



Innovation of Multimodal Digital Modules Based on Ethnomathematical Problems for Meaningful Mathematics Learning in *Merdeka* Curriculum

I Putu Pasek Suryawan^{1*}, I Wayan Lasmawan², I Gusti Putu Suharta³ 

^{1,2,3} Universitas Pendidikan Ganesha, Singaraja, Indonesia

ARTICLE INFO

Article history:

Received March 24, 2023

Revised March 28, 2023

Accepted October 10, 2023

Available online November 25, 2023

Kata Kunci :

Modul Digital, Multimodal,
Etnomatematika, Pembelajaran Berbasis
Masalah

Keywords:

Digital Modules, Multimodal,
Ethnomatematics, Problem based Learning



This is an open access article under the [CC BY-SA](https://creativecommons.org/licenses/by-sa/4.0/) license.
Copyright ©2023 by Author. Published by Universitas
Pendidikan Ganesha

ABSTRAK

Hakikat kurikulum Merdeka mengharapkan pembelajaran matematika bermakna dan sesuai dengan gaya belajar dan kebutuhan. Budaya dan teknologi merupakan kombinasi yang tepat untuk diterapkan dalam pembelajaran matematika untuk menerapkan Kurikulum Merdeka. Penelitian ini bertujuan untuk mengembangkan modul digital multimodal berbasis permasalahan etnomatematika untuk pembelajaran matematika bermakna yang dapat beradaptasi dengan perkembangan teknologi. Model pengembangan yang digunakan dalam penelitian ini adalah model ADDIE. Kegunaan modul ditentukan oleh hasil validasi ahli, uji praktikalitas, dan uji efektivitas yang dilakukan dosen, guru, dan siswa sebagai subjek penelitian. Berdasarkan uji validitas materi diperoleh validitas sebesar 4,45 dan uji validitas media memperoleh validitas sebesar 4,87 yang termasuk dalam kategori Sangat Tinggi. Rata-rata skor kepraktisan adalah 4,3 dengan kriteria sangat tinggi. Kisaran nilai yang diperoleh siswa adalah 83%. Dengan demikian modul yang dikembangkan dapat dikatakan efektif dan layak digunakan. Melalui inovasi modul ini, pembelajaran menjadi bermakna, mengakomodasi setiap gaya belajar dan kebutuhan siswa, serta memfasilitasi siswa untuk belajar mandiri.

ABSTRACT

The essence of the curriculum Merdeka expects mathematics learning to be meaningful and in accordance with learning styles and needs. Culture and technology are the right combination to be applied in mathematics learning to implement the curriculum Merdeka. This research aims to develop multimodal digital modules based on ethno mathematical problems for meaningful mathematics learning that can adapt to technological developments. The development model used in this study is the ADDIE model. The service of the module is determined by the results of expert validation, practicality tests, and effectiveness tests by lecturers, teachers and students as research subjects. Based on the material validity test, a validity of 4.45 was obtained and a media validity test obtained a validity of 4.87 which was included in the Very High category. The average practicality score is 4.3 with very high criteria. The range of grades obtained by students is 83%. Thus the modules developed can be said to be effective and feasible to use. Through the innovation of this module, learning becomes meaningful, accommodates every learning style and student need, and facilitates students to learn independently.

1. INTRODUCTION

One of the government's efforts to improve the quality of education is by revitalizing the curriculum into the Kurikulum Merdeka. Kurikulum Merdeka is a curriculum with diverse intracurricular learning. Teachers have the flexibility to have various teaching devices so that learning is tailored to the learning needs and interests of students (Pratiwi et al., 2023; Rahayu et al., 2022). Of course, this will be a big challenge for teachers to be able to optimize strategies and teaching materials that will help rejuvenate the implementation of learning. The Kurikulum Merdeka is currently considered the most relevant to use considering that when this curriculum was designed, it must place the needs, income, experience, learning outcomes, and interests of students as the main reference (Numertayasa et al., 2022; Rahayu et al., 2022). The main characteristics include simplification of content and focus on essential materials, collaborative and applicable project-based learners, as well as the achievement of class hours and flexible class hour arrangements. Based on the analysis of the spirit of the Kurikulum Merdeka, the learning process should be in accordance with the needs and characteristics of students through meaningful learning, and accommodate every student's learning style that utilizes IT-based learning media (Jannati et al., 2023; Suryawan & Juniantari, 2018).

*Corresponding author.

