jpte@unm.ac.id 1

877-Sri Yulias Anggraeni.pdf

Class AA 5

Class AA

Universitas Pendidikan Muhammadiyah Sorong

Document Details

Submission ID
trn:oid:::1:3306404561

Submission Date
Aug 1, 2025, 2:42 PM GMT+7

Download Date
Aug 1, 2025, 2:48 PM GMT+7

File Name
877-Sri_Yulias_Anggraeni.pdf

File Size
3.4 MB

14 Pages

6,546 Words

37,764 Characters

18% Overall Similarity

The combined total of all matches, including overlapping sources, for each database.

Filtered from the Report

- Bibliography
- Quoted Text

Match Groups

41 Not Cited or Quoted 14%
Matches with neither in-text citation nor quotation marks

22 Missing Quotations 4%
Matches that are still very similar to source material

0 Missing Citation 0%
Matches that have quotation marks, but no in-text citation

0 Cited and Quoted 0%
Matches with in-text citation present, but no quotation marks

Top Sources

15% Internet sources
6% Publications
9% Submitted works (Student Papers)

Match Groups

- **41** Not Cited or Quoted 14%
  Matches with neither in-text citation nor quotation marks
- **22** Missing Quotations 4%
  Matches that are still very similar to source material
- **0** Missing Citation 0%
  Matches that have quotation marks, but no in-text citation
- **0** Cited and Quoted 0%
  Matches with in-text citation present, but no quotation marks

Top Sources

15% Internet sources
6% Publications
9% Submitted works (Student Papers)

Top Sources

The sources with the highest number of matches within the submission. Overlapping sources will not be displayed.

1	Student papers	
Universitas Khairun		7%
2	Publication	
Ashadi, Joko Priyana, Basikin, Anita Triastuti, Nur Hidayanto Pancoro Setyo Putro....		<1%
3	Student papers	
Universitas Pendidikan Indonesia		<1%
4	Publication	
"Theory and Practice of Lesson Study in Mathematics", Springer Science and Busi...		<1%
5	Publication	
Ade Gafar Abdullah, Vina Adriany, Cep Ubad Abdullah. "Borderless Education as a...		<1%
6	Internet	
journal-center.litpam.com		<1%
7	Internet	
journal.walisongo.ac.id		<1%
8	Student papers	
Universitas Negeri Surabaya The State University of Surabaya		<1%
9	Internet	
www.researchgate.net		<1%
10	Internet	
iredu.ube.fr		<1%

11	Internet	
www.grafiati.com		<1%
12	Internet	
jonedu.org		<1%
13	Internet	
eric.ed.gov		<1%
14	Publication	
Maila D.H. Rahiem. "Towards Resilient Societies: The Synergy of Religion, Educati...		<1%
15	Internet	
journal.unj.ac.id		<1%
16	Internet	
recsam.edu.my		<1%
17	Publication	
Ahmet Aykan, Bekir Yıldırım. "The Integration of a Lesson Study Model into Dista...		<1%
18	Publication	
Mas'ud Muhammadiah, Andi Hamsiah, Abdurrohman Muzakki, Nuramila Nuramil...		<1%
19	Internet	
journal.uinsgd.ac.id		<1%
20	Publication	
Ade Gafar Abdullah, Tutin Aryanti, Agus Setiawan, Maizam Binti Alias. "Regionaliz...		<1%
21	Publication	
Ivandro Arsena Putra, Arthur Huwae. "Exploring the Role of Mindfulness in Prom...		<1%
22	Publication	
Noora Bosch, Tellervo Härkki, Pirita Seitamaa-Hakkarainen. "Teachers as reflectiv...		<1%
23	Internet	
ejournal.umm.ac.id		<1%
24	Internet	
files.eric.ed.gov		<1%

25 Internet
www.eu-jer.com <1%

26 Internet
www.neliti.com <1%

27 Publication
Endah Retnowati, Anik Ghufron, Marzuki, Kasiyan, Adi Cilik Pierawan, Ashadi. "Ch... <1%

28 Publication
Herry Agus Susanto, Meidawati Suswandari, Dewi Kusumaningsih, Sri Mulyati. "C... <1%

29 Publication
Suprapto Endah Retnowati, Jerusalem Mohammad Adam, Kristian Sugiyarto, Wag... <1%

30 Publication
Tianyu Kong, Yan Zhao, Fatao He, Maoyu Wu, Yuxia Xu, Yixi Wang, Yinfei Ma, Le C... <1%

31 Publication
Varisa Tri Utari, Ika Maryani, Enung Hasanah, Suyatno Suyatno, Asih Mardati, Nor... <1%

32 Internet
cognizancejournal.com <1%

33 Internet
doaj.org <1%

34 Internet
ejournal.undiksha.ac.id <1%

35 Internet
journal.ia-education.com <1%

36 Internet
pkm.lpkd.or.id <1%

37 Internet
repository.up.ac.za:8080 <1%

38 Internet
stemeducationjournal.springeropen.com <1%

39 Publication

Jefri Faizal, Ahmad Shofiyuddin Ichsan. "Critical Reviews of IPAS Learning in Prim... <1%

40 Internet

jppipa.unram.ac.id <1%

IJORER : International Journal of Recent Educational Research
Homepage : https://journal.ia-education.com/index.php/ijorer
Email : ijorer@ia-education.com

p-ISSN : 2721-852X ; e-ISSN : 2721-7965
IJORER, Vol. 6, No. 4, July 2025
Page 1237-1250

Advancing Teachers' Pedagogical Competence through STEM-Based Lesson Study in Indonesian Primary Schools

Sri Yulias Anggraeni[1], Fauzan Adhim[2], Rina Sugiarti Dwi Gita[3]
[1, 2, 3] Universitas PGRI Argopuro, Jember, Indonesia

DOI: https://doi.org/10.46245/ijorer.v6i4.877

Sections Info

Article history:
Submitted: May 07, 2025
Final Revised: July 04, 2025
Accepted: July 11, 2025
Published: July 31, 2025

Keywords:
Teachers' Pedagogical Competence; Professional Development STEM-Based Learning; Lesson Study; Primary School.

