Improving students' mathematical logical intelligence through the online-based integration of local wisdom of Sulapa Eppa Walasuji

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Abstract

Mathematical logical intelligence is one of the skills that are needed in the 21st century related to mathematical problem-solving skills. The importance of this skill is not in line with the facts on the ground, where students are still weak in counting and using logic in problem solving. The purpose of this research is to improve students' mathematical logical intelligence through the online-based integration of local wisdom of Sulapa Eppa Walasuji. Sulapa Eppa Walasuji is one of the Bugis-Makassar local wisdoms with a unique pattern, appropriate to be used as a medium for learning transformation of geometry. Through the integration of local wisdom, Sulapa Eppa Walasuji can create contextual mathematics learning, so that students can easily understand the material by connecting real-life concepts. This research includes experimental research with a quasi-experimental design of the nonequivalent control group design type. The research instrument used was a mathematical logical intelligence test consisting of five essay questions. The data analysis used is descriptive statistics with gain score and effect size testing. The results showed that the mathematical logical intelligence of experimental class students increased by 43.16 with the effective contribution of the r effect size being 0.910. This indicates that the online-based integration of Sulapa Eppa Walasuji can improve students' mathematical logical intelligence.

INTRODUCTION

One of the sciences that is exact (definitely), so it becomes a must in studying it explicitly from kindergarten to university is mathematics (Asfar & Asfar, 2020; Nurannisa et al., 2021; Asfar et al., 2019). Learning mathematics can train students to understand a concept through the process of thinking and reasoning in drawing conclusions, developing creativity, making predictions, and improving students' problem-solving abilities through the delivery of information and ideas (Asfar & Asfar, 2021; Asfar et al., 2021). One of the mathematical skills that are needed in facing the challenges of the 21st century is mathematical logical intelligence. Mathematical logical intelligence is a form of student skills in counting and using logic (Widyawati & Rahayu, 2020; Ayuningsih & Ciptahadi, 2020). This intelligence is closely related to students' skills in solving mathematical problems, namely being able to think and formulate solutions in a logical order (Nisa, Mukhlis & Maswar, 2020; Pradestya, Imswatama & Balkist, 2020; Hitalessy, Mataheru & Ayal, 2020). However, students' skills in solving math problems are still very low, where students are very weak in solving non-routine questions, especially contextual so that this research provides concrete examples to students contextually.

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The low skill of students in solving math problems can be seen from the results of the 2018 PISA survey, where the mathematics learning achievement score of Indonesian students is 379 which is ranked 67th out of 74 countries (OECD, 2019). This is also supported by the national achievements of students based on the results of the National Examination (NE) in 2019, where mathematics became the subject with the lowest score among other subjects. The national achievement score for mathematics is 39.33 which is below the standard of graduation criteria, namely 55 (scale 0-100). This fact is in line with the results of the National Examination (NE) students in Bone Regency who obtained a score of only 34.25 are in the less category. One of the materials that hinder students' achievement is geometry material with a score of 29.57 (Puspendik, 2020).

The problem of the low mathematical problem-solving skills of students in geometry material was also found in class XI students of SMAN 19 Bone, where students experienced problems in applying for existing numbers, students had difficulty in identifying problems and determining the relationship between symbols and causal patterns, incorrectly using formulas, unable to determine alternative answers that are appropriate to the problem, and it is difficult to conclude the solution to the problem at hand. The characteristics of these students indicate that students' mathematical logical intelligence is still very low. Mathematical logical intelligence is a set of a number of numeracy skills and mastery of logic that greatly assist students in solving problems in a structured and logical manner. Students who have high logical mathematical intelligence tend to be able to interpret a problem and examine and solve it appropriately (Sari & Hasibuan, 2019).

