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Lesson Study in an Inclusive Mathematics Classroom using Multicommunications Media: Ring Theory Course

Andi Husniati[1,*], Irwan Akib[1], Muhammad Rizal Usman[1], Kristiawati[1] & Nur Fauziyah[2]

[1]Department of Mathematic Education, Universitas Muhammadiyah Makassar, Indonesia

[2]Department of Mathematic Education, Universitas Muhammadiyah Gresik, Indonesia

*Corresponding email: andihusniati@unismuh.ac.id

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Abstract: Lesson Study in an Inclusive Mathematics Classroom using Multicommunications Media: A Ring Theory Course. Objective: This study aims to describe learning ring theory courses by a lesson study using multicommunication media in inclusive classes of Muhammadiyah Makassar University. **Methods:** This study uses an experimental research design by analyzing and directly assisting students in learning. The analysis of this activity refers to plan, do, and see stages. The subjects in this study were students of the 2017 class of Muhammadiyah Makassar University, totaling 28 students, one of whom was a deaf student. **Findings:** The results show that at the beginning of the performance of lesson study without video, deaf students were still less actively involved in discussing with their group friends, while in the performance of learning using multi communication media, namely in the form of learning videos accompanied by running text and sign language, deaf students seemed more active than previous learning without video media. **Conclusion:** It is concluded that the use of multi-communication media through the implementation of lesson study has a positive impact on learning and helps students understand the material, especially students who are deaf.

Keywords: lesson study, multicommunication, inclusive education.

Abstrak: Lesson Study di Kelas Matematika Inklusi menggunakan Media Multikomunikasi: Mata Kuliah Ring Theory. ***Tujuan:*** *Penelitian ini bertujuan untuk mendeskripsikan pembelajaran ring theory dengan menerapkan lesson study menggunakan media multi komunikasi di kelas inklusi Universitas Muhammadiyah Makassar.* ***Metode:*** *Penelitian ini menggunakan desain penelitian eksperimen dengan menganalisis dan mendampingi siswa secara langsung dalam pembelajaran. Analisis kegiatan ini mengacu pada tahapan plan, do, dan see. Subjek dalam penelitian ini adalah mahasiswa Universitas Muhammadiyah Makassar angkatan 2017 yang berjumlah 28 mahasiswa, salah satunya adalah mahasiswa tunarungu.* ***Temuan:*** *Hasil penelitian menunjukkan bahwa pada awal pelaksanaan lesson study tanpa video, siswa tunarungu masih kurang aktif berdiskusi dengan teman satu kelompoknya, sedangkan pada pelaksanaan pembelajaran menggunakan media multikomunikasi yaitu berupa video pembelajaran yang disertai dengan video pembelajaran. dengan menjalankan teks dan bahasa isyarat, siswa tunarungu tampak lebih aktif dibandingkan dengan pembelajaran sebelumnya tanpa media video.* ***Kesimpulan:*** *Disimpulkan bahwa penggunaan media multikomunikasi melalui pelaksanaan lesson study memberikan dampak positif dalam pembelajaran dan membantu siswa dalam memahami materi, khususnya siswa tunarungu.*

Kata kunci: *lesson study, multikomunikasi, pendidikan inklusi.*

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INTRODUCTION

The people with disabilities have the right to receive a quality education across all types, pathways, and levels of education inclusively and especially, according to Law Number 8 of 2016's mandate in Article 10 (Afifah & Hadi, 2018; Singal et al., 2017). Additionally, Article 42 (4a) specifies that one of the duties of the higher education disability service unit is to enhance the capability of educators and other educational staff in dealing with students with disabilities (Andriana, 2021). Furthermore, Law Number 12 of 2012 Article 32 paragraph (1) states that can carry out educational services for persons with disabilities in higher education in the form of special education and special service education (Saputra, 2020). In line with this, Permenristekdikti No. 46 of 2017 concerning special education and Special Service Education in Higher Education in article 8 paragraph (1) states that universities facilitate learning and assessment according to the needs of students with special needs without reducing the quality of learning, and in paragraph (2) states that as referred to in paragraph (1) can be made in the form of adjustments: (a). material, (b). tools/ media, (c). the learning process, and (d). Evaluation.