ABSTRACT

Objective: This study aims at comprehensively investigating the practical STEM-based lesson study to improve teachers' pedagogical competence in primary schools. **Method:** This study conducts a qualitative case study. This sstudy was conducted in SD Negeri Bades. The researcher incorporated observation sheets and semi-structured interviews in collecting the data. **Results:** The findings show that there are three stages conducted in STEM-based learning; planning, doing, and seeing stage. Further, incorporating STEM-based lesson study indicates an improvement of teachers' pedagogical competence in primary schools. In addition, teachers are able to share their ideas to design effective lesson design, and able to design effective lesson plan to make effective and meaningful STEM-based learning in SD Negeri Bades. **Novelty:** This study provides practical integration of STEM-based lesson study to improve teachers'pedagogical competence within context of Indonesian primary schools.

INTRODUCTION

As science and technology in 21st century has developed, this has forced teachers to adapt with these challenges and to master 21st century skills. (Rahmaniya & Haryanto, 2024) added that 21st century learning emphasizes the development of skills that are relevant to human needs in the future. This encourages a transformation in learning methods and approaches used by teachers in the learning process. In this context, the learning process must be collaborative, contextual, and integrated with society (Asri et al., 2023).

In this case, to promote these collaborative and contextual learning process, integrating STEM-based learning is said to be one of the relevant approaches to implement. Moreover, this STEM-based learning has a significant role in improving students' critical, creative, innovative, collaborative and communicative thinking abilities (Lestari & Zulyusri, 2022). This requires a more innovative learning process in which the learning activities can juxtaposed with the real world (Astuti et al., 2021). In addition, this enables students to be more active in the learning activities and to think systematically and logically.

Furthermore, teachers play an important role to adapt this STEM-based learning approach into classroom practice. Aspects of teacher skill and creativity in managing learning will have an impact on the quality of learning. The learning success is also influenced by the teacher's skills and creativity in managing learning (Andriyani, 2022). In addition, teachers must be able to master basic teaching skills including: opening and closing lessons, explanation skills, asking questions, skills for guiding small group discussions, class management skills, reinforcement skills, and small group and individual teaching skills (Andriyani, 2022).

IJORER : International Journal of Recent Educational Research
Homepage : https://journal.ia-education.com/index.php/ijorer
Email : ijorer@ia-education.com

p-ISSN : 2721-852X ; e-ISSN : 2721-7965
IJORER, Vol. 6, No. 4, July 2025
Page 1237-1250

Teachers must also have outstanding pedagogical competence in designing and managing learning. In other words, teachers must always learn and always be imaginative in looking for ideas, innovations and implementing them into learning. Pedagogic competence is crucial to determine the success of learning process such as students' development, planning, designing learning, and evaluating learning outcomes (González et al., 2024). In addition, how successful teachers carry out pedagogical process depends on the teachers' pedagogical competence (Hanum & Robandi, 2023).

Still, it is said that there have been the lack of teachers' pedagogical competence leading to ineffective teaching-learning process. Most teachers tend to incorporate conventioal-teaching method leading to uninteresting learning activities (Wulandari & Nisrina, 2020). Most teachers, in addition, struggle with designing effective lesson planning. This in turn, teachers tend to be monotonous, less creative and less innovative in designing and implementing meaningful learning.

Lesson study is said to be one way to increase teachers' pedagogical competence in implementing STEM-based learning in schools. Lesson study is a form of teacher professional development through collaborative and continuous learning assessment (Suardana et al., 2020). (Plantin Ewe, 2020) added that lesson study can be used as a method to develop teacher learning in the classroom. It is expected that teachers can improve teaching strategies and increase their competence in designing more effective and meaningful learning.

Further, lesson study can be an effective tool for teachers in developing their pedagogical competence. Lesson study is one of professional development model has been popular in recent years (Aykan & Yıldırım, 2022). It is said to be significant to improve teachers' competence and help teachers learn classroom-best practices in the classroom (Dewi et al., 2021). This consists of three stages; planning, doing, and seeing (Erita et al., 2022).

In addition, (Dewi et al., 2021) states that there are stages in implementation lesson study namely the planning stage (*plan*), resist execution (*do*), and the degree of reflection (*see*). The planning stage is the stage of analyzing topics, students' realities, creating learning plans. The implementation stage includes three steps, namely; arousing students' interest, realizing meaningful learning for students, concluding lessons, and the reflection stage which includes reflecting on lessons (Sairo, 2021). (Sairo, 2021) also adds that lesson study become a means for teachers to improve learning practices.

Previous studies have examined the use of lesson study to increase teachers' competence in designing effective learning. (Yennizar & Librianty, 2022) found that lesson study has a significant influence on teachers' pedagogical and professional competence. Besides, lesson study also has a positive impact on teachers' active collaboration and reflective attitudes in improving the quality of their learning. Lesson study, in addition, can effectively develop pedagogical knowledge and improve teacher teaching.