E-mail addresses: suryawan.adisti@gmail.com (I Putu Pasek Suryawan)

The implementation of the Kurikulum Merdeka occurred during the onslaught of the Industrial Revolution Era 4.0 became a challenge and could also be a convenience. To be able to adapt to this industrial revolution era, an education system is needed that can form a creative, innovative, and competitive narrative so that it can catch up with other developed countries (Agustini et al., 2019; Astuti, 2019; Nastiti et al., 2022). This can be achieved, one of which is by optimizing the use of technology as an educational tool that is expected to be able to provide outputs that can adapt to changing times and is certainly in line with the current application of the Kurikulum Merdeka (Lase, 2019; Rahayu et al., 2022). Improving mindset, mentality, and values is a fundamental thing that needs to be prepared.

In this condition, digital native certainly cannot be separated from digital technology such as smartphones, computers, the internet (Mardina, 2011; Smaragdina, 2020). This generation is also very good at using digital devices and spends more time with technology, easier to learn using technology, and more interested in teaching materials and learning media that they can access through digital devices such as smartphones. Using technology in this learning allows for increased cognitive comfort levels of students and optimizes learning time (Ilic, 2021; Nataliia, 2022). This is the challenge for teachers in terms of developing teaching devices according to student needs, one of which is in the form of digital modules.

According to previous study the digital module or E-Module is a modification of conventional modules by combining the use of information technology, so that existing digital modules can be more interesting and interactive (Karmila, 2020). The use of digital modules is also in line with the characteristics of the Kurikulum Merdeka where the content in digital modules becomes simpler and focuses on essential materials. But in reality in the field digital modules have not been widely used by schools. This is certainly very unfortunate considering that some of the advantages obtained from using digital modules are very relevant to the needs of more real and complex learning visualization (Rakhamawati & R., 2016; Wahyudi, 2019). The characteristic of suitable and effective subjects using digital modules is mathematics.

In addition to learning tools such as digital modules, appropriate learning styles are also the key to student success in learning. By realizing this, students are able to absorb and process information and make learning easier with student learning styles (Bire et al., 2014; Gilakjani, 2012). According to other study learning styles are divided into three, namely visual, auditorial and kinesthetic learning styles (Sarfa, 2016). Visual learning style is a learning style by seeing, observing, looking, and the like, visual representation in mathematics is very important for teachers and students in the process of teaching and learning mathematics (Raiyn, 2016; Sheromova et al., 2020). Auditorial learning style is a learning style by hearing and kinesthetic learning style is a learning style by moving, working, and touching. The point is to learn by Judging from this statement, an approach is needed that can facilitate the learning style of these students, one of which is with a multimodal approach. In research conducted by previous study stated that Multimodal is a term used to refer to the way people communicate using different modes at the same time, which is defined as the use of several semiotic modes in product design, or semiotic events simultaneously, and in a certain way these modes are combined to reinforce, complement, or be in a certain order (Al Fajri, 2018; Kress & Leeuwen, 2001).

Multimodal can also be said to be a technical term that aims to show that in the process of meaning, humans make use of various semiotics (Iadem, 2003; O'Halloran, 2011; Pan, 2022). In addition, multimodal is also defined as all semiotic, verbal and visual sources that can be used to realize the type and level of dialogical involvement in a textbook. Where, semiotics or semiotics is the science of signs used to find out the meaning contained in learning animation or in other words semiotics is a sign which is understood as something that represents something else (Y. Chen, 2010; Papageorgiou, 2017). The use of technology in addition to providing a lot of advantages also has disadvantages. The percentage of students exploring the environment will be reduced and this can cause learning to be less meaningful. Therefore, it is need for cultural values in life that can be related to mathematics learning.

Mathematics is the source of knowledge and the main needs of each individual, while culture is a complete unity and comprehensive code of conduct in society and plays an important role in fostering the noble values of the nation (Rosa et al., 2017; Subali et al., 2018). This is in line with opinion which states that education and culture have a very important role in cultivating and developing cultural values, which have an impact on character formation based on cultural values owned (Haran et al., 2019; Suryawan & Juniantari, 2018). This is in line with previous study which states that if ethno mathematics is applied as an approach to learning, then the mathematical concepts learned will be related to student culture so that learning becomes meaningful (Wahyuni et al., 2013). One good learning model and strategy in understanding and learning mathematics while fostering a love for culture is to study ethno mathematics (Lisnina. Zulkardi, 2020; Prahmana et al., 2021; Umbara, 2021).

