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Transformation of the Teaching Process in Learning Population Geography Subjects Through Lesson Study with LOC-R: A Real Action

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Abstract
This study explores the effectiveness of integrating Lesson Study with the LOC-R (Literacy, Orientation, Collaboration, Reflection) learning model in teaching Population Geography in higher education—the research aimed to enhance student literacy, learning activity, and the overall teaching process. A classroom action research approach was employed, incorporating two cycles of Lesson Study with LOC-R implementation. Data was collected through observations, interviews, and document analysis. The findings reveal that the combined model significantly improved student literacy, particularly in data interpretation and understanding. It also fostered active student participation, collaboration, and critical thinking skills. The Lesson Study cycles provided a platform for teacher professional development, leading to improved teaching practices and a more collaborative learning environment. This research suggests that integrating Lesson Study with LOC-R offers a promising approach to enhancing Population Geography teaching and learning. Further studies are recommended to explore the application of this model in other disciplines and contexts.

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INTRODUCTION

Lesson Study (LS) has a very long history, but it is largely unaffected by this conclusion. This is because LS occurs in the classroom to directly improve student learning (Dudley, 2015). Lesson

Study is a professional development model for teachers that emphasizes improving the quality of learning collaboratively and continuously. This concept originates from Japan and has been applied in various countries, including Indonesia.

In Indonesia itself, review and research results have been found that are oriented toward applying the Lesson Study in the learning process. It started at primary and secondary education levels. This is proven by search results from Google Scholar, and in the 2018-2024 (nowadays) period, there were approximately 19,300 articles. After further study, the Lesson Study topic not only focuses on improving the quality of learning but also on developing the level of professionalism of teachers in the context of the learning and teaching process. This means that Lesson Study does not always emphasize improving student learning outcomes. It was explained in a research result that the Lesson Study had a positive impact on a series of research, which also made a major contribution to previous research. Lesson Study can have a positive impact on the professional development of teachers in an elementary school (Rozimela, 2020).

Meanwhile, this research implemented a Lesson Study in higher education in the Geography Education Study Program, Faculty of Teacher Training and Education, Khairun University. This has also been done several times by previous researchers and has had a positive impact after the research was conducted, both on the quality of teachers, student learning outcomes, and the teaching and learning process itself (Fitriana et al., 2022). Other results state that the implementation of LS is aimed at increasing the culture of collaboration between lecturers to provide each other with the best teaching experience (G. Gunawan et al., 2015). Even in other studies, it was found that the research suggests that the Lesson Study methodology holds significant potential for enhancing professional development in higher education. By fostering collaborative problem-solving, expanding professional knowledge, facilitating improvements, and promoting a collegial approach, Lesson Study empowers teachers to address the challenges and opportunities presented in their daily practice (Calvo et al., 2018). On the strong basis, which has been explained above, this research and application of Lesson Study was carried out by researchers, with the hope of bringing results and impacts that are equally positive and significant, even better.

If look at the three main objectives of Lesson Study, in general, it is to build the teacher's ability to manage their learning more interestingly together with other teachers or in a team. Then the ability of the teacher or team has a significant impact on students' abilities which can be seen from the learning results and final reflection. The three main objectives of the Lesson Study concluded from various reference sources are presented in the following table;

TABLE 1.
MAIN OBJECTIVES OF LESSON STUDY

No	Objective	Descriptions
	Improving the quality of learning	Teachers can perfect their instructional practices through repeated cycles of planning, implementing, observing, and reflecting.
	Developing teacher professionalism	Teachers become more reflective, collaborative, and able to solve problems in learning.
	Building a learning community	Lesson Study creates an environment where teachers can learn from each other, share ideas, and support each other.

