched.

Engaging learning is the key to fostering motivation, curiosity, and active participation of students in the classroom. To achieve this, teachers need to present strategies and approaches that are relevant to the needs and characteristics of students (Mea, 2024). Innovative learning media serves to motivate students, present information, and help teachers design quality teaching to achieve learning goals (Jauza & Albina, 2025). Thus, the use of innovative learning media not only enriches teaching methods, but also becomes the main tool in creating an effective, interactive, and meaningful learning process for students.

One of the innovations developed to answer these challenges is the Manang module, which is a digital teaching module based on ethnomathematics and AR. These modules are designed to deliver learning experiences that are interactive, contextual, and relevant to students' daily lives. The advantage of this module lies in the integration of content with a pedagogical approach that is in accordance with the needs of prospective teachers. In addition, there has been no research combining the ethnomathematics of Mandar culture in the *Pattu'du Kumba* dance with AR technology in mathematics learning. This makes the Manarang module an alternative media that is not only innovative, but also adaptive to the needs of modern culture-based education. Thus, this module is expected to be a link between the theory obtained in college and the learning practices that will be faced in the field.

Like any instructional material, the effectiveness of the Manarang module depends on two essential aspects: validity and practicality. Validity ensures content accuracy, material appropriateness, and design consistency (Oktaviana, 2017; Anwar, 2017), while practicality measures its ease of use and effectiveness for users in this case, prospective mathematics teachers (Ramadhani & Izzati, 2023). Thus, this study seeks to evaluate the validity and practicality of the Manarang module based on the perspectives of mathematics education students. The findings are expected to contribute to the development of innovative mathematics learning materials, enrich the literature on ethnomathematics and AR-based education, and strengthen teacher competencies in facing the challenges of the digital era.

2. RESEARCH METHOD

This research uses the research and development method (Research and Development) with the Borg and Gall model. The main goal of this study is to produce a Manarang module that is feasible and practical for prospective mathematics teachers to use. Referring to Siregar (2023), the development procedure according to Borg and Gall

consists of ten stages, namely: (1) preliminary study and information gathering, (2) planning, (3) designing the initial form of the product, (4) initial trial, (5) revision of the main product, (6) main trial, (7) operational revision, (8) operational trial, (9) final revision, and (10) dissemination and implementation. The research flow of the Borg and Gall model is illustrated in Figure 1.