Based on the studies conducted, it was found that there were many similar studies including research conducted in a study entitled development of Dayak culture-based ethnomathematics module in mathematics learning with joyful learning approach stated that Dayak culture-based ethnomathematics

module with *joyful learning* approach got good results, so it can be used to teach mathematical concepts to grade 4 students at SDN 29 Idai (Priyani, 2021). In addition, on research conducted by other study entitled development of ethno mathematics-based mathematics teaching materials to improve the understanding of mathematics of grade III elementary school students stated that the Ethnomathematics-Based Teaching Materials developed are effective in improving student learning understanding (Muhammad & Novitasari, 2020). But in reality in the field meaningful learning is very difficult to find, even though according to studies conducted by learning with effective cultural values help increase student understanding in learning.

Considering the existing problems, this research was carried out focusing on the development of ethnomathematics-based multimodal mathematics digital modules to accommodate each student's learning style. In addition, the digital modules developed are designed in line with the essence of the Kurikulum Merdeka which is being encouraged to be implemented. This development also aims to obtain digital modules that meet valid, practical, and effective criteria so that they become solutions in digitizing education in the era of the industrial revolution 4.0 and in accordance with the spirit of the Kurikulum Merdeka.

2. METHODS

The preparation of multimodal digital modules based on ethnomathematical problems is one type of development research (R&D) that refers to the ADDIE model. This development is used to get a new product or develop a product that already exists before (Arikunto, 2011). ADDIE is a program for developing and validating products (Sugiyono, 2019). Development research is a method of testing the effectiveness of developed products. This model is very suitable for use in digital modules or other types of development. The ADDIE model was chosen because it is simple, easy to understand, and has a systematic structure. The ADDIE research procedure can be noted in Figure 1.

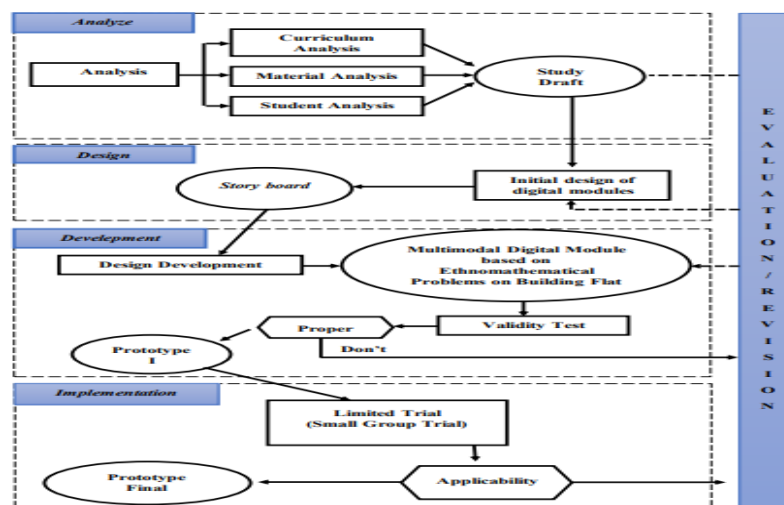


Figure 1. Research Procedure

The subjects in this study are material experts who include lecturers and teachers who are competent in the field of mathematics in order to get the best information and input to compile digital modules. Media experts who include mathematics lecturers are carried out to identify whether the modules developed are appropriate and certainly easy to understand. As well as junior high school students as test subjects for the use of digital modules and made respondents in filling out questionnaires and feasibility tests carried out.

Data collection at the initial stage is carried out by content analysis, which is intended through content analysis of curriculum, textbooks, and analysis related to mathematics. This observation was made to obtain information on the conditions and problems of mathematics learning. Furthermore, opinion surveys, which were conducted with teacher interviews to collect response questionnaires to obtain authentic data related to the digital modules developed.

The data collected in this analysis are quantitative data and qualitative data. Qualitative data includes assessments and advice from expert experts and respondents who use digital modules that aim to improve digital modules, this data is analyzed descriptively or qualitatively. While quantity data was

analyzed using descriptive statistics with average scores and percentages with Likert scales (Sukardi, 2009). The digital module is said to be feasible if the minimum average score obtained is 2.60, and practical if the average score obtained is at least 2.6 can be seen in Table 1, Table 2, and Table 3.

