

Students' Mathematical Connection Ability through Learning Strategies Based on Local Wisdom

Andi Muhammad Irfan Taufan Asfar¹, Sumiati², Andi Muhamad Iqbal Akbar Asfar^{3*}, Andi Nurannisa⁴

^{1,2,4}Mathematics Education Department, University of Muhammadiyah Bone, Indonesia

³Chemical Engineering Department, Ujung Pandang State Polytechnic, Indonesia

*Email: andiifalasar@gmail.com

Received: 28 August 2021 ; Revised: 24 February 2022 ; Accepted: 30 April 2022

Abstract. *Students' mathematical abilities are still considered low due to the lack of students' mathematical connection abilities. One effort to overcome the low ability of students' mathematical connections is to involve the culture around students in the learning process. This study aims to analyze students' mathematical connection ability through learning strategies based on local wisdom a'bulo sibatang, assamaturu, mappesabbi, and sipakatau. The research method used is a quantitative quasi-experimental type of nonequivalent control group design. The purposive sampling technique obtained class XI MIPA 3 (experimental class) and XI MIPA 1 (control class). The instrument used is a test for indicators of mathematical connection ability. The result shows that improvement of mathematical connection ability of students who implement learning strategies based on local wisdom better than mathematical connection ability of students without learning strategies based on local wisdom. The improvement in the mathematical connection ability of experimental class students is the high category and control class is the medium category.*

Keywords: *mathematical connection, learning strategies, local wisdom*

Introduction

Mathematics has an important position in realizing human expertise, especially in the fields of science and technology (Sumiati *et al.*, 2019; Wardah, Utomo & Putri, 2021; Asfar & Asfar, 2020), where Namkung *et al* (2019) dan Sukestiyarno, Mashitoh & Wardono (2021) stated that mathematics has an effect on everyday life with high technology quality as it is today. This is in line with Asfar, Asfar & Sartina (2018) statement that the changing times in the global era do not come out of mathematics, because being ability in technology requires better mathematical ability. However, the mathematical ability of students in Indonesia are still very low, so that Indonesian students cannot compete with students from other countries (Hana, Surahmat & Fathani, 2019; Asfar, Asmawaty & Nursyam, 2019; Ibrahim *et al.*, 2021)

Results of *Programme for International Student Assessment* (PISA) for Indonesia was announced by *The Organization for Economic Cooperation and Development* (OECD, 2019) in 2018, showing that students' ability in mathematics is still low, where Indonesia was ranked 73rd with an average score of 379. Meanwhile, the average mathematics achievement score in OECD countries is 489 (Lanya *et al.*, 2021).

One of the important factors that students in improving their mathematical abilities must master is mathematical connection ability (Prihandhika, 2017; Sumiati *et al.*, 2019). The

mathematical connection was popularised by NCTM in 1989 and used as one of the curriculum standards aimed at assisting the formation of student perceptions by viewing mathematics as a unity whole as a stand-alone material and recognizing the relevance also benefits of mathematics both at school and outside of school (NCTM, 2013). In addition, Yolanda & Wahyuni (2020) state that mathematical connections are higher order thinking skills, which link between concepts in mathematics both internally, namely related to mathematics itself, and externally, namely mathematics with other fields in everyday life. Connection is very important for students to master, because the ability to connect will make it easier for students to solve problems related to everyday life (Siregar & Surya, 2017; Fendrik, 2019).

The importance of connections in mathematics learning has not been balanced by the mathematical connection abilities possessed by the student. Basically, the student's mathematical connection ability is still low, this can be seen from the OECD report regarding the results of the PISA relating to student's ability to solve questions that require a mathematical connection process, only 5.4% or about 95% of students participating in the activity have not been able to associate problems with concepts/principles, associate with other fields of study, or with daily life (Wijayanti & Abadi, 2019; Apriyani & Hadiwinarto, 2021; Dudung & Oktaviani, 2020). The low ability of mathematical connections is caused by the learning process in the classroom which still emphasizes the activities of the teacher, students are not very active, and the questions given tend not to vary, so that students have difficulty answering questions related to problems of daily life (Prihandhika, 2017). This is also seen in class XI students of the senior high schools in Bone, South Sulawesi, where the results of interviews with mathematics teachers in class XI obtained information that students have difficulty connecting mathematical concepts and difficulties answering questions related to everyday life problems. Therefore, innovations in mathematics learning are needed to improve students' mathematical abilities, interests and activities (Paneo, 2019; Asfar *et al.*, 2019). One of them is to involve students' culture and life so that learning is more meaningful and students more easily understand mathematical concepts studied in everyday life (Muthmainnah, Ramli & Ikhsan, 2021; Risdiyanti & Prahmana, 2017; Nurannisa *et al.*, 2020). Several researchers have widely studied mathematics learning based on local wisdom, but in improving students' mathematical connection ability no one integrates Bugis-Makassar local culture *a'bulo sibatang*, *assamaturu*, *mappesabbi*, *sipakatau*.