Therefore, higher education educators must improve their ability to facilitate and manage inclusive classes. One of the efforts that can make is implementing lesson study by utilizing learning media that favours students with disabilities. Wood & Cajkler, (2018) & Win (2022) are the models for fostering educators through collaborative and sustainable learning assessments according to the principles of peer-to-peer and mutual learning to build a learning community through lesson study. Meanwhile, Fernandez (2002) & Sumarni et al. (2020) state that a Lesson study can be seen as an approach to improving learning. Lesson study has the advantage of creating collaboration between teachers in developing education, providing opportunities for teachers to solve learning problems together, and making teachers communicate closer (Khalid et al., 2016; Wood & Cajkler, 2018). Sucilestari & Arizona (2019) & Yalcin (2019) write that a Lesson study is a form of approach to improving the quality of learning carried out by teachers in a collaborative way. The steps implemented are designing learning to achieve specific goals, implementing learning, observing the implementation of education, and doing reflection to discuss the knowledge that has been done as material for improvement in the next lesson plan (Coenders & Verhoef, 2019; Iqbal et al., 2021; Merdekawati, 2018).

A lesson study is an activity carried out in collaboration between teachers to develop learning (Skott & Møller, 2017). The stages of lesson study quoted from the writings of Najah et al. (2019) consist of planning (plan), implementation (do), and reflection (see). The implementation of this study uses inquiry learning by utilizing multi-communication media in ring theory courses. Ghaemi & Mirsaeed (2017) & Kelley & Knowles (2016) explains that a classroom learning strategy organizes or manages mathematics learning around problem-solving activities and provides students with opportunities to think critically, propose their creative ideas, and communicate with friends mathematically. The essence of inquiry learning is that students discuss a problem the educator gives to be clarified and defined and exchange ideas between members to solve a problem (Fatmawati et al., 2019; Wale & Bishaw, 2020). In the learning process, it is expected that learning materials are appropriately delivered so that students can understand what is being learned, not only individually, but it is hoped that all students can be actively involved without exception. Moreover, if there are students with disabilities who are members of the class, it

is necessary to think about learning media to help them learn.

Many factors can make learning more exciting and produce high student learning outcomes. One of them is the active involvement of students in the learning process. Students are actively involved in observing, operating tools, or practicing using concrete objects as part of the lesson. Therefore, fundamental, consistent, and systematic steps are needed in the learning process. One is using appropriate learning media and two-way communication provided by teachers and students. The term multi communication can be seen from the two elements "multi' meaning have more than one form, and communication' meaning. Salim (2016) wrote that multi-communication is an approach to creating successful communication between people with different understanding and acquisition of languages. Total communication means the willingness to use all communication facilities available to understand and be understood. Multi-communication is a concept that aims to achieve effective communication between fellow deaf or deaf people and the broader community by using the media of speaking, lip reading, listening, integrated gestures, movement, and visual imagery (pictures). Multi-communication is a communication system that uses speech, residual hearing, speech reading, and or vibrational stimulation and civilization for a spontaneous conversation (Wilson et al., 2005). Multi-communication media is a medium that can use in teaching and learning activities to help students learn. Multi-communication media is a tool that can help students to understand learning material, especially for students who have limitations, such as deaf students (Adnyani et al., 2021).