The results of initial observations on students show that their condition still has a low literacy level. Literacy plays a role in supporting individuals in participating in social, political, and

economic life. A high level of literacy interest will allow students to contribute more actively and competitively in various aspects of life. From an economic perspective, literacy plays an important role in economic development. Literate students are more likely to have better job opportunities, be entrepreneurial, and participate in the creative economy and innovation. This condition can also be concluded that student learning activity is low.

Low learning activity among students is a problem that is often faced in the world of higher education. This can hinder the achievement of learning goals and reduce the overall quality of education. Several factors that can cause low student learning activity include: 1) Learning methods: Using monotonous and less interesting learning methods can make students feel bored and lose motivation. 2) Learning motivation: Internal factors such as interests, goals, and hopes for the future, as well as external factors such as family support and the social environment can influence student learning motivation. 3) Learning environment: The physical condition of the class, learning facilities, and social interaction in the class can influence students' comfort and focus in studying. 4) Student characteristics: Individual differences in learning style, personality, and socioeconomic background can also influence learning activity.

Summarizing the points above, research should be carried out which will become the grass root for further research related to increasing literacy and learning activities among students in the tertiary environment. So, it is very necessary to carry out this research which links two methods that are considered relevant for increasing literacy and learning activities, namely, combining lesson study with LOC-R.

Referring to the title explained above, “Lesson Study with LOC-R”, the principle of novelty which is used as a strong foundation by researchers is, combining the LOC-R in the Lesson Study cycle. The researchers chose the LOC-R model because initial observation results showed that student conditions and the material content of population geography courses would be very suitable if LOC-R were used. Besides that, the LOC-R learning model offers several benefits, including improving students' reading comprehension, fostering their ability to understand texts critically, providing a structured approach to learning, and promoting critical thinking. Developed in 2018, LOC-R is a valuable tool for enhancing student learning (Mukhlis, 2024). In more detail, the research methods section described the combination of LOC-R in the Lesson Study.

LOC-R stands for Literacy, Orientation, Collaboration, and Reflection. This learning model is designed to improve students’ literacy skills, especially in understanding text, diagrams, graphics, and its kind. This LOC-R model has several advantages, such as; enhancing literacy skills, developing critical thinking skills, having systematic steps, and facilitating collaboration. Through several advantages, LOC-R is considered the most suitable when combined with Lesson Study, such as increasing student literacy, which is very appropriate to the material's content in population geography courses and student conditions. Apart from that, the steps in LOC-R are also systematic. The advantages are especially considered to facilitate collaboration, so apart from collaboration within the LS teams, collaboration also occurs within student groups.

METHODS

This research is included in the category of classroom action research (CAR) with a qualitative approach because the entire research and data collection process is a cycle of learning and teaching. This research employed the CAR model to enhance teaching by increasing student

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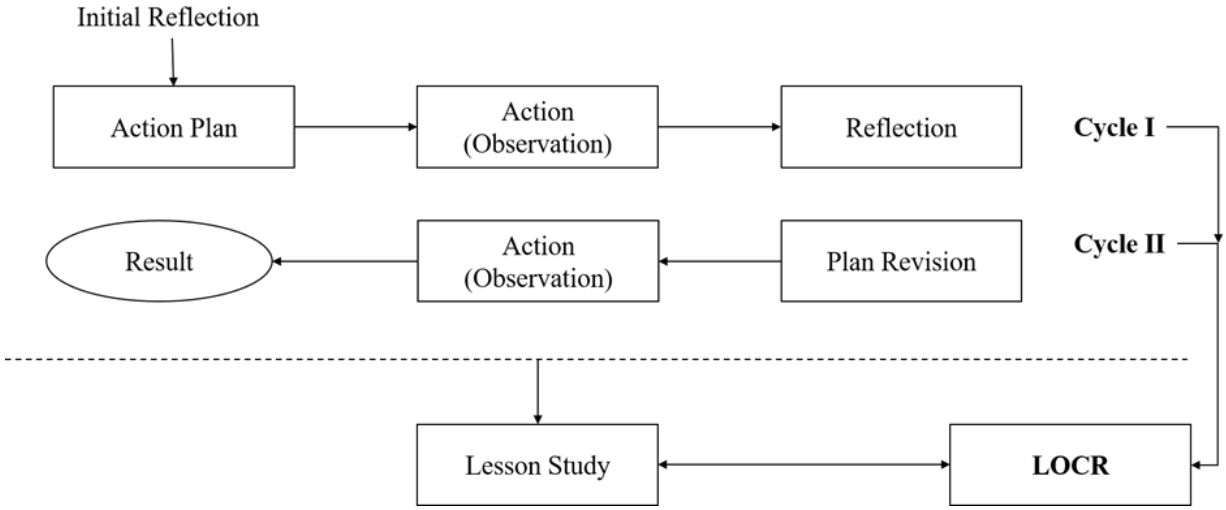
engagement. CAR focused on the teaching process as a means to boost student activity (I. Gunawan, 2017) . There are two cycles during this action research process, cycle I and cycle II (see Figure 1). Which in these cycles is dominated by LS and then in each cycle, the LOC-R model is applied. Action research has several benefits, one of which is mapping weaknesses and strengths in learning and being able to make innovations in learning both in the application of media and methods and learning strategies so that learning can be maximized (Diana et al., 2021).