Students' low mathematical logical intelligence is caused by the learning process that does not relate students' real-life concepts to learning materials, so students have difficulty in interpreting and studying a problem to determine the right solution in solving it (Asfar et al., 2019). The basis of the logical-mathematical approach according to Pramesti & Oktalia (2021) is identical with measurable, quantitative, and analytical thinking activities. Mathematical logical intelligence greatly affects student learning outcomes, including student achievement in mathematics. Students who have high mathematical logical intelligence can easily solve the math problems they face. The results of research by Rahmawati & Ibrahim (2021) show that student learning outcomes get an average score of 58.4 which indicates the influence of mathematical logical intelligence on student learning outcomes. This is in line with the research of Rinawati & Ratu (2021), where students' mathematical logical intelligence in solving mathematical problems is only in the sufficient category. This is because students have not been able to solve non-routine, especially contextual problems, so students find it difficult to use mathematical operations appropriately in problem solving. An alternative solution that can overcome the low mathematical logical intelligence of students is by creating a learning innovation that can stimulate students' thinking processes by linking real-life concepts through ethnomathematics-based learning (Asfar et al., 2019). Ethnomathematics based learning can give students the opportunity to understand concepts by linking the culture or students' experiences in learning mathematics (Nurannisa, Asfar & Asfar, 2020; Kurniawan et al., 2019; Asfar, Asfar & Nurannisa, 2021). The application of ethnomathematics-based learning really requires learning media that can involve students' learning experiences in the learning process (Nur et al., 2021).

This research was conducted by applying ethnomathematics-based learning media in developing students' mathematical logical intelligence through the online-based integration of

local wisdom of Sulapa Eppa Walasuji. Sulapa Eppa Walasuji is a form of Bugis-Makassarese local wisdom that is commonly found in wedding traditions (Alfaruq & Zulkarnain, 2020; Akbar et al., 2019; Naing & Hadi, 2020), which is a series of bamboo designed in the shape of a rhombus, usually used as Baruga (gate) a Bugis wedding (Moham et al., 2019) and a place for the groom's Erang-erang (Syahri, Marwati & Attar, 2020). The concept of Sulapa Eppa Walasuji can be related to the geometric pattern of transformation, namely translation, reflection, dilation, and rotation which can train students' problem-solving skills through logical procedures and thinking (mathematical logical intelligence). The integration of local wisdom of Sulapa Eppa Walasuji in the learning process is a new thing for the world of education that has never been done before. Whereas, the concept of Sulapa Eppa Walasuji has a unique pattern to stimulate logical thinking, especially students' reasoning power with their daily examples so that the examples are not in abstract form but are more concrete and contextual.

The research was carried out online as a form of online learning during the COVID-19 pandemic with the help of an android application. The android applications used in this research include applications Zoom Meeting, Trello, and Liveworksheets. The Zoom Meeting application is used as a face-to-face medium for teachers and students which is carried out online in the learning process. The Trello application is used as a medium for student discussion in collecting assignments given by the teacher and allows communication between students and teachers and students with other students (feedback). Meanwhile, the liveworksheet is used as online-based interactive student worksheet media. These three applications are used to support online learning that is carried out during the research. Therefore, this research aims to improve students' mathematical logical intelligence through the online-based integration of local wisdom of Sulapa Eppa Walasuji.

METHODS

This research is a type of experimental research conducted to improve students' mathematical logical intelligence through the online-based integration of local wisdom of Sulapa Eppa Walasuji. The research design used is a quasi-experimental type of nonequivalent control group design. Through purposive sampling (teacher considerations), two classes were selected as research samples, namely class XI MIPA 1 as the control class and class XI MIPA 2 as the experimental class. The experimental class was given treatment by applying the online-based integration of local wisdom of Sulapa Eppa Walasuji. While in the control class, learning is carried out as usual, namely a problem-based learning model. The number of students in each research class was 28 students. Virtually, the research design can be seen in Figure 1.

Figure 1. Nonequivalent Control Group Design

The research instrument used is a test of students' mathematical logical intelligence with five essay questions. To see the improvement of students' mathematical logical intelligence with the online-based integration of local wisdom of Sulapa Eppa Walasuji, *Gain Score* and *Effect Size* tests were carried out. The assessment criteria of *Gain Score* used in this research can be seen in Table 1.