Table 1. Digital Module Eligibility Criteria

Skor	Criterion
$4,20 \leq \bar{X} \leq 5,00$	Very Worth It
$3,40 \leq \bar{X} < 4,20$	Proper
$2,60 \leq \bar{X} < 3,40$	Pretty decent
$1,80 \leq \bar{X} < 2,60$	Not Worth It
$1,00 \leq \bar{X} < 1,80$	Very Unworthy

Table 2. Convert Quantitative to Qualitative Data

Score Range	Average Score	Category
$X > \bar{X}_i + 1,8$	$X > 4,2$	Excellent
$\bar{X}_i + 0,6s_{bi} < X \leq \bar{X}_i + 1,8s_{bi}$	$3,4 < X \leq 4,2$	Good
$\bar{X}_i - 0,6s_{bi} < X \leq \bar{X}_i + 0,6s_{bi}$	$2,6 < X \leq 3,4$	Enough
$\bar{X}_i - 1,8s_{bi} < X \leq \bar{X}_i - 0,6s_{bi}$	$1,8 < X \leq 2,6$	Less
$X \leq \bar{X}_i - 1,8s_{bi}$	$X \leq 1,8$	Very Lacking

Table 3. Digital Module Effectiveness Criteria

Completeness	Category
$X > 80\%$	Excellent
$60\% \leq X \leq 80\%$	Good
$40\% < X \leq 60\%$	Good enough
$20\% \leq X \leq 40\%$	Not Good
$X < 20\%$	Bad

3. RESULT AND DISCUSSION

Results

The teaching material developed in this study is the Multimodal Digital Mathematics Module Based on Ethnomathematical Problems which contains four sub-discussions, namely Cubes, Beams, Prisms, and Pyramids. The multimodal digital module developed is structured with a multimodal approach to consider student learning styles. An appropriate learning style is the key to student success in learning. Based on research conducted, multimodal approach is important in today's technological era. With a multimodal approach, it allows educators / teachers to meet the needs of different students in a learning environment.

In this multimodal digital module based on ethnomathematical problems, there is a problem at the beginning of the sub-material which of course contains cultural values, subject matter, learning videos, exploration media and practice problems related to building flat side space material. The following is a description contained in the multimodal mathematics digital module based on ethnomathematical problems as show in Figure 2, Figure 3, Figure 4, and Figure 5.



Figure 2. Problems

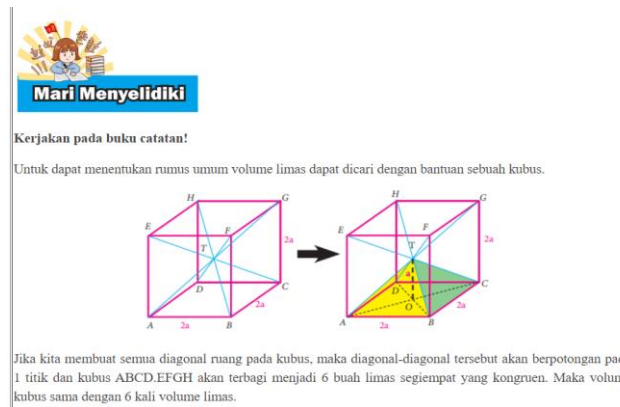


Figure 3. Let's Investigate

Base on Figure 3, after analyzing the problem, students will be asked to investigate by completing the stages provided in the module to get the expected goals.

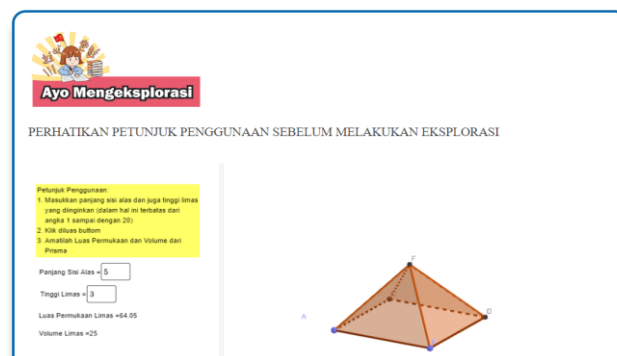


Figure 4. Let's Explore

Base on Figure 4, this content contains geogebra media which is used to illustrate the webs of building flat side spaces and finding the area and volume of the building. This aims to give freedom to students to explore and convince students again regarding what has previously been obtained.



Figure 5. Let's Try

Base on Figure 5, after all the stages are carried out, the next step is to do practice questions on the Let's Try content. This content contains practice questions and feedback that can be accessed by students to find out the extent to which the material provided can be understood by students. Finally, learning videos are provided that are used to provide reaffirmation of the material provided.

The Multimodal Digital Module developed into a product will then be tested for feasibility through 3 criteria, namely validity, practical and effective. The results of the assessment and tests carried out on the developed digital module can be assessed in Table 4.