Lesson study is a form of research (Yoshida & Fernandez, 2016). Lesson study stages are implemented similarly to CAR cycles (Kemmis & McTaggart, 2014). The Lesson Study incorporated the CAR cycles. Teachers planned collaboratively, observed a model lesson, and then reflected together. For more details on the methods and stages used in this research, see Table 2;

TABLE 2.
RESEARCH STAGES WITH LESSON STUDY AND LOC-R

Stages	Research	Lesson Study	LOC-R
Planning Cycle I	Determination of research subjects Research scenario planning Creation and validation of the instruments used Communication with the team to carry out lesson study Prepare the necessary equipment (audio recorder)	PLAN Prepare a Semester Learning Plan which is then discussed with the LS team Students are divided into 6 groups (@4-5 people) in each learning process in class Students carry out activities DO One person from the group representative presents or explains the results of literacy	All phases of LOC-R activities are focused on student activities LITERACY
Implementation Cycle I	Carrying out lesson study in the form of peer groups in the lecture room Researchers and a team of observers recorded each stage of the lesson study carried out.		ORIENTATION COLLABORATION REFLECTION (reflection in this stage is meant as an activity that is different from reflection in the research stage, reflection here is intended by students giving impressions or messages or
Observation and Reflection	Observation Researchers and the Lesson		

Stages	Research	Lesson Study	LOC-R
Cycle I	Study team discuss the results and reflect them with the results of observations at the implementation stage. Reviewing and assessing the discussion results becomes an improvement in cycle II.	activities (understanding the contents of the text, data, and diagrams). SEE Other students and model lecturers assess and provide suggestions or input for the results of the student's presentation.	explaining their learning experiences with the model lecturer).
Planning Cycle II		PLAN DO SEE	LITERACY
Implementation Cycle II			ORIENTATION COLLABORATION REFLECTION (reflection in this stage is meant as an activity that is different from reflection in the research stage, reflection here is intended by students giving impressions or messages or explaining their learning experiences with the model lecturer).
Observation Cycle II			
Reflection Cycle II			
Writing research reports			

Source: Adapted from (Zulfiani et al., 2014).