Table 1. Gain Score Assessment Criteria

Normalized <i>N-Gain</i>	Interpretation
$0.7 \leq g \leq 1$	High
$0.3 \leq g \leq 0.7$	Moderate
$0 \leq g \leq 0.3$	Low

RESULTS AND DISCUSSION

The results of this research indicate that students' mathematical logical intelligence has increased with the online-based integration of local wisdom of Sulapa Eppa Walasuji in the learning process. Improvements can be seen from the data analysis results of *gain score* of students presented in Figure 2.

Figure 2. Comparison of *Gain Score* in Control Class and Class Experiment

Based on test results of *gain score* above, it can be concluded that the increase occurring after the application of integration of local wisdom Sulapa Eppa Walasuji based online is in the high category of 0.91 (91%), while the control class with the application of the problem-based learning model is in the medium category of 0.50 (50%). This indicates that the two research classes, both the control class and the experimental class, have increased. However, the increase that occurred in the experimental class was higher than in the control class. This is also supported by the results of the analysis of *effect size* which shows a large contribution from the application of online-based integration of local wisdom of Sulapa Eppa Walasuji to students' mathematical logical intelligence.

Table 2. Result of *Effect Size* Analysis

Class	<i>d Effect Size</i>	<i>r Effect Size</i>	Category
Control	1.816	0.664	Medium effect
Experiment	4.487	0.910	Big effect

From the results of the effective contribution of treatment, namely the application of the online-based integration of local wisdom of Sulapa Eppa Walasuji in improving students' mathematical logical intelligence in testing by comparing the results of the *pretest* and *posttest* of the experimental class, the value of $d = 4.487$ and the *effect size* based on $r = 0.910$, these results are in large effect category which means that the application of the online-based integration of local wisdom of Sulapa Eppa Walasuji is effective in increasing students'

mathematical logical intelligence. Meanwhile, in the control class, it can be seen that the application of the problem-based learning model also contributes effectively to students' mathematical logical intelligence by $d = 1.816$ and the *effect size* based on $r = 0.664$, this result is in the moderate effect category. Based on the results of data analysis, it can be concluded that the application of the online-based integration of local wisdom is Sulapa Eppa Walasuji more effective in developing students' mathematical logical intelligence than problem-based learning models.

The online-based integration of local wisdom Sulapa Eppa Walasuji in the learning process refers to three stages of learning, namely exploration, collaboration, and evaluation. The exploration stage is the initial stage carried out to find and identify a problem (Putra, 2021; Indari *et al.*, 2020). In the exploration stage of the integration of Sulapa Eppa Walasuji, the teacher and students explore the pattern of Sulapa Eppa Walasuji then identify the elements of the transformation of geometry contained in it. Students in this case observe and interpret the transformation of the concepts of geometry and relate them to everyday life that students usually encounter. This is in line with the indicators of students' mathematical logical intelligence which requires students to be able to determine the relationship between symbols and causal patterns in the problem-solving process. The next stage is collaboration, which is an interactive, constructive and knowledge-based process that involves many students in problem-solving activities to achieve the desired goals (Malik *et al.*, 2021). Collaboration is closely related to the process of motivation, division of tasks, understanding group vision, targets, and self-evaluation (Santoso *et al.*, 2021; Rahmawati *et al.*, 2019). Through this collaboration stage, students will be given various questions that require students' thinking processes in counting, so that they are able to apply arithmetic operations correctly in problem solving. In the final stage, students are given an evaluation as a benchmark for the success of the learning process that has been implemented (Suardipa & Primayana, 2020; Anwar, 2021). Maihani *et al.*, (2019) stated that the evaluation stage is an assessment stage to find out whether the activities carried out are running according to the target. The evaluation stage in the integration of Sulapa Eppa Walasuji, where the teacher provides independent evaluations to students to determine the extent to which students' understanding is related to the transformation of geometry that has been studied. The form of learning success can be seen from the extent to which students' ability to solve the problems given.