Table 4. Feasibility of Multimodal Digital Module

Aspects	Percentage	Information
A. Validity		
Material Expert	97.5% (Valid)	Very High
Media Members	94% (Valid)	Very High
B. Practicality		
Teacher Response Questionnaire	86.4% (Practical)	Excellent
Student Response Questionnaire	84% (Practical)	Good
C. Effectiveness		
Average student score	78.1	
Number of graduating students	24/31	
Student pass percentage	83% (effective)	Very High

Discussion

This research departs from the fact that mathematics learning carried out in class has obstacles, such as students do not understand the material provided, lack of teaching materials that can support every learning style of students, moreover this time learning is expected to be in accordance with the essence of the Kurikulum Merdeka which means that teachers play a major role in facilitating students to learn while still referring to the freedom of the way students learn (Bire et al., 2014; C. W. y. Chen, 2021). Based on this, it is necessary to develop multimodal digital modules based on ethnomathematical problems to be able to help teachers and students in terms of providing learning materials. The results of the research conducted show that multimodal digital modules based on ethnomathematical problems have good quality and are effective as evidenced by the results of validation by media experts and excellent material experts. The results of the quantity of quality of the modules developed in T abel 4 show that the digital modules developed are feasible because they meet the criteria of validity, practicality, and effectiveness. The average score of media experts is 4.875 (97.5%) which means that the design aspect, accessibility meets existing standards and material experts are 4.70 (94%) which means that the material contained in the module is in accordance with the existing curriculum.

Based on the practicality test, teachers and students as users of digital modules agree if the developed multimodal digital modules are used in learning. This can be seen through the average teacher response score obtained at 4.32 (86.4%) and the average student response score of 4.20 (84%). The questionnaire for teachers contains 10 statements. Teachers strongly agree that the modules developed (1) help students understand learning, (2) the material contained in the modules is in accordance with the curriculum used, (3) the use of modules in learning can increase student learning motivation. Students strongly agree that (1) the display of multimodal digital modules is attractive, (2) digital modules are easy to use, (3) the instructions in the modules make it easier for students to optimize digital modules.

The effectiveness of the digital modules developed was measured by testing 31 students. The average score obtained is 78.1 with a student graduation percentage of 83%. So the results of this study show that the digital modules developed are effectively used in classroom learning. Digital modules are easy for students to understand with excellent mastery of the material. Good mastery of the material is due to (1) the modules used use a multimodal approach so as to facilitate student learning styles (Y. Chen, 2010; Sarfa, 2016), (2) Digital modules are carried out with exploration media with geogebra which can increase student learning motivation (Rhilmanidar & R, 2020; Velichova, 2011).

The results of this study can be used as a solution to help teachers in the learning process in class, especially on building flat side room material. What's more, it is very effective with the Kurikulum Merdeka today. In previous studies, the digital module developed was only in the form of text or video, while the digital module developed used a multimodal approach, where the material was presented not only in the form of text or video, but the material was also presented in illustrations to meet the learning style of students, illustrations were given using geogebra as the media. This is in line with research conducted by study which states that *geogebra-based* learning is very well applied in learning (Nababan, 2020). The renewal of the digital module developed is based on ethnomathematical problems. According to other studies that mentioned the Ethnomathematics approach can provide knowledge to students related to local culture and the culture is very close to the student's environment (Fouze & Amit, 2018; Rosa & Orey, 2011).

Students can learn culture through information technology which then the culture is raised in a mathematics learning.

With the development of problem-based digital mathematics modules with an ethnomathematical approach, it is able to support the implementation of the Kurikulum Merdeka, not only to improve the learning obtained, but also to contribute to the development of thought (Jauhari et al., 2022; Soboleva et al., 2022). This can be a learning solution in the Kurikulum Merdeka by analyzing the characteristics of the curriculum with the characteristics of the digital modules developed. So that the module is in line with the intracurricular program in the curriculum structure. The digital modules developed contain simpler materials and focus on essential materials. This digital module is also designed to be operated independently by students so that it is more flexible and can be adjusted to the student's ability level and of course in accordance with the learning style of each student to provide meaningful mathematics learning for junior high school students who are in phase D.

4. CONCLUSION

The multimodal digital mathematics module based on ethnomathematical problems developed meets the eligibility criteria based on validity, practicality and effectiveness tests carried out with very high categories. These results were obtained through expert assessments and teacher and student response questionnaires. The implementation of multimodal digital module-assisted learning makes it easier for students to learn independently, this is because students can operate modules according to student needs and learning styles. In addition, digital modules equipped with illustrations help students easily imagine the context of the discussion related to visuals. Based on this, meaningful learning through ethnomathematics-based digital modules will be able to be a solution to educational needs with the development of science and technology because it can make students learn independently and accommodate every student's learning style.