Further, (Hadi, 2020) has investigated the implementation of lesson study to improve teachers' competency at SMK Negeri 1 Singkep. It is found that lesson study appears to be effective for improving STEM-based teachers' teaching abilities. In addition, lesson study has a positive impact on increasing teachers' competence in improving the quality of learning and developing skills in problem solving (Ruspa et al., 2025). Most

IJORER : International Journal of Recent Educational Research
Homepage : https://journal.ia-education.com/index.php/ijorer
Email : ijorer@ia-education.com

p-ISSN : 2721-852X ; e-ISSN : 2721-7965
IJORER, Vol. 6, No. 4, July 2025
Page 1237-1250

teachers participating in the lesson study feel more confident and creative in creating learning scenarios in class.

Previous studies have shown that lesson study appears to be effective to improve teachers' pedagogical competence in designing effective learning. Still, there have been gaps in the contexts of implementing STEM-based lesson study conducted in phase B students. In addition, the gaps also deal with the subject IPAS in which this IPAS is a subject requiring students to develop and master science process skills to solve related problems in everydaylife (Mellani Saputri & Patonah, 2023).

Further, to address this gap, the researcher is interested in further investigating the implementation of STEM-based lesson study to advance teachers' pedagogical competence in elementary schools. This study aims at investigating practical STEM-based lesson study to improve teachers' pedagogical competence. Thus, this study can serve a literature and practical guide for teachers and principals in educational settings to improve teachers' pedagogical competence.

RESEARCH METHOD

Research Design

This study was a qualitative research. A qualitative research provides an in-depth examination of single entity (Cresswell, 2015). A qualitative approach was needed to gather verbal and in-depth information from the teachers regarding how to manifest pedagogical competence creatively and teachers' challenges in educational setting. This study conducted a descriptive case study approach investigate and explore in depth implementation of STEM-based lesson study at SD Negeri Bades to improve teachers' pedagogical competence.

Research Participants

This study aimed at obtaining a comprehensive understanding of teachers' practical competencies regarding the implementation of STEM-based lesson study at SD Negeri Bades. In this study, the researcher used three phase B teachers from SD Negeri Bades 01, SD Negeri Bades 02, and SD Negeri Bades 03. In addition, the researcher then chose one teacher model to implement STEM-based lesson study on the topic of photosynthesis taught at phase B students. A description of research participants is shown in the table 1.

Table 1. Research participants

No	Participant Codes	School's Name	Teaching Experience
1	Respondent 1	SD Negeri Bades 01	7 years
2	Respondent 2	SD Negeri Bades 02	11 years
3	Respondent 3	SD Negeri Bades 03	9 years

Research Instruments

Data collection deals with the process of collecting data and aims at obtaining insight regarding the topic of the study (Taherdoost, 2021). In this study, the researcher used observation and semi-structured interview. Participatory observations were used during the planning and doing stage of STEM-based lesson study. Meanwhile, semi-structured interviews with teachers who took part in the activities lesson study to obtain data regarding the implementation of STEM-based lesson study to improve teachers' pedagogical competence in SD Negeri Bades.

IJORER : International Journal of Recent Educational Research
Homepage : https://journal.ia-education.com/index.php/ijorer
Email : ijorer@ia-education.com

p-ISSN : 2721-852X ; e-ISSN : 2721-7965
IJORER, Vol. 6, No. 4, July 2025
Page 1237-1250

Research Procedures

According to (Dewi et al., 2021), there were three stages of lesson study implementation namely; the planning stage (*plan*), resist execution (*do*), and the degree of reflection (*see*).

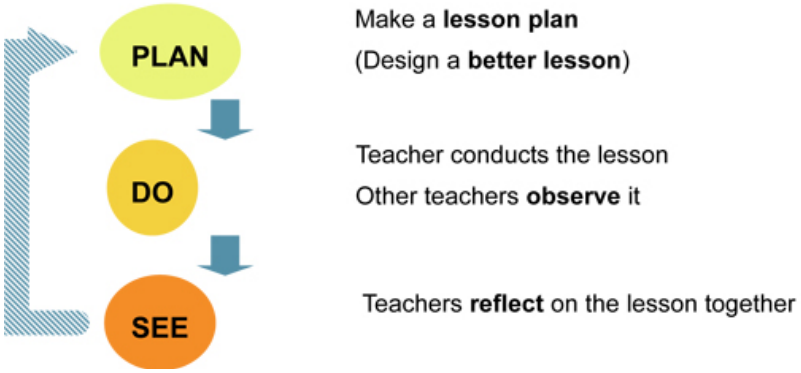

Figure 1. Lesson study scheme

During the planning stage, the researcher conducted a workshop emphasizing on the designing lesson design dealing with STEM-based learning. During this stage, the participatiory observation was used to observe the participants' activities dealing with formulating lesson design. In addition, in this stage, the researcher examined teachers' pedagogical competence in design effective lesson design dealing with STEM-based learning.

In doing stage, the researcher then observed the teacher model to implement lesson design dealing with STEM-based learning. During this stage, the research obtained the data regarding to the implementation of lesson design used in the teaching-learning process. In the seeing stage, teachers' pedagogical were observed and assessed, including their competency to identify strengths and weaknesses and propose strategies for improvement. The researcher then conducted in-depth interviews to explore their perception on the STEM-based lesson study conducted. In addition, teachers feedback provided further context to enable a triangulation of analysis and findings.

Data Analysis

Data analysis process is dealing with collecting, describing, and interpreting the collected data of the study. The data analysis was primarily descriptive, focusing on identifying practices of teachers' pedagogical competence regarding to the practical implementation of STEM-based lesson study. The data obtained from the observation and interviews were analysed using a thematic analysis approach. This consists of stages dealing with transcription, coding and theme identification, and interpretation. In addition, these stages will help the researcher to obtain deeper information about participants' pedagogical competence, experiences, and perceptions on the implementation of STEM-based lesson study conducted in SD Negeri Bades.