Figure 3. Comparison of Average Mathematical Logical Intelligence

Based on the stages of learning with the integration of local wisdom of Sulapa Eppa Walasuji, students' mathematical logical intelligence can be improved according to indicators. The indicators of mathematical logical intelligence used in the research are students' ability to

count or apply arithmetic operations correctly, students ability to understand relationship patterns or determine the relationship between symbols and causal patterns, and students' ability to solve problems (Sari & Hasibuan, 2019; Mukharromah, 2019). The analysis of increasing students' mathematical logical intelligence for each indicator can be seen as follows.

Indicator 1, namely the ability to count. The students' numeracy skills in the control class in solving the *pretest* questions was 27.08. Students have been able to use arithmetic operations in solving the given problem, but are still in the moderate category. When students are faced with problems that require logical thinking in solving them, students experience difficulties. After the *posttest*, students showed an increase in numeracy but not much different from their initial ability, which was 28.89. Meanwhile, the numeracy ability of students in the experimental class in solving the *pretest* questions was only 25.83 which was in the medium category. After implementing the integration of Sulapa Eppa Walasuji in the learning process, students' numeracy skills increased to 29.54. Students who were initially unable to apply arithmetic operations to complex and more complex problems are now able to do so because they are familiar with questions that require logical thinking. This is created when students are faced with a real-life concept that is easy to understand, namely the concept of Sulapa Eppa Walasuji which is closely related to the geometry pattern of the transformation being studied.

Indicator 2, namely the ability to understand the pattern of relationships. The ability to understand the pattern of relationships in the control class was only 27.36. Students have been able to determine the relationship between symbols and causal patterns in problem solving, but do not understand the pattern of relationships that occur, so students are unable to explain the procedures they go through in obtaining the final score. At the time of the *posttest*, students showed an increase in this indicator but it was still in the moderate category, which was 28.19. The result of the *pretest* of experimental class students in measuring indicator 2 (understanding the pattern of relationships) is 25.69. This result has an increase seen from the results *posttest* of 29.44. That is, the integration of Sulapa Eppa Walasuji can improve students' ability to understand the pattern of relationship or determine the relationship between symbols and causal patterns in problem solving. Students in the experimental class showed progress, where at first students were less able to solve the problems given with the right procedure. However, after exploring the geometric transformation pattern on the concept of Sulapa Eppa Walasuji, students begin to understand the procedure they go through until they reach the final result of the concepts of translation, reflection, dilation, and rotation. It can be seen when students explain the relationship between symbols and causal patterns in solving transformation of geometry problems.

Indicator 3, namely the ability to solve problems. The ability of the control class students in solving the problems given is still very low, seen from the result of the *pretest* students only get an average score of 2.5. The result obtained in the experimental class were even lower than the control class, which was only 1.67. After the application of the problem-based learning model in the control class, the students' problem-solving ability increased to 22.22. This increase is still in the moderate category. Meanwhile, the experimental class increased by 37.78 in the high category. This indicates that the integration of Sulapa Eppa Walasuji is more influential in improving students' problem-solving abilities than problem-based learning models.

Based on the analysis of increasing students' mathematical logical intelligence for each indicator, it appears that the problem-based learning model is able to improve students'

mathematical logical intelligence. However, the increase that occurred was still in the moderate category. This is in line with the results of Suparman, Yohannes & Arifin (2021) research which suggests that problem-based learning models can improve students' problem-solving abilities. In addition, with this model students will be accustomed to solving various problems so that they are accustomed to applying arithmetic operations during the problem-solving process (Fisher, Kusumah & Dahlan, 2021). Students in this research showed the same thing, namely being able to count in problem solving. However, students experience errors in solving problems due to improper completion procedures, where students are unable to connect symbols with causal patterns in problem solving. The questions given in this research are contextual questions related to students' daily experiences.