5. REFERENCES

- Agustini, K., Santyasa, I. W., & Ratminingsih, N. M. (2019). Analysis of competence on "TPACK": 21st century teacher professional development. *Journal of Physics: Conference Series*, 1387(012035), 1–9. <https://doi.org/10.1088/1742-6596/1387/1/012035>.
- Al Fajri, T. A. (2018). Pentingnya Penggunaan Pendekatan Multimodal dalam Pembelajaran. *WASKITA: Jurnal Pendidikan Nilai Dan Pembangunan Karakter*, 2(1), 57–72. <https://doi.org/10.21776/ub.waskita.2018.002.01.5>.
- Arikunto. (2011). *Dasar-dasar Evaluasi Pendidikan*. PT. Bumi Aksara.
- Astuti, S. W. (2019). Strategi Pembelajaran dalam Menghadapi Tantangan Revolusi Industri 4.0. *Prosiding Seminar Nasional Pascasarjana UNNES*. <https://www.embada.com/index.php/jeid/article/view/152>.
- Bire, A. L., Geradus, U., & Bire, J. (2014). Pengaruh Gaya Belajar Visual, Auditorial, Dan Kinestetik Terhadap Prestasi Belajar Siswa. *Jurnal Kependidikan*, 44(2). <https://doi.org/10.21831/jk.v44i2.5307>.
- Chen, C. W. y. (2021). Composing print essays versus composing across modes: students' multimodal choices and overall preferences. *Literacy*, 55(1), 25–38. <https://doi.org/10.1111/lit.12234>.
- Chen, Y. (2010). Exploring Dialogic Engagement with Readers in Multimodal EFL Textbooks in China. *Visual Communication*. <https://doi.org/10.1177/1470357210382186>.
- Fouze, A. Q., & Amit, M. (2018). Development of mathematical thinking through integration of ethnomathematic folklore game in math instruction. *Eurasia Journal of Mathematics, Science and Technology Education*, 14(2), 617–630. <https://doi.org/10.12973/ejmste/80626>.
- Gilakjani, A. P. (2012). A Match or Mismatch Between Learning Styles of the Learners and Teaching Styles of the teachers. *Modern Education and Computer Science*, 11, 51–60. <https://doi.org/10.5815/ijmecs.2012.11.05>.
- Haran, A., Hartoyo, A., & Sayu, S. (2019). Etnomatematika dalam Merangkai Manik Masyarakat Dayak Kayaan Kapuas Hulu. *Jurnal Pendidikan Dan Pembelajaran*, 8. <https://doi.org/10.26418/jppk.v8i3.31952>.
- Iadem, R. (2003). Multimodality, Resemiotization: Extending the Analysis of Discourse as Multisemiotic Practice. *Visual Communication*, 1–30. <https://doi.org/10.1177/1470357203002001751>.
- Ilic, P. (2021). The Challenge of Information and Communications Technology in Education. *SHS Web of Conferences*, 102, 01009. <https://doi.org/10.1051/shsconf/202110201009>.
- Jannati, P., Ramadhan, F. A., & Rohimawan, M. A. (2023). Peran Guru Penggerak Dalam Implementasi Kurikulum Merdeka Di Sekolah Dasar. *Al-Madrasah: Jurnal Pendidikan Madrasah Ibtidaiyah*, 7(1),

