

Impelemtation of Lesson Study Based STEM Learning to Stidents' Creativity and Concept Mastery Through Joint Project

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Abstract

The human skeletal system is a complex material to be studied by students, especially for social studies class students who take Biology specialization subjects. This study aims to train students' creativity and improve students' mastery of concepts in the joint subtopic of skeletal system material through a STEM approach with a Project Based Learning model based on lesson study. The research method was a weak experiment with a one-shot case study design. The instruments used in this study include multiple choice test instruments and observation sheets. The results showed that students' creativity was in the good category with mastery of concepts that had passed the minimum KKM limit. This shows that STEM learning with project-based learning helps students to be able to understand the concept of joints through the implemented projects. The planning and implementation of lesson study-based learning also stimulates collaboration between teachers in the field of study to be able to design innovative learning.

Keywords: Student's Creativity, Concept Mastery, STEM, PjBL, Lesson study



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Introduction

The 21st century is known as the century of globalization and the century of information technology. The 21st century is marked by changes and shifts in all fields that take place rapidly and will affect human life. In addition, in the era of knowledge of intellectual capital mastery, especially higher order thinking skills, 21st century learning skills have seven skills, namely: 1) Critical thinking and problem solving; 2) Creativity and innovation; 3) collaboration, teamwork, 4) cross-cultural understanding; 5) communication, information, media literature; 6) mastering ICT; and 7) career and learning independence (Trilling, 2009). Creativity is one of the 21st century skills that must be possessed by students, students' creative thinking ability is a thinking process that is able to provide varied ideas or ideas which can then become new knowledge and needed answers. The creative thinking process is like an introduction in going through learning problems to determine direction until students reach the desired goal or answer (Abdurrozak & Jayadinata, 2016). However, in 2020-2021 learning in schools will experience its own challenges due to the Covid-19 pandemic. In Indonesia, the impact of the spread of Covid-19 does not only occur directly in the health sector, but also occurs in other fields including education. The outbreak has turned face-to-face meetings into online (online) meetings to avoid the spread of Covid-19, or at least minimize teacher and student meetings at schools. Teaching and Learning Activities (KBM) must continue to run by maximizing technology that supports distance learning (PJJ) (Haryani, 2020).

It is suspected that online learning conditions do not stimulate students to hone 21st century skills and even students' conceptual understanding changes during the online learning process. Nowadays, hybrid learning can be used as learning that is designed to integrate online and face-to-face learning activities so that each other can strengthen, complement, and support each other and not treat online methods as a duplication of learning in class or as an add -on . (Indra, 1967). In order for the learning process to run effectively and facilitate students to hone 21st century skills, it is necessary to have the right learning strategy. Learning strategies are very important to be applied as a form of planning in the educational process. Without a clear

strategy, the learning process will not be honed so that the learning objectives that have been set are difficult to achieve optimally. Learning strategies are very useful, both for teachers and students. For teachers, strategies can be used as guidelines and references for systematic action in the implementation of learning. For students, it can make it easier and faster to understand the learning content, because each learning strategy is designed to facilitate the student learning process. In traditional learning, students receive information passively and the teacher is the determinant of the learning process. Traditional learning that tends to be teacher-centered has an impact on student learning outcomes, so it must shift to student-oriented learning .

The right learning strategy is very important to use in the learning process, especially for students in the Social Sciences 1 class at SMAN 4 Cibinong school who are majoring in biology. Students majoring in social studies have different basic interests from science students, biology subjects require learning competencies in the realm of comprehensive high-level understanding. However, in reality today students tend to be passive and can only memorize rather than understand, especially in class XI IPS. Students are said to understand if they can demonstrate the performance of that understanding at a higher level of ability, both in the same context and in different contexts. Understanding is one of the most important factors in learning biology. How to learn to achieve understanding is something that needs to be considered by an educator in order to achieve learning objectives. In an effort to overcome these problems, it is necessary to apply appropriate approaches and learning models for students.

The application of STEM has a great opportunity to train students' thinking skills through its characteristics (Murnawianto, 2017). Meanwhile, Toto (2019) revealed that the application of the STEM approach to teach science with many learning models that can be used. Among the models of learning that are applicable are Project Based Learning, Problem Based Learning, Inquiry Learning and Cooperative Learning . In addition to the approach, the learning model is also very important to note in arranging the course of the learning process. According to (Kemendikbud; 2017) that the Project Based Learning (PBL) is a model of learning that uses a project in the process of learning, and centered on the student (Student -centered). The PBL model of giving freedom to the students to plan activities to learn them, carry out the project is collaborative, and ultimately produce work that can be presented to the other (Kemendikbud; 2017).