Meanwhile, the online-based integration of local wisdom of Sulapa Eppa Walasuji in the experimental class showed positive results. Students experience an increase in mathematical logical intelligence with the ethnomathematics-based contextual learning, namely Sulapa Eppa Walasuji. Students who initially have not been able to use arithmetic operations correctly are now able to do so because they are accustomed to solving problems logically. All forms of questions presented can be solved easily because students are able to determine the pattern of relationship of each given problem, so that in the end students are able to solve problems with the right procedures. This is in line with the research of Marufi *et al.*, (2021) where ethnomathematics-based learning can improve students' mathematics learning outcomes. Students in this research were able to solve problems easily because they understood the material being taught with learning that linked real-life concepts or students' own experiences. In addition, the application of android applications in this research also has a major influence on the success of the learning process. According to Fatahillah, Dafik & Alfiyantiningsih (2021), the use of android in learning mathematics has a positive impact on students learning outcomes. This is because the use of android is something new and unique for students, so that students' curiosity about learning increases and students become more motivated in participating in the learning. The *Zoom Meeting* application, which is the main application in the implementation of online learning can increase student activity in learning mathematics. The learning process with the help of the *Zoom Meeting* application makes students happy and feels challenged (Asfar & Asfar, 2020), it can be seen from the positive student preference scores of 80% and 20% are constrained because they have not been able to operate the *Zoom Meeting* application (Daniatun, Qohar & Susanto, 2021).

Figure 4. Online Learning Through the *Zoom Meeting* Application

Other applications used in this research process are the *Trello* application and the *liveworksheet* application. These two applications are new things that students have never encountered in previous learning, so students are interested in participating in mathematics learning. Learning in general still uses tests in the form of student worksheets presented in paper form, where students work on assignments on the answer sheets provided. Students in this research worked on online questions through the *liveworksheet* application. This app can be accessed on any device without being installed. Students just click on the question link shared by the teacher, then the student worksheet will immediately open. The results of the students' *pretest* and *posttest* done on the *liveworksheet* can be seen in Figure 5. Figure 5 shows that the experimental class students test results with the application of the online-based integration of Sulapa Eppa Walasuji increased, where by the highest score obtained by the students in the *pretest* was 60 and increased to 100 in the *posttest* results. This shows that the online-based integration of Sulapa Eppa Walasuji can improve student learning outcomes in mathematics subjects, especially students' mathematical logical intelligence.

After the process of working on the questions, students can upload their answers via the *Trello* application, which is a collaborative work management application that allows users to manage various projects they are working on in one place or container (Sarbani, 2020). Through this application, students can communicate and collaborate in working on or discussing the questions given, and can ask the teacher directly related to the obstacles faced in the learning process.

Figure 5. Top Value *pretest* and *posttest* Class Experiments

This research really supports the online learning process by bringing back several applications that can be used in the learning process, where these applications have basically been around for a long time but have not been explored well in the world of education. Moreover, this research also presents a new learning atmosphere with the integration of local wisdom of Sulapa Eppa Walasuji. Previously, there had been no research linking the concept of Sulapa Eppa Walasuji in the mathematics learning process. Therefore, the online-based

integration of Sulapa Eppa Walasuji is a new breakthrough in 21st century learning, namely the integration of local wisdom based on digital literacy.

CONCLUSIONS

Based on the results of the research data analysis, it can be concluded that the online-based integration of local wisdom of Sulapa Eppa Walasuji is effectively applied to mathematics learning, especially the transformation of geometry material in improving students' mathematical logical intelligence. The increase in students' mathematical logical intelligence with the online-based integration of Sulapa Eppa Walasuji is in the high category, which is 0.91 (91%) with the effective contribution based on r effect size = 0.910. This indicates that the application of the online-based integration of local wisdom of Sulapa Eppa Walasuji has a major effect in increasing students' mathematical logical intelligence. Therefore, this research can be an alternative solution in creating a learning innovation with local wisdom and support digital literacy learning (online-based) that can be applied in ethnomathematics-based mathematics learning.

For further research, it is suggested to integrate local wisdom of Sulapa Eppa Walasuji in offline mathematics learning. Moreover, the concept of Sulapa Eppa Walasuji is not only used in the transformation geometry material, but is also appropriate as a learning medium for the flat shape material, so that it can be a reference for future research to test the integration of Sulapa Eppa Walasuji in the learning process with flat shapes material.