Some of the biggest obstacles are when presenting a problem related to mathematics; this is because mathematical objects are objects of thought that are abstract and cannot be observed with the five senses (Hernadi, 2013; Ratumana & Theresia Laurens, 2016). Therefore, it is natural that mathematics is not easily understood and liked by most students, especially deaf students, with its characteristics. For this reason, teaching a mathematical concept/principle requires experience through concrete objects, namely media/props that can be used as a bridge for students to think abstractly and communicate mathematics. How can a mathematics teacher present mathematics as an essential lesson in his life so deaf students can understand what the author conveys from each classically presented explanation in an inclusive class with hearing, language, intelligence, and cognitive abilities to study with other regular students? Experts Dewayani et al. (2017) state that teaching deaf children must consider how to rehabilitate their hearing, develop their communication, and develop and organize their education (Anggraeni, 2020). Interested in studying about implementing lesson study by utilizing multi-communication media in learning in inclusive classes. This study is expected to be a source of information regarding the importance of multi-communication to build students' learning abilities, especially for children with special needs

METHODS

Participants

This research was conducted in June 2020, the even semester of the 2020/2021 academic year. The target class is students in the VII semester of the Mathematics Education Study Program, Muhammadiyah University of Makassar. The total number of students is 28, one of whom was a deaf student. The sample is selected based on the target subject because only this class is the inclusion class. Five discussion groups consist of 5-6 students each.

Research Design and Procedures

This research is packaged in the form of an experimental one-group pretest-posttest. This research is one type of quantitative research. Learning is carried out by applying lesson study that utilizes multi-communication media that helps deaf students to study together. The implementation was carried out in 6 meetings, the first meeting was giving a pretest, the 2nd-5th meeting was delivering teaching materials and the 6th meeting was giving a posttest. The activities carried out are lesson study activities through inquiry learning to ring theory material. The stages of lesson study carried out in this study are:

a. Planning stage (plan)

This stage includes Lesson Design, making teaching materials, learning videos and preparing schedules. This stage is carried out jointly by a team of lecturers.

b. Implementation stage (do)

Activities at this stage are open lessons in a bold way to apply the results of the activity plan. One member of the team acts as a model lecturer and the other members act as observers. The focus of attention is directed to the behavior and thought processes of students in student learning activities, not to the appearance of the lecturer model who is teaching. Learning is carried out virtually/ online using a breakout room.

c. Reflection stage (see)

This stage aims to find the advantages and disadvantages of implementing learning and assessing whether the actions taken are according to plan, where the deficiencies lie and how to improve or other alternative actions such as what can be done to correct existing deficiencies. This stage was initiated by the model lecturer conveying his impressions and thoughts regarding the implementation of learning, then given to the observer who served as an observer. Criticism and suggestions are conveyed wisely without interference or the feelings of the model lecturer with the aim of improving learning practices in the future.

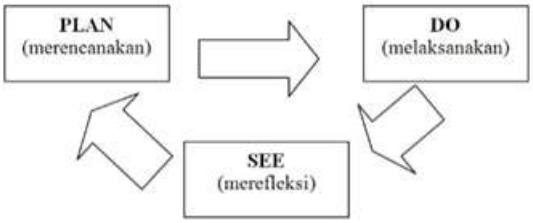

Figure 1. Lesson study activity scheme

Instruments

The instruments used in this study were direct observation by observers, response questionnaires, and tests. Observation sheets are used to find out student learning activities in the classroom where observers can freely describe the results of their observations according to the conditions in the class and how observers observe students who can collaborate and communicate in group discussions. Student response questionnaires were given to students after learning was carried out to know the assessment of student responses to the implementation of lesson study using multi-communication media. Student response questionnaires in the form of structured questionnaires using the Guttman scale are filled using the Yes or No category. while the test is used to determine the level of student understanding of Ring Theory material after the student has taken part in learning mathematics using multi-communication media.