RESULTS AND DISCUSSION

Results

This study is dealing with investigating the implementation of STEM-based lesson study to improve teachers' pedagogical competence in SD Negeri Bades. In this study, there are three stages of STEM-based lesson study conducted to improve teachers'

IJORER : International Journal of Recent Educational Research
Homepage : https://journal.ia-education.com/index.php/ijorer
Email : ijorer@ia-education.com

p-ISSN : 2721-852X ; e-ISSN : 2721-7965
IJORER, Vol. 6, No. 4, July 2025
Page 1237-1250

pedagogical competence. These are planning stage, doing stage, and seeing stage. In addition, these stages are conducted sequentially to provide rich data regarding to the implementation of STEM-based lesson study to improve teachers' pedagogical competence. Each stages are explained in detailed data, as follows:

Planning stage

This planning stage involves introductory workshop. This deals with focusing on stating the purpose of lesson study, discussing challenges face by the phase B teachers during the teaching-learning session, and collaborating with phase B teachers to design an effective STEM-based learning. In addition, this stage includes two-day workshops addressing three teachers teaching at phase B from three schools as the subject of the study. In this stage, these collaborative teachers propose challenges dealing with teaching photosynthesis to phase B students in elementary school.

Based on the results of observation, most students are less motivated and reluctant to learn photosynthesis due to factor such as inappropriate strategies and media used. In this stage, researcher and researcher subject develop learning strategy using STEM-based learning approach in teaching photosynthesis to phase B students. During the observation of this stage, it is found that the teachers actively participate in collaborative activities dealing with designing effective lesson design to address students' challenges during the lesson. In addition, teachers are required to design STEM-based learning activities in their lesson design. The followings are collaborative lesson design made by collaborative teachers as the subject of the study.

Figure 2. Planning stage of STEM-based lesson study

Based on the figure 2 above, it shows that the researcher itself explains the concept of STEM-based lesson study on the research subjects; phase B teachers from SD Negeri Bades 01, SD Negeri Bades 02, and SD Negeri Bades 03. In this phase, the researcher conducts collaboirative activity dealing with planning lesson desig to use in doing stage. The research subjects also discuss the challenges faced by the participants in teaching-learning process before conducting STEM-based lesson study. The following is how the researcher coducts collaborative activity in STEM-based lesson study.

Figure 3 above shows that the researcher and research participants collaborate in designing lesson design regarding to the topic of photosynthesis. In this case, the researcher ensures that lesson study conducted in this phase should emphasize on the making of STEM-based lesson design.

IJORER : International Journal of Recent Educational Research
Homepage : https://journal.ia-education.com/index.php/ijorer
Email : ijorer@ia-education.com

p-ISSN : 2721-852X ; e-ISSN : 2721-7965
IJORER, Vol. 6, No. 4, July 2025
Page 1237-1250

Figure 3. Planning stage of collaborative activity with research participants

Based on the result of interview obtained from the respondents, it shows that all teachers in this study never make collaborative lesson study before this lesson study. Most teachers tend to copy lesson study file from other teachers. In addition, during teaching IPAS in the classroom, most teachers are rarely to implement STEM-based learning before.

> *"I have never made lesson design before. I usually download on the internet or copy file from other teachers during the teachers forum or KKG. I also rarely conduct STEM-based learning due to the lack of facilities in our school."* (Respondent 1).

In contrast, it is found that most teachers have positive perception on the STEM-based lesson study. It is stated that collaborative lesson study promote their collaborative skill and pedagogical competence in designing effective learning approach and STEM-based learning activities into classroom practice.

> *"In line with Respondent 1, before this lesson study we never make any lesson design. We often ask from other teachers from other schools. But I find myself better after participating in this lesson study. We can share ideas what should we do with STEM-based learning to promote our students' learning."* (Respondent 2)

Further, based on the results of interviews, Respondent 3 also shares same ideas related to the STEM-based lesson study conducted in SD Negeri Bades.

> *"It is a good chance for teachers to learn and share ideas. This lesson study help us to make an effective lesson design to our students. Now I know that STEM-based learning is not always dealing with school facilities. We can suit with our students' needs and material taught."* (Respondent 3)

Based on the data above, it can be said that STEM-based lesson study has significantly promote teachers' pedagogical competence. It indicates that most teachers are actively engaged in lesson study emphasizing on designing STEM-based lesson design. In addition, this lesson study can provoke collaboration within teachers in SD Negeri Bades.

Doing stage

This doing stage involves the implementation of lesson study made by the collaborative teachers in planning stage. This stage involves one teacher model to implement STEM-based lesson design, two collaborative teachers as the observer, and 16 students from 3rd grade at SD Negeri Bades 01. The following is doing stage in which the teacher model implements the lesson design formulated in planning stage.

IJORER : International Journal of Recent Educational Research
Homepage : https://journal.ia-education.com/index.php/ijorer
Email : ijorer@ia-education.com

p-ISSN : 2721-852X ; e-ISSN : 2721-7965
IJORER, Vol. 6, No. 4, July 2025
Page 1237-1250

Figure 4. Doing stage of STEM-based lesson

Figure 5. Doing stage of STEM-based lesson

Figure 4 and 5 above show that doing stage is dealing with the implementation of lesson design formulated in the planning stage. In this context, one teacher model is chosen to implement the lesson design. During this stage, the researcher is assisted by two research participants to observe how teacher model implements the lesson design into teaching-learning process. Based on the results of observations during this stage, it shows that teacher model implements STEM-based lesson study dealing with the topic of photosynthesis. In this stage, the teacher model are able to conduct effectively STEM-based learning into classroom activities.