AUTHOR CONTRIBUTIONS STATEMENT

ANFA worked as the principal investigator for this research project. The study was designed, conceptualized and carried out by him. She had major contribution in devising theoretical framework and reviewing literature pertaining to the study. The other people had been an integral part of the whole process from brainstorming to writing her input has always been important. She played an important role in data collection and analysis.

REFERENCES

- Akbar, A. M., Yudono, A., Wikantari, R., & Mochsen, M. (2019). [Local wisdom values as philosophy of buginese aristocratic traditional house form in bone south Sulawesi](#). *Journal of Xi'an Shiyong University*, 16(8), 62–71.
- Alfaruq, A. M., & Zulkarnain. (2020). [Kearifan lokal rumah tradisional bugis baranti di kabupaten Sidrap](#). *Jurnal Timpalaja*, 1(2), 68–71.
- Anwar, K. (2021). [Urgensi evaluasi dalam proses pembelajaran](#). *Jurnal Pemikiran dan Pencerahan*, 17(1), 108–118. <https://doi.org/10.31000/rf.v17i1.4183>
- Asfar, A. M. I. T., Asfar, A. M. I. A., Asfar, A. H., Sirwanti, Rianti, M., & Kurnia, A. (2019). [The elaboration study as an innovative learning model in an effort to improve the understanding of mathematics](#). *International Journal of Innovation, Creativity and Change*, 5(3), 842–864
- Asfar, A., Asfar, A., Aspikal, & Nurwijaya. (2019). [Efektivitas case based learning \(CBL\) disertai umpan balik terhadap pemahaman konsep siswa](#). *Histogram: Jurnal Pendidikan Matematika*, 3(5), 29–45.

- Asfar, A. M. I. T., & Asfar, A. M. I. A. (2020). [Case-based games learning strategies to improve conceptual understanding in mathematics](#). *Journal of Physics: Conference Series*, 1663, 1–10.
- Asfar, A. M. I. T., & Asfar, A. M. I. A. (2020). Zoom aman bagi pengguna? review kelemahan dan panduan praktis preventif pembelajaran melalui daring atau online. 1–17.
- Asfar, A. M. I. T., & Asfar, A. M. I. A. (2021). [The effectiveness of distance learning through edmodo and video conferencing jitsi meet](#). *Journal of Physics: Conference Series*, 1760, 1–8. <https://doi.org/10.1088/1742-6596/1760/1/012040>
- Asfar, A. M. I. T., Asfar, A. M. I. A., & Nurannisa, A. (2021). [Integration of local traditions bugis-makassarese: Learning strategies to improve mathematical communication skills](#). *Journal of Physics: Conference Series*, 1808, 1–10. <https://doi.org/10.1088/1742-6596/1808/1/012064>
- Asfar, A. M. I. T., Asfar, A. M. I. A., & Sulastri, S. (2021). [Improving student's complex problem solving through LAPS-Talk-Ball learning integrated with interactive games](#). *Journal of Physics: Conference Series*, 1722, 1–7.
- Asfar, A. M. I. T., Asmawaty, Asfar, A. M. I. A., & Nursyam, A. (2019). [Mathematical concepts understanding: The impact of integrated learning model](#). *Al-Jabar: Jurnal Pendidikan Matematika*, 10(2), 211–222.
- Ayuningsih, N. P. M., & Ciptahadi, K. G. O. (2020). Pengaruh model pembelajaran giving question and getting answer terhadap kecerdasan logis matematis. *Jurnal Pendidikan Matematika*, 11(1), 134–142.
- Daniatun, R., Qohar, A., & Susanto, H. (2021). [Students' activeness in mathematics learning via zoom on algebra learning material](#). *Al-Jabar: Jurnal Pendidikan Matematika*, 12(1), 17–24.
- Fatahillah, A., Dafik, & Alfiyantiningsih, N. (2021). [Developing construct 2 android-based education math game to improve the ICT literacy on number patterns subject](#). *Al-Jabar: Jurnal Pendidikan Matematika*, 12(1), 25–34.
- Fisher, D., Kusumah, Y. S., & Dahlan, J. A. (2021). [The achievement of middle school students' mathematical problem solving abilities through project-based learning models](#). *Al-Jabar: Jurnal Pendidikan Matematika*, 12(1), 185–192.
- Hitalessy, M., Mataheru, W., & Ayal, C. S. (2020). [Representasi matematis siswa dalam pemecahan masalah perbandingan trigonometri pada segitiga siku-siku ditinjau dari kecerdasan logis matematis, linguistik dan visual spasial](#). *Jurnal Pendidikan Matematika (Jumadika)*, 2(1), 1–15.
- IEA. (2016). *TIMSS 2015 international result in mathematics*. Online.
- Indari, R., Saguni, F., & Marwany. (2020). [Efektifitas pengetahuan sains melalui pendekatan eksplorasi lingkungan sekitar sekolah di taman kanak-kanak nurul jami'ah talise](#). *Jurnal Pendidikan Anak*, 1(1), 63–76. <https://doi.org/10.24239/abulava.vol1.iss1.5>
- Kurniawan, A. P., Anam, A. C., Abdussakir, & Rofiki, I. (2019). [Integrasi etnomatematika dengan model pembelajaran probing-prompting untuk melatih komunikasi matematis siswa](#). *Jurnal Matematika dan Pembelajaran*, 7(1), 1–15.