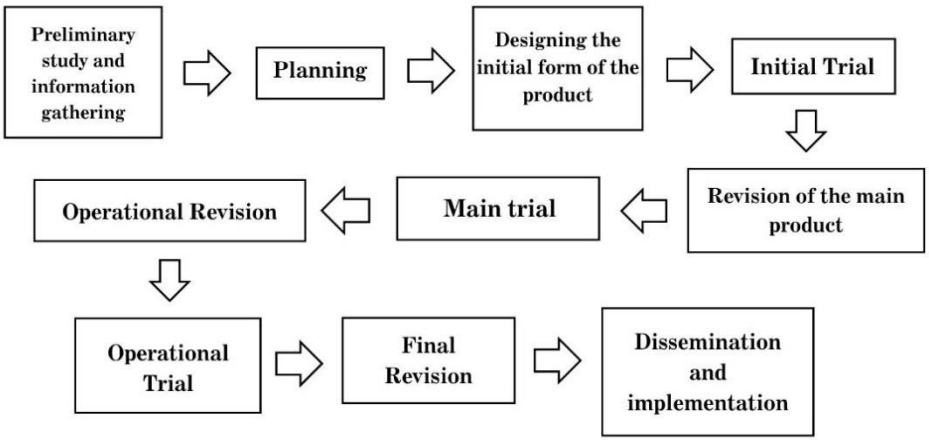

Figure 1. Borg and Gall Model Research Methods

In this study, as many as 32 students of the Mathematics Education study program at the University of West Sulawesi were involved in the module trial stage. Data collection used research instruments that included validation sheets from subject matter experts and media experts to assess aspects of the content, language, and appearance of the module, as well as student response questionnaires focused on the practicality aspects of the module. The researcher used four assessment indicators to test the validity of the material, namely (1) quality of content/material, (2) learning objectives, (3) feedback and adaptation, and (4) motivation. Then, for the validity test of the media, four assessment indicators were also used, namely (1) screen design display, (2) ease of use, (3) consistency, and (4) usefulness. Furthermore, the indicators of the assessment aspect of the practicality of the module use seven assessment indicators, namely (1) appearance/design, (2) ease of use, (3) language clarity, (4) questions/exercises, (5) motivation, (6) understanding of concepts, and (7) conformity of ethnomathematics with the material. Each statement on the assessment instrument uses a Likert scale with a range of 1 to 5, where a score of 1 indicates the category of "strongly disagree " and a score of 5 indicates the category of "strongly agree". Before use, all instruments are first validated by one media expert and one subject matter expert to ensure the suitability of the indicators, clarity of language, and relevance to the purposes of the assessment. Based on input from experts, some of the statements in the questionnaire were revised to be clearer and less ambiguous.

The data collected from the validation results were analyzed using quantitative descriptive analysis techniques, namely through the calculation of the average score from

the validators to determine the level of product validity. The practicality data was obtained from the percentage of student questionnaire scores. The determination of validity and practicality criteria is based on assessment categories that are adjusted to the guidelines for the development of teaching materials.

To calculate the average percentage of validity can be used the following formula.

$$V = \frac{\sum x}{\sum xi} \times 100\%$$

Information:

V = Percentage of Instrument Validity

$\sum x$ = Total Member Ratings

$\sum xi$ = total sum of ideal values

After the percentage results are known, the validity level of the developed instruments is then grouped into validity criteria according to Kurniasi & Arsisari (2020) shown in Table 1.

Table 1. Module Validity Percentage Criteria

Interval	Criteria
85% < V ≤ 100%	Highly Valid
70% < V ≤ 85%	Valid
50% < V ≤ 70%	Less Valid
V ≤ 50%	Invalid

Furthermore, to see the practicality of a module according to Ananda & Usmeldi (2023), you can use the formula and criteria in the following Table 2.

$$Value = \frac{Score\ obtained}{Maximum\ Score} \times 100$$

Table 2. Module Practicality Criteria

Interval	Criteria
81 – 100	Very Practical
61 – 80	Practical
41 – 60	Less Practical
21 – 40	Impractical

3. RESULTS AND DISCUSSION

The development of the Manarang module followed a research and development process that involved expert validation and practicality testing by prospective mathematics teacher students. The module was designed based on ethnomathematics and augmented reality (AR) to provide an interactive, contextual, and 21st-century learning experience. Revisions were carried out gradually based on feedback from experts and student responses, resulting in a final product deemed suitable for further trials.

In general, the Manarang module consists of several key components. Figure 2 presents the module cover, which contains the title, user information, and author identity. Figure 3 illustrates the module usage flow, serving as a guide for students to make use of the available features. Figure 4 displays the foreword and table of contents, which help users navigate the material in a structured and systematic manner.

Figure 5 presents the core material on geometric transformations, integrated with local cultural contexts through an ethnomathematical approach. This integration provides a contextual dimension closely related to students' daily lives, making abstract concepts easier to understand. Figure 6 demonstrates the AR feature that enables students to visualize geometric objects in three dimensions, thereby making conceptual understanding more concrete. In addition, the module is equipped with practice questions, application examples, and self-assessments with automatic feedback to measure students' mastery of concepts.