RESULT AND DISCUSSION

The implementation of this research using lesson study was accompanied by the stages of the LOC-R learning model. LOC-R Learning consists of Literacy, Orientation, Collaboration, and Reflection. LOC-R learning in this research is modified learning from map literacy (Segara et al., 2018). The LOC-R learning model is based on Vygotsky's Theory. The following are the stages of learning LOC-R namely 1) Literacy. The stage where students carry out literacy activities independently to understand, respond, reflect, evaluate, create knowledge, plan attitudes, and action plans from a stimulus. 2) Orientation. The stage where the teacher explains the learning objectives where learning activities are carried out to construct knowledge about facts, concepts, and values by considering sociocultural literacy competencies. 3) Collaboration. Learning activities involve collaboration between students, teachers, and fellow students. This learning activity aims to increase cognitive levels with the help of partners, teachers, and peers. 4) Reinforcement/repetition/conclusion or synthesis related to learning activities or material during learning activities (Segara et al., 2021) see Fig. 2, to find out how LOC-R is included in LS. The learning carried out by the model lecturer is observed by many other lectures, and observed by the main Lesson Study Team at the Faculty of Teacher Training and Education, Khairun University

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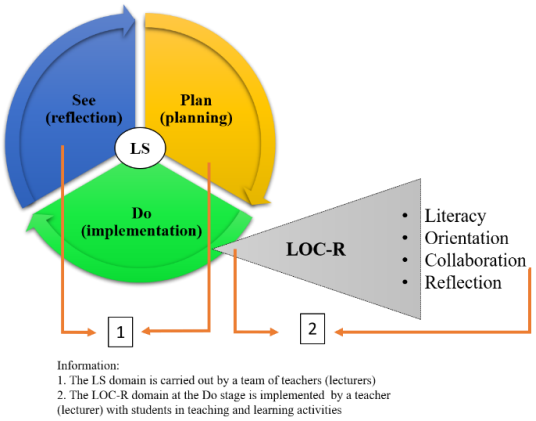

Figure 2. Implementation of the LOC-R Model in LS

Lesson study is not a learning method or learning strategy, but in Lesson Study, various methods, models, or learning strategies can be selected and applied to suit the situation, conditions, or learning problems faced by lecturers and students. In LS, lecturers must change the classical learning process that is teacher-oriented into student-oriented learning. LS activities are not momentary activities but continuous, continuous activities and an effort to apply the principles of Total Quality Management. This activity is intended to continuously improve learning processes and outcomes so that it can encourage the formation of a learning community that systematically and consistently makes individual and managerial improvements (Wiharto, 2018).

LS activities consist of the main steps in the form of activities to design learning to achieve goals, implement learning, observe the implementation of learning, and reflect on to discuss the learning studied for improvement in the next learning plan. The main focus of implementing lesson study is student activities in class with the assumption that student activities are related to lecturer activities in-class learning. Lesson Study consists of planning (Plan), implementation of actions and observation (Do), and reflection (See).

A. Planning Stages (Plan) in Lesson Study

Learning planning begins with identifying existing problems, such as unsatisfactory learning outcomes or less effective learning methods. The results of this analysis then become the basis for preparing a better Semester Learning Plan (SLP, commonly known as RPS-ind.). Then Lesson Study activities followed with the planning stage, researchers together with the Lesson Study team conducted a workshop to discuss and equalize perceptions regarding the implementation of the learning activities that would be carried out. This activity plan discusses issues that include the material to be taught by the model teacher/lecturer, the model steps used, methods, learning media, student seating positions, and the readiness of the model lecturer so that the designed learning process can run effectively and efficiently. The design of student seating positions is arranged in the shape of the letter "U" which aims to make it easier for students to carry out activities, interact, share, and collaborate. Apart from that, it also makes it easier for model lecturers and observers to go around observing the activities carried out by each study group which are presented in Figure 3.