A'bulo sibatang is a philosophy of a bamboo stick with many segments interpreted as a potent form of unity and togetherness in a group like a bamboo stick (Syaiful, 2019). The meaning of this culture teaches the importance of cooperation in solving problems, where each student certainly has a different level of understanding so that this form of collaboration can support students to share knowledge. *Asamaturu* means deeper than the meaning of gotong

royong, which emphasizes increasing cooperation which means that every human being helps each other in carrying out an activity to realize a common goal (Rosida, Taqwa & Kamaruddin, 2018). The meaning of *assamaturu* itself includes a more detailed concept of *a'bulo sibatang*, if *a'bulo sibatang* includes collaborative activities, then *assamaturu* completes the collaboration with activities to share with other groups. The collaboration process does not only cover one group but also carries out the process of exchanging ideas with other groups. *Mappesabbi* comes from the word *sabbi* which means witness, so the meaning of *mappesabbi* is to witness (Radjab, 2014). Watching in the learning process can be interpreted as a presentation process, where each group representative displays or witnesses the results of his group work to provide an overview or equalization of perceptions with other groups. Meanwhile, *sipakatau* comes from the Bugis-Makassar language which means to humanize human, there is no discrimination and everyone has the same rights (Syarif, *et al.*, 2016; Maida 2016). That is, from the presentation process, each student has the same right to accept or reject the answer given by giving a reasonable reason. The learning strategies of *a'bulo sibatang*, *assamaturu*, *mappesabbi* and *sipakatau* can be used to improve students' mathematical connection ability. This is because the collaboration process can make it easier for students to connect mathematical concepts with everyday life. Each student has a different experience so that the perception equation makes it easier for students to understand mathematical concepts and relate them.

Bugis-Makassar local culture *a'bulo sibatang*, *assamaturu*, *mappesabbi*, *sipakatau* is integrated into learning to increase students' creative thinking based on existing character values and local wisdom. Besides that, students can easily understand mathematical concepts that will be learned in everyday life and make learning more meaningful. So that later students learn with their daily examples. The learning strategies of *a'bulo sibatang*, *assamaturu*, *mappesabbi*, *sipakatau* are applied in online learning by transforming the learning process from offline to online. This is because due to the Covid-19 pandemic situation, the student learning process in the classroom must change the method with *learning from home* or learning from home (Kusumaningrum & Wijayanto, 2020), where online learning is the best choice in implementing learning activities and at the same time technology is developing. so rapidly (Gozali, 2020; Asfar, Asfar & Darmawan, 2018; Amin & Murtiyasa, 2021). Rohana & Ningsih (2019) and Yani *et al.* (2021) stated that information technology could support the development of students' mathematical ability. Based on this, this research will implement several android applications that can support online learning, such as the *zoom meeting* application, *random generator*, *meistertask* and *quizzz*. Therefore, this study aims to analyze students' mathematical connection ability through learning strategies based on local wisdom *a'bulo sibatang*, *assamaturu*, *mappesabbi*, *sipakatau*.

Method

This research is a quantitative with a *quasi-experimental* type of *non-equivalent control group design*. Learning is implemented online, so the class selection is based on the teacher's considerations based on student readiness in online learning. Based on the recommendation given by the teacher, the experimental class was XI MIPA 3, while the control class was XI MIPA 1. The research design can be seen in Table 1.

Table 1. Non-equivalent control group design

Class	Pre-test	Treatment	Post-Test
C	O ₁		O ₂
E	O ₃	X	O ₄

Based on Table 1, it can be seen that the research design used is the non-equivalent control group design. In this design, two classes are symbolized as C (control class) and E (experimental class). The primary difference between the two classes is that the experimental class is given treatment symbolized by X (implementation learning strategies based on local wisdom). Both classes were given a pretest before implementing the learning process, and the posttest was presented at the end of the lesson. Pretest and posttest, in this case are symbolized by O, namely O₁ pretest control class and O₂ posttest control class. O₃ symbolizes the pretest for the experimental class and the posttest for the experimental class is O₄.

The population of this study was all students of class XI in one of the senior high schools in Bone, South Sulawesi. The purposive sampling technique was used to choose the classes based on the teacher's instruction. This refers to the online learning process, where the teacher permits two classes based on student learning readiness so that the experimental class is class XI MIPA 3 and the control class is class XI MIPA 1 with 30 students each. The experimental class implemented learning strategies based on local wisdom, namely *a'bulo sibatang*, *assamaturu*, *mappesabbi*, *sipakatau*. While the control class is carried out without learning strategies based on local wisdom and only applies problem-based learning strategies that have been used by teachers so far in learning mathematics with two-variable linear equation systems.

The instrument used in this study is test including indicators of mathematical connection ability, namely linking mathematical ideas, linking mathematical ideas with other disciplines, and linking mathematical ideas with everyday life. The test used has been checked the validity and reliability. From the ten items, five valuable items were obtained with the t-count value more significant than the t-table (1.734) at a significance level of = 5%. The determined r-value is more significant than the r table (0.456), reflecting the test's reliability level, with a significance level of 5%. N-Gain (normalized gain) is used to determine the average improvement in students' mathematical connection ability before and after learning, while hypothesis testing is used to test to test the hypothesis that improvement of mathematical connection ability of students who

use learning strategies based on local wisdom better than mathematical connection ability of students without learning strategies based on local wisdom.