Data Analysis

For data analysis from the results of student responses that have been collected used descriptive qualitative analysis

techniques, while calculating activity data and test student learning outcomes using the formula:

1. Student Activity Analysis

Data obtained from the results of student activity sheets in the learning process were analyzed using the formula (Fauziah, 2020).

$$AP = \frac{\sum P}{\sum p} \times 100\%$$

Table 1. Activity criteria for students' ability communicate and collaborate in group

Activity	Criteria
2.6 - 4	Good
1.3 – 2.59	Enough
0 – 1.29	Less

Information:
AP = The percent value sought
$\sum P$ = Number of students doing the activit
$\sum p$ = Total number of students (28)

2. Analysis of Student Learning Outccomes Test

Pretest and posttest were held to find out differences in student learning outcomes at the time before after being given the action.

a. Student Scores

$$S = \frac{R}{N} \times 100\%$$

Information:
S = The valus sought
R = Score obtained by each student
N = Sum of all scores/maximum scores

b. Calculate the average class value using the following formula:

$$\bar{x} = \frac{\sum x_i}{N}$$

Information:
= Average value
$\sum x$ = Sum of all values
N = Number of students

RESULTS AND DISCUSSION

The results of this study indicate that students can improve their communication and collaboration skills. On the other hand, they can enhance the ability to solve a given problem. The following are the observations of students' communication and collaboration skills for each treatment (Table 2).

Table 2. Student's ability to communicate and collaborate

Group	Abilities	Meeting 1	Meeting 2	Meeting 3	Meeting 4
1	Communication	1.32	2.76	3.32	3.51
	Collaboration	2.23	3.00	3.54	3.66
2	Communication	1.64	2.33	3.32	3.55
	Collaboration	1.45	2.35	3.36	3.16
3	Communication	2.57	2.32	3.21	3.34
	Collaboration	2.57	2.32	3.23	3.53
4	Comunication	2.22	3.12	3.78	3.89
	Collaboration	2.34	2.54	3.20	3.63
5	Comunication	1.56	2.26	3.32	3.66
	Collaboratition	2.53	3.01	3.46	3.56
Average	Comunication	1.32	2.76	3.39	3.59
	Collaboration	2.23	2.43	3.40	3.63
Category		Less	Enough	Good	Good

The analysis results in Table 1 show that the use of multi-communication in deaf students can help students in learning. This is indicated by the increased value obtained for each indicator of the treatment carried out. In treatment 1, the value of communication and collaboration aspects is 1.32-2.23, with a low category. However, along with the treatment carried out, there is an increase in the value of the remedy obtained. The importance of communication and collaboration is reviewed from the aspect of student learning outcomes. The results of the learning analysis of deaf students are presented in Table 3.

Table 3. Student learning outcomes

Information	Pre	Post
Average	55.42	80.65
Median	56.50	78.50
Modus	35.00	76.00
Minimum	30.00	60.00
Maximum	75.00	93.00
Standard deviation	13.89	8.89
Variance	192.97	79.12

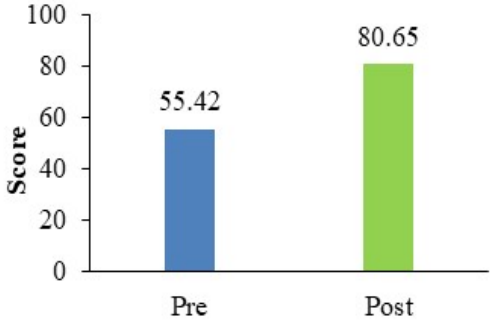

Figure 2. pretest and posttest scores

Based on the findings in Table 3 and Figure 2, using multi-communication in learning, especially for deaf children, can help improve learning outcomes. This is evidenced by the increase in the value of pre and post-test. Furthermore, the implementation of lesson study in this research is divided into three stages, namely planning (plan), implementation (do), and reflection (see).

1. Planning stage (plan)

Learning design is carried out at this stage: making lesson designs. The lesson design is based on inquiry learning steps with a character education approach on the set material, a ring. Characteristics that students in learning will achieve include honesty, discipline, creativity, curiosity, enthusiasm, responsibility, tolerance, hard work, democracy, friendly/communication, and independence. In addition, at this stage, make learning videos accompanied by sign language and student worksheets.