Figure 2. Manarang Module Cover

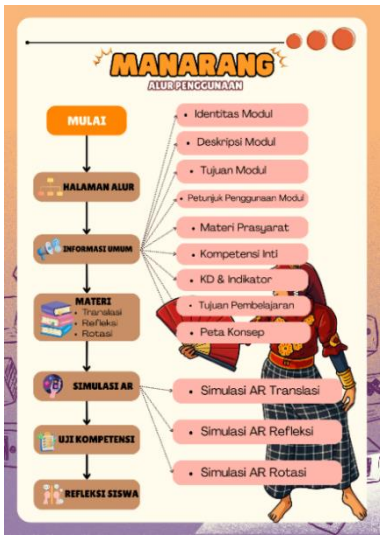

Figure 3. Manarang Module Usage Flow

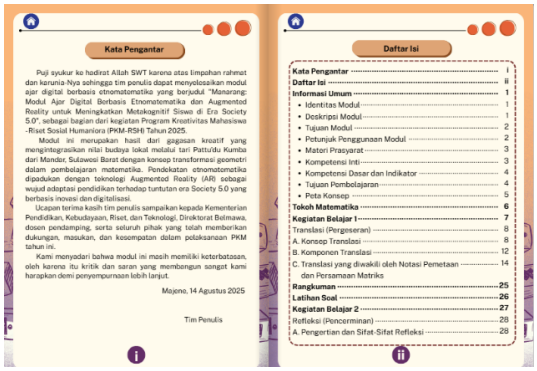

Figure 4. Preface and Table of Contents of the Manarang Module

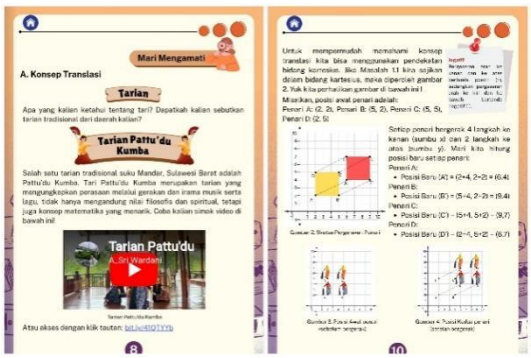

Figure 5. Geometric Transformation Material Combined with Local Cultural Context

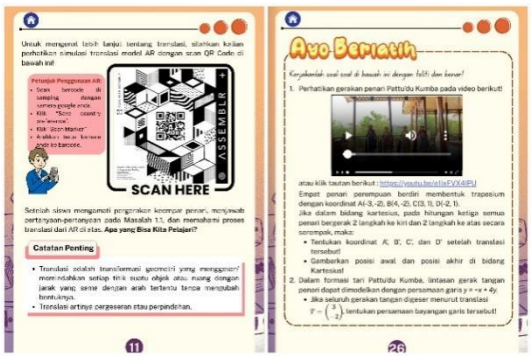

Figure 6. AR Features and Practice Questions in the Manarang Module

3.1 Research Results on the Development of the Manarang Module

After the module was developed, the next stage was to conduct validity and practicality tests to evaluate its feasibility before classroom implementation. The results showed that the Manarang module had undergone validation by media and material experts, as well as practicality testing by prospective mathematics teacher students. Validation was carried out to ensure quality in terms of visual design, consistency, and usefulness, as well as content accuracy, learning objectives, and motivational value.

The results of validation by media experts can be seen in Table 3 below:

Table 3. Media Expert Validation Results

Aspects Assessed	Average Percentage	Criteria
Display Screen Design	92%	Highly Valid
Ease of Use	88%	Highly Valid
Consistency	90%	Highly Valid
Benefits	93,3%	Highly Valid
Average	90,67%	Highly Valid

The results of the media expert validation are presented in Table 3. The average score obtained was 90.67%, which falls into the "highly valid" category. This indicates that the visual design was considered attractive, navigation was easy to follow, and the design consistency supported effective use.

Next, validation by subject matter experts was conducted to assess the quality of content, suitability of learning objectives, and the extent to which the modules could motivate students. The validation results are shown in Table 4 below:

Table 4. Validation Results of Manarang Module Material Experts

Aspects Assessed	Average Percentage	Criteria
Quality of Content/Material	90%	Highly Valid
Learning Objectives	90%	Highly Valid
Feedback and Adaptation	85%	Highly Valid
Motivation	100%	Highly Valid
Average	90%	Highly Valid

The average validation of subject matter experts is 90% with "very valid" criteria**.** The highest score is found in the motivation aspect of 100%, which means that the module is really considered to be able to arouse students' enthusiasm for learning through the integration of ethnomathematics and AR features.