After knowing the t-test about N-Gain of students' mathematical connection ability, then an analysis was carried out for each indicator of students' mathematical connection ability. The improvement in students' mathematical connection ability can be seen from the result of the N-Gain test with the criteria in Table 2 (Nursaniah, Nurhaqiqi & Yuspriyati, 2018). It aims to measure the achievement of students' mathematical connection ability in more detail through the elaboration of three indicators, namely linking mathematical ideas, linking mathematical ideas with other disciplines, and linking mathematical ideas with everyday life.

Table 2. The N-gain criteria

Nilai	Keterangan
$0,70 < g < 1,00$	Tinggi
$0,30 < g < 0,70$	Sedang
$0,00 < g < 0,30$	Rendah

Results and Discussion

The results of the research that has been carried out by applying learning strategies based on local wisdom in the experimental class and learning without learning strategies based on local wisdom in the control class obtained data on students' *pre-test* and *post-test* scores on mathematical connection ability. Based on the results of *Shapiro Wilk's* test of normality, the p-value for the *pre-test* and *post-test* for the experimental class and control class was less than 0.05, which means the data were not normally distributed. Furthermore, the homogeneity test was carried out on the *pre-test* and *post-test* data for the experimental class and the control class, where the test results showed *Lavene Statistics* for the *pre-test* was 0.549 (homogeneous) and the *post-test* was 0.006 (not homogeneous). This shows that there are differences in the improvement of students' mathematical connection ability using learning strategies based on local wisdom (experimental class) and without learning strategies based on local wisdom (control class). The students' mathematical connection ability for each indicator are presented in Table 3.

Table 3. Students' mathematical connection ability for each indicator

Indicators	Linking mathematical ideas	Linking mathematical ideas with other disciplines	Linking mathematical ideas with everyday life	
Experimental	<i>Pre-test</i>	55,35	47,21	40,56
	<i>Post-test</i>	88,52	85,35	83,87
	N-Gain	0,74	0,72	0,73
	Category	High	High	High
Control	<i>Pre-test</i>	67,34	58,41	53,69
	<i>Post-test</i>	88,40	78,92	80,21
	N-Gain	0,64	0,49	0,57
	Category	Medium	Medium	Medium

Table 3 shows the differences of students' mathematical connection ability for each indicator in the experimental class and control class before and after the learning process. The improvement in the mathematical connection ability of experimental class students is in the high category, namely the indicators linking mathematical ideas by 0.74 (74%), the indicators linking mathematical ideas with other disciplines by 0.72 (72%), and the indicators linking mathematical ideas with everyday life by 0.73 (73%). Meanwhile, in the control class, students' mathematical connection ability was in the medium category, namely the indicators linking mathematical ideas by 0.64 (64%), the indicators linking mathematical ideas with other disciplines by 0.49 (49%), and the indicators linking mathematical ideas with everyday life by 0.57 (57%). These results indicate that the average value of each indicator of mathematical connection ability has increased, both in the experimental class and the control class.

The difference of the average of N-Gain in students' mathematical connection ability between the experimental class and the control class refers to the results of hypothesis testing using the Mann Whitney test. The average of N-gain, standard deviation, and n for experimental class and control class as presented in Table 4.

Table 4. The average of n-gain, standard deviation, and n for experimental class and control class

Class	N	Maximum	Minimum	The Average of N-Gain (%)	Standard Deviation
Experimental	30	100	35	80.74	15.96
Control	30	100	27	68.77	31.84

The Mann Whitney test for data in Table 4 obtained p-value = 0.001. This shows that the improvement of mathematical connection ability of students who implement learning strategies based on local wisdom better than mathematical connection ability of students without learning strategies based on local wisdom.

The impact of the Covid-19 pandemic, learning is carried out online using the application *zoom meeting* as a face to face medium in learning. The stage is *a'bulo sibatang* where students are formed into several heterogeneous groups using a application *random generator*. *Random generator* is an application that can be used in team formation are heterogeneous (Fahrizal & Solichin, 2020). The stage *assamaturu* is the process of working on assignments in groups by students using the application aligned *meistertask* as a medium that can manage and track assignments in each place (Adwinda & Pradono, 2020). In addition, it can review time scales, *tracking issues* and collaboration between users (Lindner, 2020). The stage is *mappesabbi* witnesses where each group representative the results of group work on the application *meistertask*. While at the stage *sipakatau*, the evaluation stage, all students can take quizzes on the application *quizizz*. Through *games* interactive *quizizz makes* students happy when learning

because they are equipped with various games and high interest and motivation can advance student learning outcomes (Anggraeni & Nurjanah; 2020 Solikah, 2020).