- Maihani, S., Kumita, & Lubis, M. J. (2019). Program kemitraan masyarakat melalui pelatihan kewirausahaan bagi mahasiswa dalam mengalahkan rasa takut dan bersahabat dengan ketidakpastian menjadi wirausaha tangguh di cafe pos nongkrong bireuen. *Jurnal Pengabdian Kepada Masyarakat*, 2(1), 29–32.
- Malik, A., Ubaidillah, M., Fatmawati, S., Aswirna, P., Qaddafi, M., & Sutarno, S. (2021). Collaborative skills of prospective teachers in laboratory activities related to the concept of elasticity. *Journal of Physics: Conference Series*, 1731, 1–6. <https://doi.org/10.1088/1742-6596/1731/1/012073>
- Marufi, Ilyas, M., Winahyu, & Ikram, M. (2021). An implementation of ethno-STEM to enhance conceptual understanding. *Al-Jabar: Jurnal Pendidikan Matematika*, 12(1), 35–44.
- Moham, N., Dwiyanto, F. A., Pakpahan, H. S., Islamiyah, & Setyadi, H. J. (2019). Pengenalan karakter tulisan menggunakan metode backpropagation neural network. *Sains, Aplikasi, Komputasi dan Teknologi Informasi*, 1(2), 14–22.
- Mukharromah. (2019). Kecerdasan logis matematis siswa dalam menyelesaikan masalah matematika melalui problem posing pada materi himpunan kelas VII MTs Nurul Huda Mojokerto. *Jurnal Penelitian, Pendidikan dan Pembelajaran*, 14(8), 16–22.
- Naing, N., & Hadi, K. (2020). Vernacular architecture of buginese: The concept of local-wisdom in constructing buildings based on human anatomy. *International Review for Spatial Planning and Sustainable Development*, 8(3), 1–15.
- Nisa, F. B., Mukhlis, M., & Maswar, M. (2020). Analisis hubungan antara kecerdasan logis matematis dengan kemampuan komunikasi matematis siswa. *Alifmatika: Jurnal Pendidikan dan Pembelajaran Matematika*, 2(2), 199–211.
- Nur, A. S. A., Ramli, A., Inanna, Asfar, A. M. I. A., Asfar, A. M. I. T., & Ernawati. (2021). Analysis curiosity and analogy abilities of college student reviewed from a scientific approach at the university of muhammadiyah bone. *JIRA: Jurnal Inovasi dan Riset Akademik*, 2(5), 590–609.
- Nurannisa, A., Asfar, A. M. I. T., & Asfar, A. M. I. A. (2020). Learning design based on local wisdom maddawa-dawa, mammanu-manu and mappettuada. *JTAM (Jurnal Teori dan Aplikasi Matematika)*, 4(2), 214–223.
- Nurannisa, A., Asfar, A. M. I. T., & Asfar, A. M. I. A. (2021). Learning design: Integrated local tradition ma'dawa-dawa, ma'manu-manu, ma'pettuada based on android. *Journal of Physics: Conference Series*, 1760, 1–6.
- OECD. (2019). *PISA 2018 Result: What students know and can do*. Online.
- Pradestya, R., Imswatama, A., & Balkist, P. S. (2020). Analisis kemampuan kognitif pada langkah-langkah pemecahan masalah ditinjau dari kecerdasan logis matematis. *Pasundan Journal of Research in Mathematics Learning and Education*, 5(1), 73–92.
- Pramesti, S. L. D., & Anisah Oktalia. (2021). Pengaruh kecerdasan logis matematis dan kecerdasan spasial terhadap hasil belajar matematika materi bangun ruang. *Indonesian Journal of Islamic Elementary Education*, 1(1), 49–60.
- Pusat Penilaian Pendidikan. 2019. *Laporan hasil ujian nasional*. <https://hasilun.puspendik.kemdikbud.go.id/#2019>. Diakses pada tanggal 21 Juli 2021.