The practicality test was carried out by involving 32 prospective mathematics teacher students. The test instruments include aspects of appearance, ease of use, language clarity, exercises/sample questions presented, learning motivation, concept understanding, and module added value. The results of the practicality test are shown in Table 5 below:

Table 5. Results of the Manarang Module Practicality Test

Aspects Assessed	Average	Criteria
Appearance/Design	88,5	Very Practical
Ease of Use/Navigation	86,4	Very Practical
Language/Text Clarity	88,5	Very Practical
Exercises/ Sample Questions	86,6	Very Practical
Motivating the Spirit of Learning	86,9	Very Practical
Concept/Material Understanding (including AR)	85,4	Very Practical
Added Value/ Module Content	87,3	Very Practical
Average	87,07	Very Practical

The average practicality of the Manarang module is 87.07 which is a "very practical" criterion**.** This confirms that the module is considered easy to use, attractive appearance, and relevant to the needs of prospective mathematics teacher students.

3. 2 Discussion of the Validity and Practicality of the Manarang Module

The results of the study indicate that the Manarang module has met two important requirements for teaching materials, namely validity and practicality. The validation results from 90.67% media experts and 90% material experts indicate that the design and content of the module are in the category of being "very valid". Clear layouts, harmonious colors, and the use of illustrations are considered to be able to support student understanding. The ease of navigation and consistency of the design also contribute to ensuring that the modules can be used independently by prospective mathematics teacher

students. This is in line with the findings of Ananda & Usmeldi (2023) who stated that the validity of e-modules is influenced by visual quality, format consistency, and integration of learning design. The ethnomathematical approach embedded in this module also reinforces previous research, which emphasizes that connecting learning with local cultural contexts can increase the meaning of learning helping students in constructing mathematical concepts (Raisa et al., 2024). Finally, the application of AR makes learning more interesting supported by the findings of Ananda et al. (2024) and empirical evidence from Saumi et al. (2022), who explain that AR-based e-modules help students learn independently and interactively and actively find solutions to every problem during the mathematics learning process.

The motivation aspect obtained the highest score of 100% from subject matter experts, which indicates that the integration of ethnomathematics and *Augmented Reality* (AR) in the module is able to increase student engagement. These results support the findings of Rizal et al. (2021) that ethnomathematics-based e-modules can improve motivation and communication skills, as well as Rohim et al. (2021) who reveal similar benefits of using AR in learning. However, a slightly lower score on the concept understanding aspect (85.4%) indicates that although AR features help visualize abstract concepts, some students still need additional adaptation time or mentoring in using technology. This is consistent with Puspita et al. (2024) who stated that the effectiveness of AR is highly dependent on the readiness and familiarity of the user.

The practicality test involving 32 prospective teacher students produced an average score of 87.07 with a "very practical" category. This shows that the modules are easily accessible, have a clear structure, and support independent learning. Students consider this module interesting in terms of appearance, the language used is easy to understand, and the exercises are arranged in stages. These findings are in line with the research of Ramadhani and Izzati (2023) who emphasized that the practicality of the module is influenced by the clarity of the text and the regularity of assignment presentation. These findings are also supported by the research of Anwar & Umami (2025), which emphasizes that the success of independent learning is greatly influenced by the availability of learning media that supports visual exploration and student learning independence. In addition, the AR feature provides added value as a link between abstract and concrete concepts in the topic of geometry transformation.