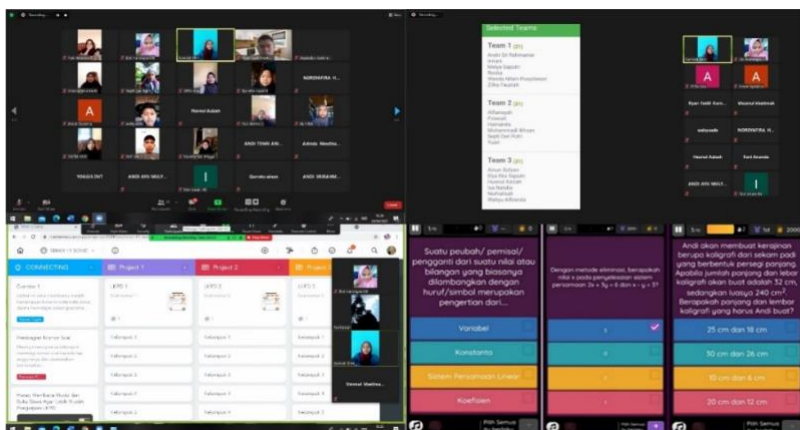


Figure 1. Online learning process based on *local wisdom*

The increase in students' mathematical connection ability can be seen from the results of data analysis *post-test* students after completing online essay questions. The test in this study consisted of 5 questions covering aspects of mathematical connection abilities, where students' answers were sent via the application *Edmodo*. The following is one of the *post-test questions* given to students.

Andi akan membuat kerajinan berupa kaligrafi dari sekam padi yang berbentuk persegi panjang. Apabila jumlah panjang dan lebar kaligrafi akan buat adalah 32 cm, sedangkan luasnya 240 cm². Berapakah panjang dan lebar kaligrafi yang harus Andi buat?

Figure 2. Question *post-test* first indicator

Figure 2 above is one of the *post-test questions* with indicators relating the mathematical ideas used in the study. When answering these questions, students must relate the rectangular material to a system of linear equations, students identify the problem and perform mathematical modeling by solving a system of linear equations.

A raft made of bamboo moving in the direction of the river can cover a distance of 46 km in 2 hours. If the raft moves against the direction of the river current, it can cover a distance of 51 km in 3 hours. What is the speed of the river flow and the raft's speed?

Figure 3. Question *post-test* the second indicator

Figure 3 above requires students to model the given problem in mathematical form by relating it to the velocity formula. Then applying mathematical ideas relationships in problems related to speed material.

Aisyah met her mother during the school holidays, buying fruit at the market. The mother bought 2 kg of mango and 1 kg of pomegranate, and she had to pay Rp15.000, while Aisyah bought 1 kilogram of mango and 2 kilograms of pomegranate for Rp18.000. How much do 5 kg of mango and 3 kg of pomegranate cost?

Figure 4. Questions for *post-test* third indicators

Figure 4 above is one of the questions with indicators relating mathematics to everyday life. Students must model the given problem in mathematical form and apply it to the solving process.

The *pre-test* and *post-test* questions used in this study have the same editorial. On average, students have been able to link between mathematical topics, linking them to other fields of science and everyday life. When analyzing problems students have been able to link between mathematical ideas, then apply the relationship through the problem solving process given and explain the relationship of mathematical ideas in the form of conclusions. The following in Figure 5 is one of the student test results given through the application *Edmodo*.

The entrance ticket to Bira beach tourist attractions for two adults and three children is Rp28.000, and for three adults and four children is Rp40.000. If a husband and wife and their two children travel to Bira beach, what is the total ticket price they have to pay?

Figure 5. Questions for *pre-test* third indicators

Misal tiket u/ orang dewasa = x
 tiket u/ anak-anak = y
 Maka: $2x + 3y = 28.000$ (i)
 $3x + 4y = 40.000$ (ii)
 D.t: $2x + 2y = \dots?$
 Jawab:
 Eliminasi x
 $2x + 3y = 28.000 \Rightarrow 6x + 9y = 84.000$
 $3x + 4y = 40.000 \quad 6x + 8y = 80.000$
 $y = 4.000$
 substitusi ke pers (ii)
 $2x + 3(4.000) = 28.000$
 $2x = 28.000 - 12.000$
 $x = 8.000$
 Jadi harga tiket masuk orang dewasa adalah Rp 8.000,00 dan untuk anak-anak Rp 4.000,00

Figure 6. Answers *pre-test* indicator relates to daily life

The results above are one of the answers to the *pre-test questions* students in the experimental class. The student's error in answering is in the ability to relate mathematical ideas in problems related to everyday life, where students' answers are still in the aspect of linking between mathematical ideas, but cannot connect these mathematical ideas with problems of everyday life. Students answered the price of each ticket for adults and children, even though the

question asked was the price of a husband and wife (2 adults) and two children. After the application of-based online learning *local wisdom* leads to students' ability in mathematical connections in solving problem solving. Students showed improvement when viewed from the *post-test questions* sent in Figure 7.

Handwritten solution for a system of linear equations in two variables (SLTV) involving mango and apple prices. The student defines mango as x and apple as y . The equations are $2x + y = 15.000$ (i) and $x + 2y = 18.000$ (ii). The student uses the elimination method to find $y = 7.000$ and then substitutes it back to find $x = 4.000$. Finally, they calculate the total cost for 5 kg of mango (20.000) and 3 kg of apple (21.000).