2. Implementation (do)

This stage is where the learning designed at the planning stage is carried out, commonly called open class. Before education is carried out, students are given pretest questions to determine the value of students initial abilities. The pretest questions include ring material. The pretest results show the number 55.42 and the posttest score of 80.65. Learning is carried out according to the stages in inquiry learning through the of lesson design, namely, at the beginning of knowledge, students learn classical in the main room through learning videos that have been equipped with sign language and running text to help deaf students understand what is being taught, after finishing learning students will join their previously divided group of friends to join a predetermined breakout room, consisting of 4 members, then given a problem and then they will discuss it with their friends the group, after finishing the discussion they will return to the main room to present the results of their

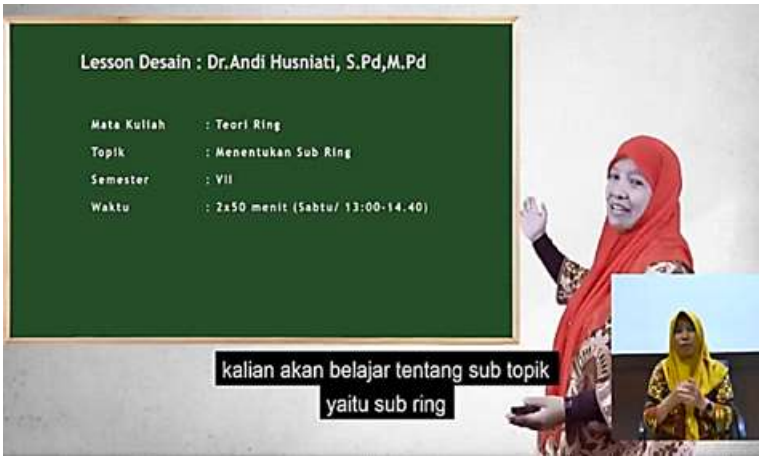

Figure 3. Learning activities including sign language

argument and the other groups will respond to each presenting group.

During the group discussion session, the deaf students seemed active and discussed using the headset for hearing what their group mates were discussing. When they were silent, the researcher sent a message via WhatsApp to ask if they understood what was discussed, and he replied, yes, I know. At the end lesson, students are given questions in the form of a lesson learned on the material taught. The following is the lecture process carried out using learning videos. At the end of the session, students were given a questionnaire to determine student responses to the learning process. Lesson stages, researchers, and the team reflect on the ongoing learning process and activities in the classroom. Reflection activities are also carried out online to find out how the processes and activities of students during lesson.