330. <https://doi.org/10.35931/am.v7i1.1714>.
- Jauhari, M. N., Shanty, A. D., Usfinit, A. H., & Batlyol, A. (2022). Optimalisasi Media dan Teknologi Asistif Dalam Kurikulum Merdeka Belajar Di Sekolah Inklusi. *Kanigara: Jurnal Pengabdian Kepada Masyarakat*, *II*(2), 446–452. <https://doi.org/https://doi.org/10.36456/kanigara.v2i2.6067>.
- Karmila, S. I. (2020). Pengembangan Modul Digital berbasis STEM menggunakan Aplikasi 3D FlipBook pada Mata Kuliah Sistem Operasi. *Mimbar Ilmu*, *25*, 3. <https://ejournal.undiksha.ac.id/index.php/mi/article/view/28702>.
- Kress, G., & Leeuwen, T. (2001). *Multimodal Discourse the Modes and Media of Contemporary Communication*. Arnold.
- Lase, D. (2019). Pendidikan di Era Revolusi Industri 4.0 : Education in the Fourth Industrial Revolution Age. *Jurnal Sunderman*, *29*. <https://doi.org/10.36588/sundermann.v1i1.18>.
- Lisnina. Zulkardi, I. P. (2020). Etnomatematika: Pengenalan bangun datar Melalui Konteks Museum Negeri Sumetara Selatan Balaputra Desa. *Mosharafa: Jurnal Pendidikan Matematika*, *9*(3), 359–370. <https://doi.org/10.31980/mosharafa.v9i3.754>.
- Mardina, R. (2011). Potensi Digital Native dalam Representasi Literasi Informasi Multimedia Berbasis Web di Perguruan Tinggi. *Jurnal Pustakawan Indonesian*. <https://doi.org/10.29244/jpi.11.1>.
- Muhammad, A. F., & Novitasari, N. (2020). Pengembangan Bahan Ajar Matematika Berbasis Etnomatematika Untuk Meningkatkan Pemahaman Matematik Siswa Kelas III Sekolah Dasar. *Jurnal Bidang Pendidikan Dasar*, *4*. <https://doi.org/10.21067/jbpd.v4i1.3877>.
- Nababan, N. (2020). Pengembangan Media Pembelajaran Berbasis Geogebra Dengan Model pengembangan ADDIE di kelas XI SMA N 3 Medan. *Inspiratif: Jurnal Pendidikan Matematika*, *6*(1). <https://doi.org/10.24114/jpmi.v6i1.19657>.
- Nastiti, F. E., Ni'mal 'abdu, A. R., & Kajian, J. (2022). Kesiapan Pendidikan Indonesia Menghadapi era society 5.0. *Edcomtech*, *5*(1), 61–66. <http://download.garuda.kemdikbud.go.id/article.php?article=1615488&val>.
- Nataliia, B. A. (2022). Mathematical Model for Adaptive Technology in Elearning system. *Modern Education and Computer Science*, *1*(3). <https://doi.org/10.5815/ijmecs.2022.04.01>.
- Numertayasa, I. W., Astuti, N. P. E., Suardana, I. P. O., & Pradnyana, P. B. (2022). Workshop Review dan Implementasi Kurikulum Merdeka di SMP Negeri 3 Selemadeg Timur. *Madaniya*, *3*(3). <https://doi.org/10.53696/27214834.236>.
- O'Halloran, K. L. (2011). Multimodal analysis within an Interactive Software Environment: Critical Discourse Perspectives. *Scholar Bank NUS Repository*. <https://doi.org/10.1080/17405904.2011.558687>.
- Pan, X. (2022). An Empirical study of application of multimodal approach to teaching reading in EFL in senior high school. *International Journal of Emerging Technologies in Learning*, *15*(2), 98–111. <https://doi.org/10.3991/ijet.v15i02.11267>.
- Papageorgiou, V. (2017). Multimodal teaching and learning with the use of thecnology: Menaing, practices and discourses. *14th International Conference on Cognition and Exploratory Learning in the Digital Age CELDA*. <https://eric.ed.gov/?id=ED579485>.
- Prahmana, R. C. I., Yuniyanto, W., Rosa, M., & Orey, D. C. (2021). Ethnomathematics: Pranatamangsa system and the birth-death ceremonial in yogyakarta. *Journal on Mathematics Education*, *12*(1), 93–112. <https://doi.org/10.22342/JME.12.1.11745.93-112>.
- Pratiwi, S. A., Marlina, R., & Kurniawan, F. (2023). Analisis Penerapan Kurikulum Merdeka dalam pembelajaran Jasmani pada siswa SMK Texar Karawang. *Jurnal Ilmiah Wahana Pendidikan*, 523–535. <https://doi.org/10.5281/zenodo.7551222>.
- Priyani, N. E. (2021). Pengembangan Modul Etnomatematika Berbasis Budaya Dayak Dalam Pembelajaran Matematika Dengan Pendekatanjoyfull Learning. *Didaktika Pendidikan Dasar*, *5*. <https://doi.org/10.26811/didaktika.v5i1.226>.
- Rahayu, R., Rosita, R., Rahayuningsih, Y. S., Hernawan, A. H., & Prihantini, P. (2022). Implementasi Kurikulum Merdeka Belajar di Sekolah Penggerak. *Jurnal Basicedu*, *6*(4), 6313–6319. <https://doi.org/10.31004/basicedu.v6i4.3237>.
- Raiyn, J. (2016). Developing a Mathematics Lesson Plan based on Visual Learning Technology. *IJ. Education and Management Engineering*, *6*(4), 1–9. <https://doi.org/10.5815/ijeme.2016.04.01>.
- Rakhamawati, M., & R. (2016). Aktivitas Matematika Berbasis Budaya pada Masyarakat Lampung. *Jurnal Pendidikan Matematika*, *7*. <https://doi.org/10.24042/ajpm.v7i2.37>.
- Rhilmanidar, R., & R. M. (2020). Efektivitas Modul pembelajaran Berbantuan Software GeoGebra pada materi Bangun Ruang Sisi Datar. *J. Didakt Mat*, *7*(2), 142–155. <https://doi.org/10.24815/jdm.v7i2.17915>.
- Rosa, M., & Orey, D. (2011). Ethnomathematics: the cultural aspects of mathematics. *Revista*