⇒ Misal : Mangga = x
 Delima = y
 Maka : $2x + y = 15.000 \dots (i)$
 $x + 2y = 18.000 \dots (ii)$
 Dit stg mangga dan 3 k apel ?
 Jawab :
 Eliminasi x
 $2x + y = 15.000 \Rightarrow 2x + y = 15.000$
 $x + 2y = 18.000 \Rightarrow 2x + 4y = 36.000$
 $-3y = -21.000$
 $y = 7.000$
 Substitusi $y = 7.000$ ke Persamaan (i)
 $2x + y = 15.000$
 $2x + 7.000 = 15.000$
 $2x = 8.000$
 $x = 4.000$
 Jadi harga satu kg mangga = 4.000 dan apel = 7.000
 $5x \Rightarrow 5(4.000) \quad 3y \Rightarrow 3(7.000)$
 $\Rightarrow 20.000 \quad \Rightarrow 21.000$
 Dengan demikian harga 5 kg mangga adalah Rp 20.000,00
 Sedangkan 3 kg apel adalah Rp 21.000,00

Figure 7. Answers *post-tets* indicators relating to daily life

Figure 7 above shows that students have been able to solve math problems related to daily life after implementing-based online learning *local wisdom*. This can be seen when students link everyday life problems given in mathematical form, apply and explain the relationship of mathematical ideas in concluding problems. In addition, online learning based on *local wisdom* in the form of *a'bulo sibatang*, *assamaturu*, *mappesabbi*, *sipakatau* is effectively applied in improving mathematical connection ability, where in the experimental class there is an increase after-based online learning is applied *local wisdom*. The stages in online learning based on *local wisdom* are as follows:

1. *A'bulo sibatang*

A'bulo sibatang is a philosophy of a single bamboo stick with many segments interpreted as a form of solid unity and togetherness in a group like a single stick of bamboo. Defend what belongs in a way together (Rosida, Taqwa & Kamaruddin, 2018). *A'bulo sibatang* in learning can be used as a group formation stage, where group formation uses application *random generator*

in dividing students into several heterogeneous teams. The division of groups, in this case, is intended to make it easier for students to understand mathematical concepts and relate them to the material to be studied. A real example at this stage is seen when the teacher gives an overview associated with students' daily lives in buying and selling interactions, which cannot be separated from mathematical concepts in calculating the results of the sale and purchase in question. Each student certainly has different experiences in solving daily problems. Through the *a'bulo sibatang* culture in the learning process that emphasizes student collaboration, it can make it easier for students to share knowledge. This knowledge sharing activity can indirectly train students' critical and creative thinking skills in solving problems. This can be seen when students can connect each mathematical concept itself or mathematical concepts with everyday life. From this stage, it can be seen that local wisdom-based learning strategies can improve students' mathematical connection abilities.

2. *Assamaturu*

Assamaturu means deeper than the meaning of gotong royong in society, namely upholding the high value of togetherness in thinking, feeling and working to achieve common goals (Rosida, Taqwa & Kamaruddin, 2018). *Assamaturu* in the learning process can be used as a stage of working on tasks or solving problems in groups. Working on tasks or problem solving in groups using the application *meistertask*. *Assamaturu* culture is more detailed than *a'bulo sibatang*. The *a'bulo sibatang* culture directs students to collaborate in one group, while *assamaturu* directs students to exchange opinions with other groups. After students obtain alternative solutions to solving problems from the results of their group discussions, they can make the same perception with other groups through the investigation process. This is so that students are not only focused on their narrow-scale views but also can dig deeper into the information in different groups. The data obtained, of course, can make it easier for students to connect mathematical concepts with other fields that students often encounter. Collaboration between students in one group and other groups during online learning is effortless with the *mesitetask* application. This application is equipped with a comment feature or different responses such as likes and dislikes. In addition, teachers can monitor active students during discussions through the *meistertask* application.

3. *Mappesabbi*

Mappesabbi comes from the word *sabbi* which means witness, so the meaning of *mappesabbi* witnessing is to witness the results of work in the form so that the truth can be accounted (Radjab, 2014). *Mappesabbi* in the learning process can be interpreted as the presentation stage, namely the activity of presenting the results of group work that has been done. The applications used are *random generator* and *meistertask*. *Random generator* application so that students who make presentations are evenly distributed so that student learning readiness, in

this case, can be improved. Each student in the group must be ready to accept their respective roles, either as presenters of material, giving rebuttals or giving input to the results of other group discussions. A review is carried out at the end of each debate to make it easier for students to understand the material. The results of this review are carried out individually and sent via the *meistertask* application. *Mappesabbi* culture can indirectly improve students' mathematical connection ability because through the presentation process, the extent to which students' ability to communicate conveys their arguments. The power of students to share is a measure of the time to which students' understanding is related to the material studied. Suppose students can complete everything given. In that case, it can be said that the students' mathematical connection abilities are in a suitable category because they have been able to solve the problems given. Meanwhile, the questions used during the learning process in this study refer to indicators of mathematical connection ability.

4. *Sipakatau*

Sipakatau is taken from the Bugis-Makassar language which means humanizing humans, there is no discrimination and everyone has the same rights (Syarif, *et al.*, 2016). *Sipakatau* in the learning process can be interpreted as an evaluation stage, students will be given a quiz related to the material that has been studied previously with a predetermined time limit using *the quizizz application*. The results of this evaluation as a form of assessment of student learning outcomes, especially on the ability of mathematical connections. *Sipakatau* which means humanizing, means that every student can provide input on the evaluation results obtained, whether they can accept or reject the results with valid reasons. Learning in this case, does not only refer to student learning outcomes but also emphasizes the process it goes through, where mathematical connections prove that students can apply mathematical concepts in solving each problem. In equalizing perceptions, namely expressing the results in the form of rebuttals, students are expected to be able to tell them in polite language by upholding the character values contained in this local culture. The use of the *quizizz* application at this stage can make it easier for teachers to determine students' mathematical connection abilities because they have a time limit in the completion process. The faster students solve problems, the more students understanding levels relate to mathematical concepts.