- Putra, I. M. D. A. (2021). Eksplorasi gamelan angklung dan selonding sebagai media ungkap dalam penciptaan karya musik “kapetengan.” *Segara Widya: Jurnal Penelitian Seni*, 9(1), 1–7.
- Rahmawati, A., Fadiawati, N., & Diawati, C. (2019). Analisis keterampilan berkolaborasi siswa SMA pada pembelajaran berbasis proyek daur ulang minyak jelantah. *Jurnal Pendidikan Dan Pembelajaran Kimia*, 8(2), 431–443.
- Rahmawati, L., & Ibrahim. (2021). Kecerdasan logis matematis dan linguistik sebagai prediktor hasil belajar matematika. *Mosharafa: Jurnal Pendidikan Matematika*, 10(2), 245–256.
- Rinawati, R., & Ratu, N. (2021). Analisis kemampuan pemecahan masalah siswa SMP kelas VIII pada materi bangun ruang sisi datar ditinjau dari kecerdasan logis matematis. *Jurnal Cendekia: Jurnal Pendidikan Matematika*, 5(2), 1223–1237.
- Santoso, A. M., Primandiri, P. R., Zubaidah, S., & Amin, M. (2021). Improving student collaboration and critical thinking skills through ASIC model learning. *Journal of Physics: Conference Series*, 1806, 1–4.
- Sari, N. K., & Hasibuan, N. H. (2019). Pengaruh kedisiplinan, rasa percaya diri dan kecerdasan logis matematis terhadap hasil belajar matematika siswa. *PYTHAGORAS: Jurnal Program Studi Pendidikan Matematika*, 8(1), 49–59.
- Suardipa, I. P., & Primayana, K. H. (2020). Peran desain evaluasi pembelajaran untuk meningkatkan kualitas pembelajaran. *Widyacarya*, 4(2), 88–100.
- Suparman, Yohannes, & Arifin, N. (2021). Enhancing mathematical problem-solving skills of indonesian junior high school students through problem-based learning: A systematic review and meta-analysis. *Al-Jabar: Jurnal Pendidikan Matematika*, 12(1), 1-16.
- Syahri, M. Z., Marwati, & Attar, M. (2020). Penerapan konsep fasad rumah tradisional takalar pada desain pasar sentral. *Jurnal Timpalaja*, 2(1), 1–14.
- Widyawati, E., & Rahayu, S. W. (2020). Kecerdasan logis matematis siswa kelas IX MTs negeri tarakan dalam memecahkan masalah sistem persamaan linear dua variabel. *Journal of Mathematics Education, Science and Technology*, 5(1), 51–60.