3. 3 Practical Implications of the Manarang Module for Prospective Teachers

The Manarang module has the potential to become a learning facility as well as an example of innovative learning materials for prospective teacher students. This module shows how the local cultural context (ethnomathematics) can be combined with modern technology (AR) to enrich the learning process. Teachers are encouraged to leverage these insights to enrich their teaching strategies, especially when conveying abstract mathematical concepts such as field geometry, which often poses challenges for students. Thus, Manarang not only improves understanding of concepts and fosters appreciation of

local culture but can help visualize abstract mathematical concepts such as field geometry, which often poses challenges for students. However, this study has some limitations. First, the number of samples was limited to 32 students from one university so that the generalization of results was limited. Second, the evaluation of this research only focuses on aspects of validity and practicality, not measuring the effectiveness of modules in improving learning outcomes, teaching skills, and high-level thinking skills. Further research needs to be conducted with a larger and more diverse sample and add effectiveness tests to assess the impact of the modules more comprehensively.

When compared to previous research, these results are consistent with various findings that show that digital technology-based e-modules are not only valid but also practical in learning. Research by Anwar and Umami (2025) proves that ethnomathematics and AR-based e-modules have a high level of validity with an average score of 92.18% in the aspects of material substance, learning design, visual display, and software, and are declared practical with student responses of 92.01%, categorized as very good. The Manarang module developed in this study also utilizes AR technology and visual illustration to strengthen student understanding, so that it has characteristics that are in line with the results of the research. In addition, the research of Fatma et al. (2025) shows that the integration of AR and ethnomathematics in learning significantly improves students' spatial visualization and engagement, as well as increases their motivation and interest in learning geometry. This finding is also in line with the research of Saumi et al. (2022) which revealed that ethnomathematics and AR-based e-modules are considered very valid and practical to be used in the learning process to help students learn independently and actively in finding solutions to every problem in the material studied. The same thing is reflected in the results of this study, where students feel that the module can be used independently without full assistance from the lecturer.

Overall, these findings show that the Manarang module is a valid and practical learning innovation to be used in learning, especially for prospective mathematics teachers. This module not only addresses the formal aspects of content and media validity, but also provides an interactive, engaging, and relevant learning experience to the needs of the 21st century. The integration of ethnomathematics strengthens the local cultural identity in this case *the Pattu'du Kumba* dance of the Mandar culture, while the use of AR makes abstract concepts easier to understand. Therefore, the Manarang module has the potential to be a learning medium that is able to connect the theory obtained in lectures with real learning practices in schools.

4. CONCLUSION

The Manarang module, developed using an ethnomathematics and AR approach, has proven to be highly valid and practical for students as prospective mathematics teachers. Expert validation results confirm that the content, design, and learning objectives of the module are appropriate and effective, while student feedback indicates its practicality,

ease of use, and motivational impact. The integration of AR enhances conceptual understanding, and cultural elements strengthen contextual learning. Further research is recommended with larger and more diverse samples, and exploring the effectiveness of the Manarang module across a wider range of mathematics topics, school contexts, and cultural traditions to assess the module's impact more comprehensively.

A practical recommendation for prospective teachers is to utilize local culture in learning to make it more relevant to students' daily lives, while also utilizing AR technology to help students understand abstract geometric concepts. In this way, Manarang can bridge the gap between theory learned in lectures and teaching practice in schools, and encourage prospective teachers to be more creative, reflective, and adaptive in facing the challenges of 21st-century education.

5. ACKNOWLEDGEMENTS

The author would like to express his deepest gratitude to all those who have supported and contributed to this research. Special thanks go to the media and material experts who have provided valuable input, as well as to all prospective mathematics teachers who participated in the module trial. Thanks are also extended to the University of West Sulawesi for providing facilities and support, and to Belmawa for funding this research. Hopefully, the results of this research will be useful for the development of education.

6. RECOMENDATION

Based on the results of the above study, it is recommended that further research test the effectiveness of the Manarang module in improving student learning outcomes and teaching skills, apply it to a broader context and sample, explore the development of similar modules for other mathematics topics, and optimize Augmented Reality (AR) features to increase interactivity and learning impact.