The results show that students have been able to connect topics between mathematics, connect math topics with other fields of science, and connect math topics with everyday life. In addition, through online learning based on *local wisdom*, students become active, where students can exchange ideas with their group friends and implement the knowledge they have gained. At the same time, the teacher acts as a facilitator and motivator. In line with what Putra, Lutfiyah & Laili (2019) stated that-based learning *local wisdom* can improve students' mathematics learning

outcomes. Local wisdom-based learning influences students' creativity and learning outcomes (Pamungkas, Subali & Lunuwih, 2017; Monita, Narulita & Budiarmo, 2021). In addition, Apsari & Rizki (2018) state that android can be used as a medium to support the mathematics learning process. Android-based learning media can attract students' interest in the learning process, where learning is more fun (Zakiy, Syazali & Farida, 2018; Asfar *et al.*, 2019). Several previous studies have integrated the local wisdom of *a'bulo sibatang*, *assamaturu*, *mappesabbi*, *sipakatau* in the learning process. Still, no one has ever integrated it into mathematics learning online or based on android. The application of local wisdom-based learning strategies in improving students' mathematical connection ability impacts student learning outcomes, including students' mathematical abilities. Through a series of learning stages on the design of *a'bulo sibatang*, *assamaturu*, *mappesabbi*, and *sipakatau*, students' mathematical connection abilities can be improved by various variants of questions match the indicators of mathematical connection abilities. This learning process indirectly trains students to collaborate between students and groups. In addition, discussions with other groups can instil character values in students, such as a sense of responsibility in expressing opinions during the presentation process. This series of lessons provide an overview of the student-centred learning process, where students are active during the learning process, and the teacher only acts as a facilitator and motivator.

In addition, the use of *meistertask*, *random generator* and *quizizz applications* has never been applied to mathematics learning in improving students' mathematical connection ability. Several studies so far have only examined students' mathematical connection abilities in the face of face-to-face learning. The process that applies contextual media to make it easier for students to understand mathematical concepts has not improved students' mathematical connection abilities because knowledge is still teacher-centred. This is increasingly difficult to achieve when learning online, where only some students are active, and other students cannot connect mathematical concepts in the learning process. The application of several android applications in the online learning process can attract students' interest in learning and create a new beginning in applying technology that has been increasing. Therefore, online learning based on *local wisdom a'bulo sibatang*, *assamaturu*, *mappesabbi*, *spakatau* using *meistertask*, *random generator* and *quizizz applications* can be a new thing in the learning process, as well as can be used as an alternative in improving students' mathematical connection ability.

Conclusion

Online learning based on local wisdom *a'bulo sibatang*, *assamaturu*, *mappesabbi*, *sipakatau* involves students directly in learning to build students' attention and interest and practice problem solving ability and connect. In addition, the use of several applications such as

the application *zoom meeting*, *random generator*, *meistertask* and *quizizz* realize the creation of work between groups. It will be fun with the efficiency of operating time. The result shows that improvement of mathematical connection ability of students who implement learning strategies based on local wisdom better than mathematical connection ability of students without learning strategies based on local wisdom. Thus, to improve students' mathematical connection ability, mathematics learning is recommended to implement online learning based on *local wisdom a'bulo sibatang*, *assamaturu*, *mappesabbi*, *sipakatau*.