During this stage, students are provided with the concept of photosynthesis through an interactive learning media. In addition, in this stage, the students are incorporated into in pairs to encourage their actively engagement in discussion activities. The following is the further data obtained from the observation sheet dealing with the doing phase of STEM-based learning.

Table 2. Observation sheet in Doing stage

Learning Aspects	Learning Process
Opening	Teacher model starts classroom activities through greeting, then praying together led by one of students in the class. Teacher model then starts checking students' attendance. Next, teacher reviews previous topic discusssed in the previous meeting. The teacher also brainstorm the students with the questions related to topic is being discussed.

IJORER : International Journal of Recent Educational Research
Homepage : https://journal.ia-education.com/index.php/ijorer
Email : ijorer@ia-education.com

p-ISSN : 2721-852X ; e-ISSN : 2721-7965
IJORER, Vol. 6, No. 4, July 2025
Page 1237-1250

Learning Aspects	Learning Process
Material presentation	Teacher has been dealing the topic being discussed with the context of school environment. Topic being discussed has suited with the aspect of STEM-based learning
Learning approach	Teacher model has implemented STEM-based learning approach in the teaching-learning process. In addition, this STEM-based learning approach can be seen clearly through learning steps conducted based on the lesson design.
Classroom management	Teacher model in this phase is able to manage classroom effectively. Teacher uses collaborative learning integrating with STEM-based learning. In this case, students are required to make a group discussion during the lesson.
Learning media	Teacher model has used effective learning media to provoke students' engagement. In addition, this learning media has been designed to ensure that STEM-based learning can work properly and effectively.
Evaluation	In this phase, teacher model uses students' worksheet to assess students' learning progress during the STEM-based learning.
Closing	In this closing phase, teacher model starts with reviewing material has been learned, drawing a conclusion, and praying together before closing the lesson.

Further, based on the results of interviews, teacher model has shown positive perception on this doing stage of STEM-based lesson study. The following is the data interview collected after doing stage.

> *"In this doing stage, I think it is very challenging but so far it gives us interesting and meaningful classroom practice. Using STEM-based lesson we have design in planning stage, I can manage classroom activities very well. Students are also engaged in the classroom activities. They are very interested in doing step-by-step STEM-based activities."* (Respondent 3).

Based on the data above, it indicates that teacher model has positively improved her pedagogical competence in designing and implementing effective STEM-based learning in teaching photosynthesis to phase B students at SD Negeri Bades 01. It is supported by the evaluation phase in which most students are able to master materials has been taught during the lesson.

However, during the doing stage, the researcher also finds that teacher model finds difficulties in transforming concept of photosynthesis. Based on the observation during

IJORER : International Journal of Recent Educational Research
Homepage : https://journal.ia-education.com/index.php/ijorer
Email : ijorer@ia-education.com

p-ISSN : 2721-852X ; e-ISSN : 2721-7965
IJORER, Vol. 6, No. 4, July 2025
Page 1237-1250

this phase, it is influenced by students' level to master the concept of photosynthesis. In this case, teacher model should be able to make a simple concept of photosynthesis to ensure students can understand the core concept of photosynthesis.

> *"During the implementation, I also find challenges where students are difficult to understand the concept of photosynthesis since they are still in 3rd grade. However, it leads to positive effect where students actively participate through asking questions about the material taught by me."* (Respondent 3).

Based on the data obtained from respondent 3 as the teacher model during the doing phase, it indicates that the challenges faced by teacher model dealing with how students can comprehend the concept of photosynthesis. In this case, the teacher model explains more detailed using STEM-based learning phase to ensure that students are able to use this concept into STEM-based learning.

Seeing stage

Seeing stage consists of reflection activities related to the implementation of STEM-based lesson design by teacher model at SD Negeri Bades 01. This involves the researcher, one teacher model, and collaborative teachers as the observer during the doing stage. In this stage, the researcher found that teacher model has effectively improved her pedagogical competence. She is able to design effective STEM-based lesson design in planning stage, and able to implement STEM-based lesson design in doing stage effectively. The following is seeing stage activity included in this STEM-based lesson study to reflect and assess the implementation of STEM-based lesson design in doing stage.

Figure 6. Seeing stage of STEM-based lesson study

As illustrated in figure 6 above, the researcher provides reflective activities to assess the planning stage in formulating lesson design and evaluate the planning stage dealing with the implementation of lesson design. In this context, this phase also provides deeper understanding about how the research participants perceive the implementation of STEM-based lesson study.

In seeing stage, the researcher also finds that teacher model still has challenges in transforming the concept of photosynthesis. Still, it is leading to positive impact on the students' participation in which students can ask questions on the concept being taught. It is also influenced by the students' grade in phase B. However, in this case, teacher as a model is able to manage classroom activities through direct explanation to the students using STEM-based approach. In other words, this STEM-based approach

IJORER : International Journal of Recent Educational Research
Homepage : https://journal.ia-education.com/index.php/ijorer
Email : ijorer@ia-education.com

p-ISSN : 2721-852X ; e-ISSN : 2721-7965
IJORER, Vol. 6, No. 4, July 2025
Page 1237-1250

conducted by the teacher model has stimulated students to improve students' engagement and critical thinking.

In short, in seeing stage, the researcher and collaborative teachers draw a conclusion that STEM-based lesson study conducted has significant impact on the teachers' pedagogical competence. It improves how teachers' competencies in preparing, designing, and implementing lesson design effectively into classroom practices.