7. REFERENCES

Ananda, M. T., Octaria, D., & Wulandari, I. (2024). Pengembangan E-Modul Berbasis Augmented Reality pada Materi Geometri Bangun Ruang di Kelas V Siswa Sekolah Dasar. *Indonesian Research Journal on Education*, *4*(2), 1168-1174.

Ananda, P. N., & Usmeldi, U. (2023). Validity and practicality of e-module model inquiry based online learning to improve student competence. *Jurnal Penelitian Pendidikan IPA*, 9(4), 2010-2017.

Anwar, Moh Farid Nurul, Ruminiati, Suharjo. 2017. Pengembanagn Modul Pembelajaran Tematik Terpadu Berbais Kearifan Lokal Kabupaten Sumenep Kelas IV Sub Tema Lingkungan tempat Tinggalku. *Jurnal Pendidikan Teori Penelitian dan Pengembangan*, 10: 1291-1297.

Anwar, S., & Umami, M. R. (2025). A Strengthening Deep Learning: Developing an Ethnomathematics–Collaborative Augmented Reality (ME-CAR) Module to Optimize Numeracy Skills and Self-Regulated Learning. *JMPM: Jurnal Matematika dan Pendidikan Matematika*, *10*(2).

Elfiranur, E., & Hariyani, M. (2025). Pengembangan Media Pembelajaran Interaktif Berbasis E-Book untuk Meningkatkan Minat Belajar Materi Wujud Zat dan Perubahannya. *SCIENCE: Jurnal Inovasi Pendidikan Matematika dan IPA*, 5(2), 607-616.

Fatma, N., & Anwar, K. (2025). Augmented Reality in Ethnomathematics: Developing an Interactive Magazine to Enhance Students' Spatial Skills in Cube and Cuboid Geometry. *Science And Mathematics Education Journal*, 1(01), 152-167.

Haji, S., & Yumiati, Y. (2021). Penguasaan Guru dan Calon Guru Matematika Terhadap Konsep Persamaan Kuadrat. *Jurnal Pendidikan Matematika Raflesia*, 6(1), 88-98.

Hanifah, H., & Sapti, M. (2023). Pengembangan Modul Matematika Berbasis Etnomatematika Makanan Tradisional untuk Meningkatkan Kemampuan Pemecahan Masalah. *Jurnal Inovasi Pendidikan Matematika (JIPM)*, 5(1), 16-22.

Indah, N. L. (2024). Model Pembelajaran Discovery Learning pada Operasi Bilangan Kelas 4 SD. *SCIENCE: Jurnal Inovasi Pendidikan Matematika dan IPA*, 4(4), 382-399.

Isnarizanah, G., Fathan, N., Mutaqin, R. A., & Carsiwan, C. (2024). Peran Teknologi dalam Inovasi Pendidikan di Indonesia. *JIIP-Jurnal Ilmiah Ilmu Pendidikan*, *7*(8), 8635-8639.

Jauza, N. A., & Albina, M. (2025). Penggunaan Media Pembelajaran Kreatif dan Inovatif Dalam Meningkatkan Kualitas Pembelajaran. *IHSAN: Jurnal Pendidikan Islam*, *3*(2), 15-23.

Kurniasi, E. R., & Arsisari, A. (2020). Pengembangan instrumen pengukur higher order thinking skills (hots) matematika pada siswa sekolah menengah pertama. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *9*(4), 1213-1222.

Lestari, A. P., Fitriani, N., & Bernard, M. (2025). Penerapan Pendekatan Realistic Mathematics Education (RME) Berbantuan Teknologi Interaktif untuk Meningkatkan Kemampuan Pemecahan Masalah Matematis Siswa Kelas VIII. *JPMI (Jurnal Pembelajaran Matematika Inovatif)*, 8(1), 81–90.

Mea, F. (2024). Peningkatan efektivitas pembelajaran melalui kreativitas dan inovasi guru dalam menciptakan kelas yang dinamis. *Inculco Journal of Christian Education*, *4*(3), 252-275.