References

- Adwinda, C. P., & Pradono, S. (2020). Developing an android-based running application. *Journal of Critical Reviews*, 7(8), 851–857. <https://doi.org/10.31838/jcr.07.08.182>
- Amin, Y., & Murtiyasa, B. (2021). Analisis kesulitan belajar matematika pada proses pembelajaran daring menggunakan metode pembelajaran berbasis masalah. *Jurnal Didaktik Matematika*, 5(1), 49-65.
- Anggraeni, R. D., & Nurjanah, F. (2020). *Strategi pembelajaran bahasa indonesia menggunakan media quizizz dalam meningkatkan keterampilan menulis pada siswa kelas X SMA*. Seminar Nasional Bahasa dan Sastra Indonesia (SAMASTA), 1–6.
- Apriyani, D., & Hadiwinarto, H. (2021). Improving mathematical connection ability through the approach of scientific and reciprocal teaching. *International Journal of Progressive Sciences and Technologies*, 30(1), 84-94.
- Apsari, P. N., & Rizki, S. (2018). Media Pembelajaran matematika berbasis android pada materi program linear. *Jurnal Pendidikan Matematika*, 7(1), 161–170.
- 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), 012060. <https://10.1088/1742-6596/1663/1/012060>
- Asfar, A. M. I. T., & Asfar, A. M. I. A., Aspikal., & Nurwijaya, S. (2019). Efektivitas Case Based Learning (CBL) disertai umpan balik terhadap pemahaman konsep siswa. *Histogram Jurnal Pendidikan Matematika*, 3(1), 29-45.
- Asfar, A. M. I. T., Asfar, A. M. I. A., & Darmawan, D. (2018). *The effect of REACE (Relating, Exploring, Applying, Cooperating and Evaluating) learning model to ward the understanding of mathematics concept*. *Journal of Physics: Conference Series*, 1028(1), 012145.
- Asfar, A. M. I. T., Asfar, A. M. I. A., Cheriani, C., Kurnia, A., & Hasryningsih, A. (2019). *Efektivitas model pembelajaran RICH (Relating, Inquiring, Collaborating, Hiring) terhadap pemahaman konsep mahasiswa*. Seminar Nasional Hasil Penelitian & Pengabdian Kepada Masyarakat (SNP2M), pp. 195-199.
- Asfar, A. M. I. T., Asfar, A. M. I. A., & Sartina, S. (2018). Modifikasi model pembelajaran Missouri Mathematics Project (MMP) dengan model pembelajaran Explicit Instruction (EI) dalam meningkatkan pemahaman konsep matematika siswa. *Aksara Public*, 2(4), 23-38.
- Asfar, A. M. I. T., Asmawaty, & Nursyam, A. (2019). Mathematical concept understanding: the impact of integrated learning model. *Al-Jabar: Jurnal Pendidikan Matematika*, 10(2), 211–222.

- Dudung, A., & Oktaviani, M. (2020). Mathematical connection ability: An analysis based on test forms. *International Journal of Advanced Science and Technology*, 29(6), 4694-4701.
- Fahrizal, M., & Solichin, A. (2020). Pengamanan M-Commerce menggunakan one time password metode pseudo random number generator (PRNG). *Rabit : Jurnal Teknologi dan Sistem Informasi Univrab*, 5(2), 108–116. <https://doi.org/10.36341/rabit.v5i2.1363>
- Fendrik, M. (2019). *Pengembangan kemampuan koneksi matematis dan habits of mind pada siswa*. Media Sahabat Cendekia. Surabaya
- Gozali, A. (2020). Layanan bimbingan dan konseling berbasis teknologi informasi pada masa PSBB (Pembatasan Sosial Berskala Besar). *Journal of Counseling and Education*. 1(02), 36–49.
- Hana, N., Surahmat, & Fathani, A. H. (2019). Kemampuan koneksi dan pemecahan masalah matematis peserta didik kelas VIII melalui model Cooperative-Meaningful Instructional Design (C-MID) pada materi koordinat kartesius. *JP3*, 14(7), 115–122.
- Ibrahim, Sujadi, I., Maarif, S., & Widodo, S. A. (2021). Increasing mathematical critical thinking skills using advocacy learning with mathematical problem solving. *Jurnal Didaktik Matematika*, 8(1), 1–14. <https://doi.org/10.24815/jdm.v8i1.19200>
- Kusumaningrum, B., & Wijayanto, Z. (2020). Apakah pembelajaran matematika secara daring efektif? (studi kasus pada pembelajaran selama masa pandemi covid-19). *Jurnal Matematika Kreatif-Inovatif*, 11(2), 136–142.
- Lanya, H., Zayyadi, M., Sulfiah, S. K., & Roziq, A. (2021). Students' mathematical literacy on the performance of PISA questions: What is gender correlation?. *Jurnal Didaktik Matematika*, 8(2), 222-234.
- Lindner, D. (2020). *Technologische ausstattung virtueller teams*. Virtuelle Teams Und Homeoffice, 13–34. <https://doi.org/10.1007/978-3-658-30893-3>
- Maida, N. (2016). *Pengasuhan anak dan budaya 3s (sipakata, sipakaing dan sipakalebbi) di perkotaan*. Seminar Nasional Pendidikan Ilmu-Ilmu Sosial Membentuk Karakter Bangsa dalam Rangka Daya Saing Global, pp. 327–334.
- Monita, K. A., Narulita, E., & Budiarmo, A. S. (2021). The effectiveness of local wisdom-based science teaching materials in improving high school students critical thinking skills. *Jurnal Mangifera Edu*, 5(2), 141–149. <https://doi.org/10.31943/mangiferaedu.v5i2.99>
- Muthmainnah, Ramli, M., & Ikhsan, M. (2021). Metaphorical thinking of students in solving algebraic problems based on their cognitive styles. *Jurnal Didaktik Matematika*, 8(1), 75–89. <https://doi.org/10.24815/jdm.v8i1.18978>
- Namkung, J. M., Peng, P., & Lin, X. (2019). The relation between mathematics anxiety and mathematics performance among school-aged students: a meta-analysis. *Review of Educational Research*, 89(3), 92-99. <https://doi.org/10.3102/0034654319843494>
- NCTM. (2013). *Making mathematical connection*. URL: https://www.nctm.org/News-and-Calendar/Messages-from-the-President/Archive/Linda-M_-Gojak/Making-Mathematical-Connections/. Diakses tanggal 22 April 2022.
- 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.
- Nursaniah, L., Nurhaqiqi, N., & Yuspriyati, D. N. (2018). Analisis kemampuan koneksi matematik siswa smp pada materi bangun ruang sisi datar. *JPMI (Jurnal Pembelajaran Matematika Inovatif)*, 1(5), 857-862.