- Latinoamericana de Etnomatemática*, 4(2), 32–54. <http://funes.uniandes.edu.co/3079>.
- Rosa, M., Shirley, L., Gavarrete, M. E., & Alangui, W. V. (2017). *Ethnomathematics and its diverse approaches for mathematics education* (1st ed.). Springer. <https://doi.org/10.1007/978-3-319-59220-6>.
- Sarfa, W. (2016). Analisis Gaya Belajar Siswa Terhadap Hasil Belajar Matematika Pada Materi Himpunan Siswa Kelas Vii Smp Negeri Karang Jaya Kecamatan Namlea Kabupaten Buru. *Jurnal Matematika Dan Pembelajarannya*, 2. <https://doi.org/10.33477/mp.v4i1.310>.
- Sheromova, T. S., Khuziakmetov, A. N., Kazinets, V. A., Sizova, Z. M., Buslaev, S. I., & Borodianskaia, E. A. (2020). Learning styles and development of cognitive skills in mathematics learning. *Eurasia Journal of Mathematics, Science and Technology Education*, 16(11). <https://doi.org/10.29333/EJMSTE/8538>.
- Smaragdina, N. S. (2020). Pelatihan Pemanfaatan dan Pengembangan Bahan Ajar Digital Berbasis Multimedia Interaktif untuk menghadapi era revolusi insudtri 4.0. *Jurnal Karinov*. <https://doi.org/10.17977/um045v3i1p53-57>.
- Soboleva, E., Zhumakulov, K. K., & Umurkulov, K. P. (2022). Developing a Personalised Learning Model Based on Interactive Novels to Improve the Quality of Mathematics Education. *EURASIA Journal of Mathematics, Science and Technology Education*. <https://doi.org/10.29333/11590>.
- Subali, M., Firmasari, S., & Fatchurrohman, M. (2018). Etnomatematika pada sumur purbakala Desa Kaliwadas Cirebon dan kaitannya dengan pembelajaran matematika di sekolah. *Riset Pendidikan Matematika*, 5. <https://doi.org/10.21831/jrpm.v5i2.15714>.
- Sugiyono. (2019). Metode Penelitian Pendidikan. In *Bandung:Alfabeta*.
- Sukardi. (2009). *Metodologi Penelitian Pendidikan*. PT Bumi Askara.
- Suryawan, I. P. P., & Juniantari, M. (2018). Undagi Bali Ethnomathematic Study and How to Acquire Its Knowledge. In *First International Conference on Science, Technology, Engineering and Industrial Revolution (ICSTEIR 2020)*, 536, 384–390. <https://doi.org/10.2991/assehr.k.210312.064>.
- Umbara, U. (2021). Ethnomathematics Vs Ethomodeling: how does cigugur traditional community determines the direction of the wind to seek fortune based on month. *Journal of Physics: Conference Series*. <https://doi.org/10.1088/1742-6596/1776/1/012034>.
- Velichova, D. (2011). Interactive Maths with GeoGebra. *IJET*, 6(1), 31–35. <https://doi.org/10.3991/ijet.v6iS1.1620>.
- Wahyudi, D. (2019). Pengembangan E-Modul dalam Pembelajaran Matematika SMA Berbasis Android. *GAUSS: Jurnal Pendidikan Matematika*, 2(2), 1. <https://doi.org/10.30656/gauss.v2i2.1739>.
- Wahyuni, A., Tias, A., & Sani, B. (2013). Peran Etnomatematika dalam Membangun Karakter Bangsa. In *Makalah Seminar Nasional Matematika Dan Pendidikan Matematika, Prosiding, Jurusan Pendidikan Matematika FMIPA UNY, Yogyakarta: UNY.*, 114–118. <https://core.ac.uk/download/pdf/18454275.pdf>.