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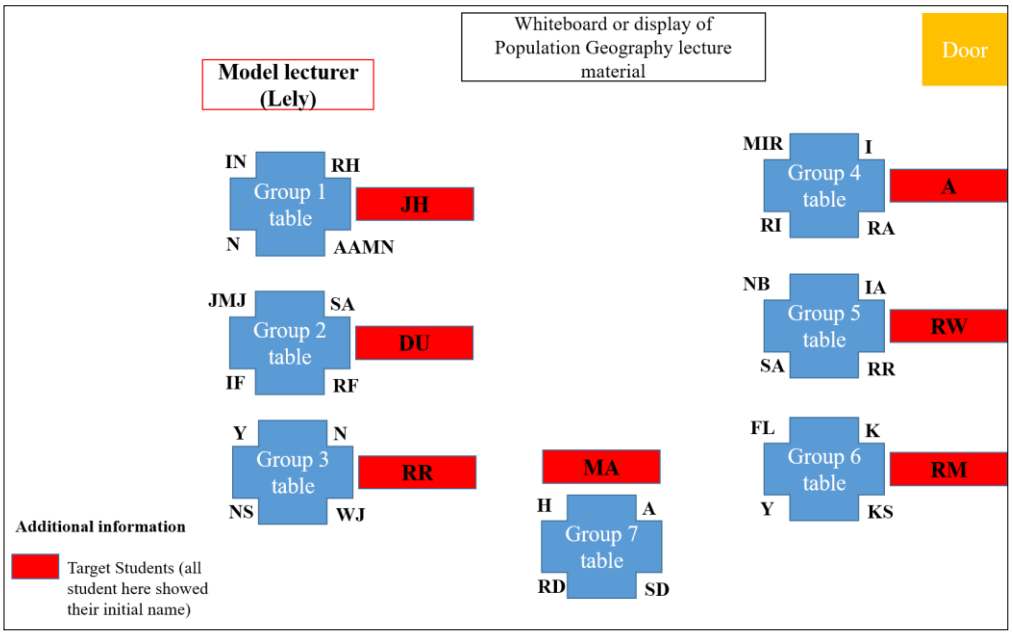

Figure 3. The student seating plan is planned to maximize the learning and teaching process

Also in the planning stage, the lecturers in the Lesson Study Team collaborated to evaluate the SLP (RPS-red.) using a student-oriented learning approach. Through this collaboration, it is hoped that SLP (RPS-red.) can be produced that is rich in innovative ideas and able to encourage active student participation in learning. Learning planning begins with identifying existing problems, such as unsatisfactory learning outcomes or less effective learning methods. The results of this analysis then become the basis for preparing a better Semester Learning Plan SLP (RPS-red.)

The SLP was prepared independently by the lecturer in charge of the Population Geography Course and then carried out an in-depth analysis of various aspects of learning together with the team, starting from student learning outcomes to the methods and media used. The results of the analysis by this team will be an important reference in improving the RPS or SLP which is comprehensive and able to overcome various challenges that may arise during the learning process

Figure 3. The model lecturer explained the preparations with the LS team, this activity was included in the planning stage.

Before the implementation and observation stages (Do), the lecturers will exchange knowledge and experiences related to the material to be taught (Fig. 3). The new learning materials

designed will also be tested first by the LS team. In addition, input from the LS expert team will be very valuable in ensuring that the learning plan created is theoretically correct and feasible to implement. Collaboration between lecturers is also key at this stage. By sharing experiences and knowledge and involving expert sources, lecturers can evaluate and improve the learning plans that have been made so that the quality of learning can be improved.

B. Implementation and Observations Stages (Do) in Lesson Study

At the implementation and observation stage (the Do stages), the main activities carried out are: (1) a model lecturer has been determined, and Mrs. Lely Adriani as instructor of the Population Geography course, will implement the Semester Learning Plan that has been prepared before, and (2) a team of other lecturers and related parties will observe directly how the learning process takes place. In the learning process, lecturers choose appropriate methods and media to help students achieve learning goals. Apart from that, lecturers also play an important role in motivating students to be actively involved in various learning activities, so that they can gain comprehensive knowledge, understanding, and analytical skills. This research was conducted in the Population Geography course with material on the characteristics of developed countries and developing countries.