Discussion

The results of this study provides a clear description of practical effect of STEM-based lesson study conducted in SD Negeri Bades has promoted teachers' pedagogical competence. As the the education has been rapidly growing these days, teachers' pedagogical competence is crucial to address the challenges (Reina-Parrado, M., Román-Graván, P., & Hervás-Gómez, 2025). Teachers, in this case, must have adequate and improve their pedagogical competence in providing and assisting students with 21st century skills. STEM-based learning in this context, plays important roles in strengthening 21st century skills, such as critical thinking, creativity, communication, and collaboration (4C), as well as student character building (Eko Atmojo et al., 2025). It is crucial for the teachers to improve their pedagogical competence in STEM-based learning. Hence, incorporating teachers into STEM-based lesson study activitie is said to be an alternative solution to promote their pedagogical competence (Kurniasih et al., 2024).

Moreover, incorporating three phases conducted in this STEM-based lesson study consisting of planning, doing, and seeing stage can help teachers to share ideas and best practices related to STEM-based learning. It is supported by previous study conducted by (Susetyarini et al., 2024), stated that lesson study can promote collaborative learning and enhance the teachers' pedagogical abilities. In addition, conducting STEM-based lesson study has encouraged teachers to actively engaged in collaborative project design.

Furthermore, using lesson study is said to be effective to help teachers in managing classroom activities. This STEM-based lesson study shows that teacher model can positively and actively engaged students with STEM-based learning. In this case, the teaching-learning process conducted by the teacher model using lesson study is said to provide students a meaningful and successful learning (Simatupang & Aryeni, 2018). In addition, during the doing phase, teacher model has been successful in transforming instructional practices. This in line with (Norbu, 2023) that the lesson study has been influential on the teachers' instructional practices. Teacher model has been successful to create positive and effective classroom discussion. The lesson study conducted by the teacher plays important role to promote engaging discussion (Wahyuni et al., 2021).The collaborative among teachers fosters a professional learning community supporting differentiated instruction and student-centered learning. Collaborative activity such as STEM-based lesson study can be a means for teachers to actively engaged in learning community. In addition, this can fosters the exchange of ideas and learning experiences (Liu et al., 2024). This provide teachers with innovative practices, impacts, and recommendations for sustaining the effects of lesson study dealing with practical implementation of STEM learning (Anning, 2025). Further, this collaborative learning activities also requires teachers collaboration along with the implementation of STEM-based learning (Gülhan, 2024).

IJORER : International Journal of Recent Educational Research
Homepage : https://journal.ia-education.com/index.php/ijorer
Email : ijorer@ia-education.com

p-ISSN : 2721-852X ; e-ISSN : 2721-7965
IJORER, Vol. 6, No. 4, July 2025
Page 1237-1250

The findings of this study show that implementation of STEM-based lesson study can promote teachers' pedagogical competence. In this case, using varied activities and strategies during the implementation STEM-based lesson study has led to the improvement of teachers' collaborative learning in designing STEM-based lesson design. Collaborative learning among teachers is crucial to promote and fostering learning environment and differentiated instructional practices (Pozas & Letzel-Alt, 2023). In addition, collaborative efforts among teachers can benefits for the students' learning outcomes (Khasawneh et al., 2023).

This study suggests compelling description that STEM-based lesson study can promote teachers' pedagogical competence. In addition, crucial and active role of teachers in designing and transforming classroom practices suggests the potential of lesson study (Muhammadiah et al., 2022). Teachers must shape, develop, and critically evaluate the learning process. Teachers also play a crucial role in integrating explorative design thinking process dealing with STEM-based learning into schools (Bosch et al., 2025). In short, as STEM-based learning as a key factor contributing to the 21st century learning, teachers have a key role in attracting students to the field of STEM (Yoshida & Sølberg, 2024).

CONCLUSION

Fundamental Finding: Based on the results of data analysis, this study suggests there three stages of STEM-based lesson study; planning, doing, and seeing stage. The findings show that there is a potential impact of STEM-based lesson study conducted in SD Negeri Bades to improve teachers' pedagogical competence. In addition, teachers are able to collaborate actively in planning stage. Teachers can effectively incorporate engaging classroom activities in doing stage and seeing stage. In addition, these findings suggest that teachers' pedagogical competence is improved through designing effective lesson design to implement in STEM-based learning activities. **Implication:** Lesson study is a means to promote teachers' competency. In this context, STEM-based lesson study can be an alternative professional development adopted to improve teachers' pedagogical competence. This, in addition, helps teachers to effectively design and incorporate meaningful STEM-based learning in the context of Indonesian elementary schools. **Limitation:** This study is limited to investigating the implementation of STEM-based lesson study on the topic of photosynthesis. In addition, this study is limited in improving teachers' pedagogical competence in SD Negeri Bades. **Future Research:** It is expected that future research is to investigating the practical implementation of STEM-based lesson study in improving the students' motivation and engagement in the context of recent deep learning approach suggested by the Minister of Education.

REFERENCES

Andriyani, M. (2022). Keterampilan dasar mengajar yang harus dikuasai oleh guru untuk meningkatkan kreativitas & efektivitas dalam proses pembelajaran. Jurnal Pendidikan Teknologi Informasi Dan Komputer, 1(1), 1–4.