Narpila, S. D., Pitaloka, D. D., Ramadhan, R., & Muttaqin, A. (2025). Perbandingan Kegiatan Pembelajaran Konvensional dan Pembelajaran Berbasis Teknologi Terhadap Hasil Belajar Siswa (Studi Kasus pada Kls VIII A SMP Cerdas Bangsa, Kecamatan Namorambe Kabupaten Deli Serdang). *Jurnal Nakula: Pusat Ilmu Pendidikan, Bahasa dan Ilmu Sosial*, 3(1), 210-220.

Nurhalimah, A., Mawaddah, M., & Abdillah, A. (2021). Peningkatan Profesionalisme Mahasiswa Sebagai calon Guru Melalui Program Kampus Mengajar. *Jurnal Ilmiah Kampus Mengajar*, 12-20.

Nurhami, N., Muharram, N., & Susanti, W. (2024). Peningkatan Kemampuan Numerasi Siswa SMA Negeri 9 Luwu melalui Pembelajaran Etno-Matematika Berbasis Augmented Reality. *Jurnal Dieksis ID*, 4(2), 128-140.

Oktaviana, D., Hartini, S., & Misbah, M. (2017). Pengembangan modul fisika berintegrasi kearifan lokal membuat minyak lala untuk melatih karakter sanggam. *Berkala ilmiah pendidikan fisika*, *5*(3), 272-285.

Puspita, G., Pasaribu, F. T., & Ramalisa, Y. (2024). Pengembangan e-modul berbasis proyek design thinking berbantuan augmented reality (AR) untuk meningkatkan kemampuan berpikir kreatif. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, 13(3), 826-837.

Rahim, A., Jainuddin, J., & Maheswari, K. A. M. (2025). Studi Deskriptif Kemampuan Pemahaman Aljabar Calon Guru Matematika. *MathSciEd of Journal*, 1(1), 01-07.

Raisa, A., Khairunnisak, C., Johar, R., & Safitri, Y. (2024). The Validity of Ethnomathematics-Augmented Reality Instructional Materials on Scale and Proportion. In *Proceedings of the 2nd Annual International Conference on Mathematics, Science and Technology Education (2nd AICMSTE)* (Vol. 828, p. 32). Springer Nature.

Ramadhani, R., & Izzati, N. (2023). Keefektifan dan kepraktisan modul dasar pemrograman. *Journal of Mathematics Education and Science*, 6(1), 47-53.

Rizal, A. F., Purwaningrum, J. P., & Rahayu, R. (2021). Pengembangan e-modul berbasis etnomatematika untuk menumbuhkan kemampuan komunikasi matematis dan minat belajar siswa. *Koordinat Jurnal MIPA*, 2(2), 1-14.

Rohim, D. C., Hana, F. M., Manggalastawa, M., & Saharani, S. (2024). Augmented Reality Learning Media with Ethnomathematic Approach to Grow Students' Mathematics Learning Motivation. *JTAM (Jurnal Teori dan Aplikasi Matematika)*, *8*(4), 1249-1261.

Saumi, F., Muliani, F., & Amalia, R. (2022). Pengembangan e-modul berbasis augmented reality dengan model guided discovery learning pada materi vektor. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *11*(4), 3850-9.

Siregar, T. (2023). Tahapan Model Penelitian Dan Pengembangan Research And Development (R&D). *DIROSAT: Journal of Education, Social Sciences & Humanities*, *1*(4), 142-158.

Syaekhan, F., Pahlevi, M. S. R., Fathurrahman, M., & Fauzi, H. (2025). Problem Pendidikan Di Indonesia: Analisis Fenomena Guru Tanpa Kompetensi. QOSIM: Jurnal Pendidikan Sosial & Humaniora, 3(3), 1158-1170.

Trihantoyo, S., Wulandari, A., Janah, M. U., Kumairo, M. N., & Alfi, D. N. (2023). Kompetensi Pedagogik Guru Dalam Implementasi Model Pembelajaran Inovatif. *Jurnal Visionary: Penelitian dan Pengembangan dibidang Administrasi Pendidikan*, 11(2), 9-14.