According to planning, and the findings, show that the LOC-R model is implemented at the Do stage in the Lesson Study (see Fig. 2). So in this discussion section, we will also explain how LOC-R is in LS according to the sequence of steps or stages. Table 3 is presented to clarify the implementation of LOC-R in LS.

TABLE 3.
Combining Loc-R Into Ls During The Teaching And Learning Process (Do)

No	Steps/stages	Description of activities
1	Literacy	The model lecturer distributes pretest questions that aim to determine students' abilities in mastering concepts related to geographic literacy. The pretest questions are created based on a literacy review that is linked to the material that will be delivered by the model lecturer. In the first stage, namely literacy, the model lecturer provides literacy activities independently. In this literacy activity, students are asked to ask questions or repeat what is conveyed in the learning video. The videos shown relate to material on the characteristics of developed and developing countries. Because no students asked questions, the step taken by the model lecturer was to ask students questions. The results of the observations showed that several students answered the lecturer's questions, but the answers given were not able to interpret the information learned from the learning video.
2	Orientation	The lecturer explains the learning objectives by carrying out learning activities to construct student knowledge. It is stated that at the orientation stage in LOC-R learning, teachers should give tasks to test students' understanding in determining and showing that students have received the information that will be conveyed by the teacher (Pasongli et al., 2022). At this stage, the model lecturer gives assignments to students to create a population pyramid based on data to determine the characteristics of developed and developing countries.
3	Collaboration	The model lecture asks students to collaborate to build togetherness, get used to having opinions, and accept opinions from group friends or other groups. Collaboration is needed by students in learning as a form of cooperation and mutual use of skills

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No	Steps/stages	Description of activities
		between one individual and another. The model lecturer collaboration stage divides students into several study groups. Each group was given a problem related to the analysis of maps of the distribution of developed and developing countries. In the discussion session, students were very active in exploring information by discussing and collaborating to shade the blind map that had been prepared by the model lecturer. Students who experience difficulties in collaborative activities will be guided by model lecturers. It can be seen that model lecturers play a very active role in accompanying and guiding study groups that experience difficulties. In this collaborative activity, students also use smartphones to search for information related to countries categorized as developing and developed countries. By using gadgets and accessing the internet, students can indirectly become literate by reading information through their respective devices. When students shade the map (see Fig. 4), the lecturer always reminds them that every continent has borders that cannot be colored. From the results of the student shading, it was found that there were groups who were not yet able to read maps and determine the names of countries on the map, and the students did not even know the borders between countries. At the end of the collaboration activity, students are asked to explain the results of their discussion which will be responded to by others before finally being reinforced by the model lecturer. In this activity, the model lecturer plays a facilitating role and directs students to get the maximum possible learning experience and also provides literacy habits and the widest possible access to information with certain limitations.
4	Reflection	Students together with model lecturers carry out the learning process. So in this activity, the model lecturer no longer discusses material issues and lecture content, but the lecturer and students reflect on their feelings and learning experiences that have occurred. This can be used by lecturers as evaluation material in determining the learning methods or media that will be used in the next meeting.

(a) (b)

Figure 4. One example of Do's activities (a) group discussion; (b) mentoring by the model lecturer Reflection Stages (See) in Lesson Study

C. Reflection Stages (See) in Lesson Study

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The third or final stage of LS, namely reflection, is an activity in which all Lesson Study participants, led by the research team, discuss the experiences of lecturers who have tried new learning methods. This discussion focuses on difficulties and things that need improvement. The purpose of the reflection stage is to evaluate the learning process that has been carried out. All Lesson Study participants, led by a facilitator from the lecturer team, will discuss lecturers' experiences who have implemented new learning methods. This discussion will focus on identifying problems and finding solutions for future improvements. Next, the observing lecturers' turn was to provide responses and suggestions. They will share the results of their observations and provide objective input, without judging the lecturer's performance. All of this input will be discussed together to find ways to improve the learning process. Participants are asked to note down all important points that arise in the discussion

Figure 5. See (reflection stages) activities carried out by the model, researcher, observers, and LS team.