Anning, A. S. (2025). Professional learning facilitators' contribution to sustainable STEM teacher learning in regional contexts. International Journal of Educational Research Open, 8(June 2024), 100406. https://doi.org/10.1016/j.ijedro.2024.100406

Asri, I. H., Lasmawan, I. W., & Suharta, I. G. P. (2023). Kompetensi abad 21 sebagai

IJORER : International Journal of Recent Educational Research
Homepage : https://journal.ia-education.com/index.php/ijorer
Email : ijorer@ia-education.com

p-ISSN : 2721-852X ; e-ISSN : 2721-7965
IJORER, Vol. 6, No. 4, July 2025
Page 1237-1250

bekal menghadapi tantangan masa depan. Kappa Journal, 7(1), 97–107. https://doi.org/10.29408/kpj.v7i1.12999

Astuti, N. H., Rusilowati, A., & Subali, B. (2021). STEM-based learning analysis to improve students' problem solving abilities in science subject: A literature review. Journal of Innovative Science Education, 9(3), 79–86. https://doi.org/10.15294/jise.v9i2.38505

Aykan, A., & Yıldırım, B. (2022). The integration of a lesson study model into distance stem education during the covid-19 pandemic: teachers' views and practice. Technology, Knowledge and Learning, 27(2), 609–637. https://doi.org/10.1007/s10758-021-09564-9

Bosch, N., Härkki, T., & Seitamaa-Hakkarainen, P. (2025). Teachers as reflective learning experience designers: Bringing design thinking into school-based design and maker education. International Journal of Child-Computer Interaction, 43(October 2024). https://doi.org/10.1016/j.ijcci.2024.100695

Dewi, F. A., Dambayana, P. E., & Namiasih, N. K. (2021). Pengimplementasian lesson study menggunakan teknik nht pada pembelajaran bahasa inggris. Journal for Lesson and Learning Studies , 4(2), 203–207. https://ejournal.undiksha.ac.id/index.php/JLLS

Eko Atmojo, S., Dwi Lukitoaji, B., Dyah Rahmawati, R., Dwi Anggriani, M., & Putri Anindya, A. (2025). Effects of hybrid stem learning on 21st-century skills and character development in prospective elementary teachers: A mixed-methods study from Indonesia. Qubahan Academic Journal, 5(2), 384–401. https://doi.org/10.48161/qaj.v5n2a1716

Erita, Y., Ahmad, S., & Sukma, E. (2022). Learning to make digital maps using project-based learning based on lesson study in cartography course. Journal of Learning Improvement and Lesson Study, 2(1), 40–45. https://doi.org/10.24036/jlils.v2i1.16

González, J., Melgoza, E., Cabeza, L., & Okoye, K. (2024). Assessment of students' learning outcome and competency through a blend of knowledge and practical ability. International Journal of Instruction, 17(2), 561–582. https://doi.org/10.29333/iji.2024.17231a

Gülhan, F. (2024). Professional learning community (plc) in steam education: a hands-on workshops sample. Science Insights Education Frontiers, 20(1), 3149–3172. https://doi.org/10.15354/sief.24.or496

Hadi, S. (2020). Membumikan lesson study dalam meningkatkan kemampuan mengajar berbasis STEM bagi guru matematika smk negeri 1 singkep kabupaten Lingga. Syntax Idea, 2(11), 923. https://doi.org/10.36418/syntax-idea.v2i11.707

Hanum, C. B., & Robandi, B. (2023). Pedagogical competence of elementary school teachers: basic knowledge and forms of learning activity. Mimbar Sekolah Dasar, 10(3), 492–512. https://doi.org/10.53400/mimbar-sd.v10i3.58109

Jhon, W, C. (2015). Penelitian Kualitatif & Desain Riset. Mycological Research, 94(3), 522.

Khasawneh, Y. J. A., Alsarayreh, R., Ajlouni, A. A. Al, Eyadat, H. M., Ayasrah, M. N., & Khasawneh, M. A. S. (2023). An examination of teacher collaboration in professional learning communities and collaborative teaching practices. Journal of Education and E-Learning Research, 10(3), 446–459. https://doi.org/10.20448/jeelr.v10i3.4841

Kurniasih, D., Kurniati, T., Baihaqie, A. G., & Oktaviyanti, E. (2024). Empowering educators through STEM and local wisdom-infused learning with lesson study at

IJORER : International Journal of Recent Educational Research
Homepage : https://journal.ia-education.com/index.php/ijorer
Email : ijorer@ia-education.com

p-ISSN : 2721-852X ; e-ISSN : 2721-7965
IJORER, Vol. 6, No. 4, July 2025
Page 1237-1250

SMAIT Al-Fityan Kubu Raya. Community Empowerment, 9(3), 521–530. https://doi.org/10.31603/ce.11137

Lestari, P., & Zulyusri. (2022). Studi literatur implementasi penerapan lkpd berbasis science, technology,engineering, and mathematics (STEM) terhadap keterampilan berpikir kritis(KBK) peserta didik. Jurnal Ilmiah Pendidikan Biologi, 08(3), 63–70. https://online-journal.unja.ac.id/biodik

Liu, J., Aziku, M., Qiang, F., & Zhang, B. (2024). Leveraging professional learning communities in linking digital professional development and instructional integration: evidence from 16,072 STEM teachers. International Journal of STEM Education, 11(1). https://doi.org/10.1186/s40594-024-00513-3

Mellani Saputri, R., & Patonah, S. (2023). Modul ajar ipas berbasis stem materi ekosistem untuk mewujudkan keterampilan proses sains siswa fase c sekolah dasar. Jurnal Basicedu, 4(1), 2024. https://doi.org/10.26877/ijes.v4i1.18391