- OECD. (2019). *PISA 2018 result: What students know and can do*. OECD Publishing, Paris.
- Pamungkas, A., Subali, B., & Lunuwih, S. (2017). Implementasi model pembelajaran IPA berbasis kearifan lokal untuk meningkatkan kreativitas dan hasil belajar siswa. *Jurnal Inovasi Pendidikan IPA*, 3(2), 118–127.
- Paneo, F. R. (2019). Upaya meningkatkan aktivitas belajar IPS melalui model pembelajaran make a match pada siswa kelas VIII SMP negeri 2 taluditi tahun ajaran 2017/2018. *Jurnal Ilmu Pendidikan Nonformal*, 05(01), 25–30.
- Prihandhika, A. (2017). Perbedaan kemampuan koneksi matematis melalui model pembelajaran react dengan model pembelajaran learning cycle 5e siswa SMKN 39 Jakarta. *JNPM (Jurnal Nasional Pendidikan Matematika)*, 1(1), 1–9.
- Putra, E. D., Lutfiyah, & Laili, N. (2019). Implementasi model pembelajaran *discovery learning* dengan soal berbasis *local wisdom* untuk meningkatkan hasil belajar matematika. *Jurnal Gammath*, 4(1), 20–27.
- Radjab, M. (2014). Analisis model tindakan rasional pada proses transformasi komunitas petani rumput laut di Kelurahan Pabiringa Kabupaten Jeneponto. *Socius*, Xv(1), 16–28.
- Risdiyanti, I., & Prahmana, R. C. I. (2017). *Ethnomathematics: exploration in javanese culture*. Journal of Physics: Conference Series, 943(1), 12–32. <https://doi.org/10.1088/1742-6596/943/1/012032>.
- Rohana, dan Ningsih, Y. L. 2019. Peningkatan kemampuan penalaran matematis mahasiswa melalui pembelajaran reflektif berbantuan aplikasi moodle. *Indiktika (Jurnal Inovasi Pendidikan Matematika)*. 1(2), 134–143.
- Rosida, V., Taqwa, M., & Kamaruddin, R. (2018). Efektivitas pendekatan etnomatika berbasis budaya lokal dalam pembelajaran matematika. *Histogram: Jurnal Pendidikan Matematika*, 2(2), 97–107.
- Siregar, N. D., & Surya, E. (2017). Analysis of students' junior high school mathematical connection ability. *International Journal of Sciences: Basic and Applied Research (IJSBAR)*, 33(2), 309–320.
- Solikah, H. (2020). *Pengaruh penggunaan media pembelajaran interaktif quizizz terhadap motivasi dan hasil belajar siswa pada materi teks persuasif kelas VIII di SMPN 5 Sidoarjo Tahun Pelajaran 2019/2020*. BAPALA, 7(3), 1–8.
- Sukestiyarno, Y. L., Mashitoh, N. L. D., & Wardono. (2021). Analysis of students' mathematical creative thinking ability in module-assisted online learning in terms of self-efficacy. *Jurnal Didaktik Matematika*, 8(1), 106–118. <https://doi.org/10.24815/jdm.v8i1.19898>
- Sumiati, Asfar, A. M. I. T., Asfar, A. M. I. A., Serly, & Hasnawati. (2019). *Peningkatan kemampuan koneksi matematis siswa melalui pengaplikasian model pembelajaran PMC (project matching a card)*. Seminar Nasional Penelitian & Pengabdian Kepada Masyarakat (SNP2M), pp. 391–395.
- Syarif, E., Fatchan, A., & Astina, I. K. (2016). Integrasi nilai budaya etnis bugis makassar dalam proses pembelajaran sebagai salah satu strategi menghadapi era masyarakat ekonomi asean (MEA). *Jurnal Teori dan Praksis Pembelajaran IPS*, 11(1), 13–21.
- Wardah, S., Utomo, D. P., & Putri, O. R. U. (2021). An analysis of errors on mathematical symbol as a metaphor in linear programming. *Jurnal Didaktik Matematika*, 8(1), 45–58. <https://doi.org/10.24815/jdm.v8i1.18304>

- Wijayanti, I. K., & Abadi, A. M. (2019). *Analysis of the difficulty of viiith grade junior high school students in circle material reviewed from the mathematics connection ability*. Journal of Physics: Conference Series, 397(1), pp.012086. IOP Publishing.
- Yani, A., Prihatin, I., Hodiyanto, H. & Sumiati, S. (2021). Android-based learning media design with contextual learning to develop problem-solving skills. *Jurnal Didaktik Matematika*, 8(2), 148-159.
- Yolanda, F., & Wahyuni, P. (2020). Pengaruh pembelajaran matematika kontekstual terhadap kemampuan koneksi matematis mahasiswa pada mata kuliah program linier. *SJME (Supremum Journal of Mathematics Education)*, 4(1), 55–63.
- Zakiy, M. A., Syazali, M., & Farida. (2018). Pengembangan media android dalam pembelajaran matematika. *Triple S (Journals on Mathematic s Education)*, 01(2), 87–96.