The goal of this stage is to gather input from multiple perspectives. Observer lecturers will present their findings based on the data that has been collected. This input will be used to identify areas that need improvement and develop strategies to improve the quality of learning. All discussion results from this reflection stage have been recorded and stored properly for future improvements. It should be emphasized that the reflection stage here is part of the LS stage which is only carried out by model lecturers and lecturer teams. Not a reflection in the LOC-R. Because LOC-R also contains a reflection stage but it is carried out by students regarding their activities during the learning process.

Lesson Study-based learning can encourage policies to improve the quality of education through collaboration between teachers, curriculum development, and the implementation of more effective learning strategies in line with student needs. According to researchers, the advantage of lesson study is that it is the result of reflection from observers. Messages from observers at the reflection stage can determine policies that lecturers can take to determine the next steps. Lesson study can lead to a transformation that focuses on the practice that will be implemented and is also committed to student development so that it can help students overcome the difficulties faced by teachers (Richit & Tomkelski, 2022; Ponte & Quaresma, 2019).

Insert LOC-R Model in LS and Teams Response

The results obtained from lesson study activities are the contribution of reflection that is presented professionally. According to observer 'NN' when showing the video at the Literacy stage; Students can utilize devices using the AI ChatGPT or Perplexity applications if students' literacy

understanding is still lacking. Moreover, in 21st-century learning, students can utilize technology in learning. Condition in 21st-century learning emphasizes that students have skills in using technology, and information media and can work and survive using life skills. According to observer 'NT', student literacy has been developed, but sometimes there are students who are still hesitant to express opinions that are understood, giving rise to limited literacy understanding. Literacy understanding is not only the ability to read but also being able to analyze phenomena that occur and being able to implement the concepts obtained in everyday life. In the Population Geography course, students with the theme of characteristics of developing and developed countries can provide discourse to students to think critically in solving problems so that sustainable development goals can run well. It is this student's thinking ability that can face challenges in global competition in the 21st century (Aliman et al., 2018).

The orientation stage found that there were still 8 students or 28% of students who were categorized as very poor in reading data so they could not interpret it in a population pyramid. This is an obstacle to increasing literacy, especially data literacy. According to 'EM', apart from learning videos, learning should begin by using infographics to increase students' understanding of visualizing data and information so that students can easily read the data. LOC-R learning at the literacy stage should be given stimulus to students in the form of videos, short stories, infographics, etc. (Segara et al., 2018). By providing stimulus in the form of infographics, videos, and short stories, it is hoped that students will find it easier to understand and interpret the data. In addition, through reflection results from observers, model lecturers can adjust the learning model that best suits students' needs, so that learning outcomes are more optimal. Lesson Study have been proven to help students process and interpret data, increase literacy, and increase student engagement and creative thinking skills (Suharniwati et al., 2024). This learning model also interprets student literacy and supports efforts to increase literacy, especially in the ability to interpret demographic data such as population pyramids. In the Lesson Study, the LOC-R learning model can be implemented collaboratively to design more effective learning strategies to increase student literacy (Fadilla et al., 2023).

Collaborative activities among students have shown improvement, especially teamwork, group discussions, and joint problem-solving. Through this collaborative activity, students not only learn about working together but also learn about communication skills, leadership, and responsibility in achieving common goals. This was proven by observer 'MY' statement which stated that students were very enthusiastic about participating in collaboration activities even though at first they were confused about distinguishing between developed and developing countries. The role of model lecturers is very much needed in helping and accompanying students in completing assignments on student worksheets. Additional observer 'EM' stated that blind maps can provide information to students in spatial intelligence. Spatial intelligence is the initial potential that humans have in combining space and the components in that space (Mayalagu et al., 2024).