Muhammadiah, M., Hamsiah, A., Muzakki, A., Nuramila, N., & Fauzi, Z. A. (2022). The role of the professional teacher as the agent of change for students. AL-ISHLAH: Jurnal Pendidikan, 14(4), 6887–6896. https://doi.org/10.35445/alishlah.v14i4.1372

N, Y., & Librianty, H. D. (2022). Pengaruh lesson study terhadap kompetensi guru pendidikan anak usia dini. Jurnal Obsesi : Jurnal Pendidikan Anak Usia Dini, 6(6), 7123–7140. https://doi.org/10.31004/obsesi.v6i6.3321

Norbu. (2023). Teachers' perception of walk-in observation and its impacts on instruction and pedagogy. Asian Journal of Advanced Research and Reports, 17(7), 63–71. https://doi.org/10.9734/ajarr/2023/v17i7494

Plantin Ewe, L. (2020). Enhancing teachers' relational competence: a teacher lesson study. International Journal for Lesson and Learning Studies, 9(3), 203–219. https://doi.org/10.1108/IJLLS-12-2019-0081

Pozas, M., & Letzel-Alt, V. (2023). Teacher collaboration, inclusive education and differentiated instruction: matter of exchange, co-construction, or synchronization? Cogent Education, 10(2). https://doi.org/10.1080/2331186X.2023.2240941

Rahmaniya, N., & Haryanto, L. (2024). JPK : Jurnal Pendidikan dan Kebudayaan JPK : Jurnal Pendidikan dan Kebudayaan. 01(03), 6–11.

Reina-Parrado, M., Román-Graván, P., & Hervás-Gómez, C. (2025). European journal of educational research. European Journal of Educational Research, 14(1), 249–265. https://scholar.archive.org/work/fxr3w63xnzgx3hpxvzuotnab44/access/wayback/https://pdf.eu-jer.com/EU-JER_13_2_573.pdf

Ruspa, A. R., Yusrini, R., Yunus, I., Ekawati, S., & Putra, A. R. (2025). Implementasi kurikulum merdeka berbasis lesson study bagi guru upt smpn 4 Masamba Linguistic Initiative, 6(1), 359–367. https://doi.org/10.53696/27214834.1145

Sairo, M. I. (2021). Pelaksanaan lesson study menggunakan metode pembelajaran mind mapping di kelas X MIPA 3. Journal for Lesson and Learning Studies, 4(1), 26–32. https://doi.org/10.23887/jlls.v4i1.32188

Simatupang, H., & Aryeni, A. (2018). Model pendekatan lesson study untuk meningkatkan keterampilan mengajar mahasiswa pada mata kuliah microteaching. Jurnal Biolokus, 1(2), 77. https://doi.org/10.30821/biolokus.v1i2.347

Suardana, N., Devi, N. L. P. L., & Selamet, K. (2020). Lesson study pada pembelajaran ipa berbasis budaya lokal di smp negeri 2 Seririt. Jurnal Widya Laksana, 9(2), 226–232. https://doi.org/10.23887/jwl.v9i2.21891

IJORER : International Journal of Recent Educational Research
Homepage : https://journal.ia-education.com/index.php/ijorer
Email : ijorer@ia-education.com

p-ISSN : 2721-852X ; e-ISSN : 2721-7965
IJORER, Vol. 6, No. 4, July 2025
Page 1237-1250

Susetyarini, E., Rofieq, A., Latifa, R., & Nurtjahyani, S. D. (2024). Advancing teacher competencies through lesson study for learning community (LSLC): Insights from smp Muhammadiyah 8 Batu city.Litpam Journal Center 8(3), 395–409. https://doi.org/10.36312/e-saintika.v8i3.1780

Taherdoost, H. (2021). Data collection methods and tools for research; a step-by-step guide to choose data collection technique for academic and business research projects hamed taherdoost. data collection methods and tools for research; a step-by-step guide to choose data coll. International Journal of Academic Research in Management (IJARM), 2021(1), 10–38. https://hal.science/hal-03741847

Wahyuni, S., Eko Susetyarini, R., Prihanta, W., & Yuliana, F. (2021). Peningkatan kualitas pembelajaran melalui lesson study learning community pada materi "waktu 24 jam" di sekolah dasar. JINoP (Jurnal Inovasi Pembelajaran), 7(1), 78–91. https://doi.org/10.22219/jinop.v7i1.10477

Wulandari, H., & Nisrina, D. A. Z. (2020). Hubungan kreativitas dan inovatif guru dalam mengajar di kelas terhadap peningkatan motivasi dan minat belajar peserta didik. Jurnal Ilmiah Wahana Pendidikan, 9(16), 345–354. https://doi.org/10.5281/zenodo.8242365

Yoshida, M., & Sølberg, J. (2024). Science teachers' beliefs on science teaching and learning for implementing in STEM education. Science Education International, 35(3), 192–197. https://doi.org/10.33828/sei.v35.i3.2

*Sri Yulias Anggraeni (Corresponding Author)
Universitas PGRI Argopuro Jember,
Faculty of Education Technology
Learning Technology Study Program
Jl. Jawa No.10, Jember Jawa Timur, Indonesia
Email: sri.yulias47@admin.sd.belajar.id

Fauzan Adhim
Universitas PGRI Argopuro Jember,
Faculty of Education Technology
Learning Technology Study Program
Jl. Jawa No.10, Jember Jawa Timur, Indonesia
Email: fauzanazizah19@gmail.com

Rina Sugiarti Dwi Gita
Universitas PGRI Argopuro Jember,
Faculty of Education Technology
Learning Technology Study Program
Jl. Jawa No.10, Jember Jawa Timur, Indonesia
Email: gitarina16@gmail.com