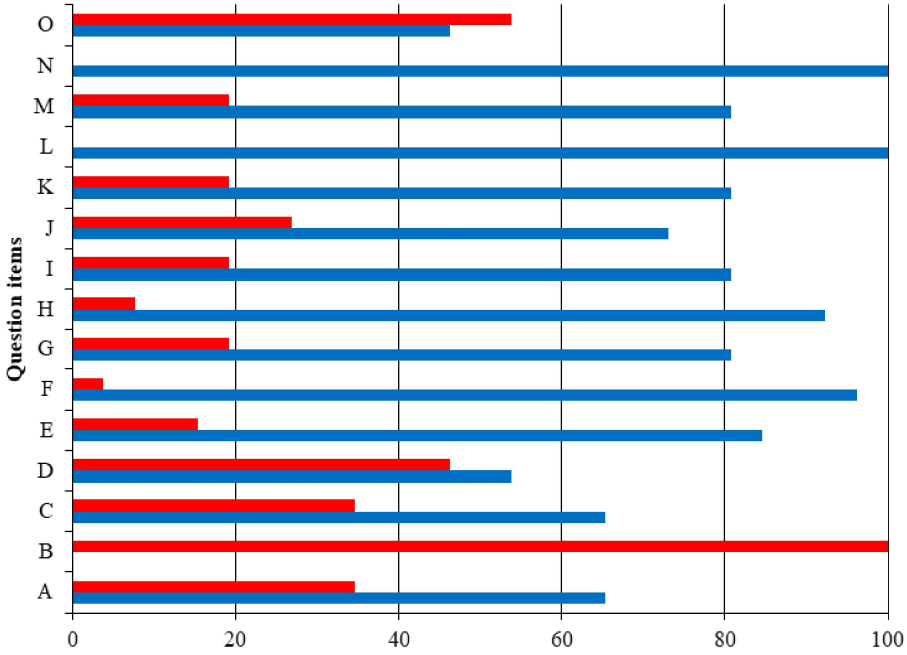

Figure 3. Students' response questionnaire

Note: (A) In your opinion, is learning by implementing online lesson study interesting?: (B) Is learning with lesson study implementation a new thing for you?; (C) Are the materials studied in accordance with the plan?; (D) Is learning with lesson study implementation easy to understand?; (E) Are you motivated to keep learning?; (F) Does learning encourage you in independent learning? (G) Is the material being studied difficult to understand?; (H) Is the learning media interesting?; (I) Is the learning media used can help to understand the material in learning?; (J) Is the problem presented in the video easy to understand?; (K) Is learning by using video easier to understand than not using video?; (L) Can assignments provide a challenge in learning?: (M) Are assessments and evaluations carried out in a transparent manner?: (N) Are the questions in the test in accordance with the indicators/learning objectives presented?; (O) Does learning with the implementation lesson study seem boring?

3. Reflection stage (See)

The results of the reflection from the team said that some students seemed to be actively discussing in each room, and even deaf students were discussing what they thought. Even at the beginning of the discussion, some of them were concerned that I was surprised to move from another room suddenly, and this was the first time I got a live learning video from an influential lecturer. Students seemed enthusiastic about discussing with their small groups without any hesitation. Observers do not appear in the room to avoid students being embarrassed to express their opinions if they feel they are being watched. Multi-communication media plays an essential role in the learning process, especially for children with special needs, one of which is deaf. Deaf children tend to be easy to understand if it involves communication that can direct students with a specific approach. It has a positive impact in terms of communication patterns or other aspects, such as collaboration. The analysis results found that the role of multi-communication media was able to have a reasonably positive impact, especially in communication and collaboration. It can be seen from the cycle of treatment given starting from treatment one to 4. Students can compensate for the use of multi-communication in terms of ability development; this is evidenced by the increase in indicator values for each treatment given, starting from the low category to reaching the good category at 4th treatment. Suarsana et al. (2019) write that the use of various learning media can provide students' understanding and can provide a separate consensus for students, especially in learning. Meanwhile, Ramadhani et al., (2018) reported that the use of learning media in various forms was able to train students with special needs in understanding lessons contextually and supporting effective learning. Of course, this can be a favorable consideration to provide suitable learning assistance for children with special needs, one of which is from the aspect of the hearing impaired.

In addition, when viewed from the aspect of learning outcomes, it appears that the use of multi-communication media provides a reasonably good picture of learning outcomes. It is evidenced by the range between the pretest and posttest scores given is quite large, which is between 23.25; this shows that the divide between the pretest and posttest in the class of children with special needs makes a significant contribution to improving student learning outcomes. Moalla et al. (2017); Hayes (2022); Hammami et al. (2019) that optimizing the role of both media and other learning supports can have a good impact, especially on the learning aspect. This is because using multi-communication in the learning process can provide a perspective on students supported by various learning supports. Therefore, multi-communication media can be separate in teaching, especially with children with special needs.

■ CONCLUSIONS

The learning activities with the implementation of lesson study are one form of activity to improve the of students in discussing to convey their ideas and ideas. However, this activity is carried out visually using breakout rooms to consult with their group friends but does not reduce student activity. The results show that students are more active with breakout rooms compared to other virtual learning, which only explains the material and then gives assignments and others. Deaf students are greatly helped in understanding learning materials by utilizing multi-communication media in education. Multi-communication is very helpful for deaf students in understanding the learning process. However, it is better if some aspects of learning media have collaborated so that students are active in terms of understanding and from the motoric side

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