In collaboration activities, teachers must provide difficult activities, this is done by encouraging students to interact socially with other students. In implementing the LOC-R learning model at the collaboration stage, teacher assistance is very necessary. This is based on each student interacting within groups and between groups where they are allowed to debate, discuss, and help each other in solving problems given by the lecturer. Teacher assistance is needed to build the collaborative spirit of students in the classroom because in collaboration, mutually helpful and

complementary activities are created and all students will feel satisfied if they can contribute and succeed together (Pasongli et al., 2023).

The collaboration stage ends with a presentation of the results of the discussion in front of the class. The discussion process takes a long time because students point to each other who will make a presentation in front of the class. Students do not yet have the confidence to express opinions in front of the class. Teacher guidance is very necessary to grow students' self-confidence. However, with presentation learning activities, students can learn to get used to speaking in front of many people. The final stage is reflection, the results of reflection are carried out in the learning process to look back at the learning process that has been carried out in more detail.

Effective learning is designed to actively involve students in various activities. Lecturers not only deliver material but also create a learning atmosphere that allows students to interact, discuss, and apply the knowledge they have acquired. To realize these goals, a relevant learning model was determined, namely LOC-R. With the aim, apart from increasing student literacy, it is also to increase learning activity which can be represented in the final learning results. Other things that make LOC-R chosen as a method combined in LS are because LOK-R has the following advantages;

1) Improve literacy skills: This model is specifically designed to improve students' ability to understand text.
2) Strengthen understanding of concepts: By connecting the text with personal experiences, students will more easily remember and understand the concepts studied.
3) Develop critical thinking skills: Students are trained to analyze information, make inferences, and evaluate arguments.
4) Improve communication skills: Through group discussions, students are trained to convey their ideas and opinions clearly and effectively.
5) Building cooperation: This model encourages students to work together with their peers so that they can improve their cooperation skills.

In the learning process, lecturers have an important role in motivating students to not only memorize information, but also understand concepts, apply them in different situations, and be able to analyze and synthesize various information. Besides that, lecturers also need to create multiple interesting and challenging learning activities so students can be actively involved and develop critical thinking skills. Effective learning must involve students actively in multiple activities. Lecturers are not only presenters of material but also facilitators who help students develop their thinking, communicating, and working together skills. This effective learning is attempted and implemented using the LOC-R model by model lecturer who are accompanied by a team of other lecturers.

CONCLUSIONS

This research has successfully implemented the Lesson Study learning model combined with the LOC-R model in the Population Geography course. This combination has proven effective in increasing student literacy and learning activities. The research results show that The LOC-R model integrated into the Lesson Study improved students' literacy skills, especially in understanding data, graphs, and text related to population geography material. Students become more active in participating in learning activities, both in group discussions and presentations. This shows that the

learning model applied can increase student involvement. The collaborative activities that are an integral part of the LOC-R model have succeeded in facilitating the development of student collaboration skills, such as communication, teamwork, and problem-solving. Through the Lesson Study cycle, the quality of learning can be continuously improved. This is reflected in constructive feedback from observers and in-depth reflective discussions.

The results of this research have significant implications for learning practices in higher education, especially in the context of increasing student literacy and learning activities. The combination of Lesson Study and LOC-R can be an effective alternative learning model to achieve better learning goals. The suggestion put forward by researchers is that further research is needed. Further research with a wider scope is needed to generalize the findings of this study. In addition, the Lesson Study with the LOC-R model can continue to be developed and adapted to different learning contexts. The results of this research can also be disseminated to educators to encourage the implementation of innovative learning models through workshops, seminars, and the like.

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CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this paper.

AUTHOR CONTRIBUTIONS

Hernita Pasongli and Rohana Sufia conceptualized the research idea and designed the study. Eva Marthinu contributed to the development of the theoretical framework and performed the classroom implementation. Lely Adriani Nasution led the teaching sessions and facilitated the lesson study process. All authors participated in data analysis, discussion of the findings, and contributed equally to the drafting and revision of the final manuscript.

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