Project Based Learning (PBL) is learning innovative that encourage the students to do the investigation work is collaborative in researching and create projects that apply the knowledge they are of finding new things, proficient in the use of technology and being able to resolve a problem. Suranti et al., (2016). STEM-based PBL in the sense that integrated PBL with STEM can increase student interest in learning, STEM-based PBL also provides challenges and motivation for students, because it is able to train students to think critically, analyze and improve higher-order thinking skills. According to Sulaeman, 2016 (in Sari et al., 2019) the PBL model is a project-based learning, where students are given the task of developing themes/topics in learning by carrying out realistic project activities. In addition, the application of project-based learning encourages the growth of student creativity. This learning model requires students to create projects related to related subjects. PBL projects are built based on students' ideas as an alternative form of solving certain real problems, so that students experience the learning process of problem solving directly. The ability of students to solve problems is one of the characteristics of creative thinking.

The results of interviews with biology teachers at SMAN 4 Cibinong show that PBL is rarely used in biology lessons, especially joint material and more often uses lecture, presentation and question and answer methods. Project Based Learning is an innovative learning model, and emphasizes contextual learning through complex activities. In addition, this learning model is designed to encourage students to work independently to build learning, and to produce real products or works. These characteristics indicate that PBL has conformity with basic competencies in joint material. Joint material has basic competencies that allow students to make observations and experiments outside the classroom. Students are required to analyze information or data from various sources about joints. In addition, students must have basic competencies in designing concepts about various joints and presenting the results in various forms of media. Project Based Learning has an emphasis on the active involvement of students and the teacher's role is as a facilitator. Students do not passively only listen to the material from the teacher and then answer questions, but are also required to be involved in creating a product that shows students' understanding of the concepts being studied and describes their knowledge of the problems being solved. The products used by the teacher for the evaluation can be in the form of presentation slides, graphics, posters, essays, and others. Project Based Learning has advantages that are very important and useful for students. The process in this model familiarizes students with working scientifically. Another advantage of this model is that it gives students the freedom to plan learning activities, carry out collaborative projects and finally present them to other students. These characteristics and advantages are expected to be able to overcome problems in learning biology, especially in class XI IPS.

Therefore, to prove whether PJBL and STEM can affect student learning outcomes, a study was conducted with the title "Implementation of Lesson Study -based STEM Learning to Train Students' Creativity and Mastery of Concepts Through Joint Projects.

Method

This study used the weak experiment method. This study involved an experimental class without a control class, so the research design was a one-shot case study (Table 1). In this design, the researcher performs the treatment and after that the research subject is given a post-test to determine the achievement of learning outcomes (Sugiyono, 2009). The subjects involved in this study were 14 students of class XI IPS 1 who carried out limited face-to-face learning at school. This is because learning is still adjusting to new normal conditions after the COVID-19 pandemic. The material presented is about the joint sub-concept of the topic of the human movement system. Learning activities were carried out in 2 meetings.

Table 1. Research Design one-shot case study

Treatment	Observation
X	O

Information:

X = Giving treatment (treatment)

O = Observation after treatment (can be in the form of post-test)

Research activities are carried out with a lesson study approach which includes the Plan, Do, and See stages. In the Plan Phase, the research team analyzed learning problems and characteristics of class XI IPS 1 students, compiled lesson designs for joint materials, compiled LKPD, teaching materials, and project assessment instruments. In the Do Stage, learning activities are carried out by involving the model teacher and observer. Furthermore, in the See Phase, reflection activities related to student learning activities during the learning process were carried out by partner teachers and observers.

Students' creativity ability is measured through a project assessment instrument using an observation sheet with the following assessment criteria: 1) Planning (design and manufacturing stages); 2) Manufacturing Process (tools and materials, manufacturing techniques, and K3); 3) Product Results (product form, functionality, aesthetics); and 4) Reports.

Mastery of students' concepts of joint material was measured using cognitive test instruments and student worksheets. Data analysis on students' conceptual mastery and creativity was carried out in the form of study group scores. This is because during the learning process, students study and discuss in small groups, so that the learning achievement that students achieve is an accumulative process of group activities. The instruments used are written instruments (Quizziz) and observation sheets when face-to-face activities are limited.

Technical analysis of the data in this study as follows:

- quantitative in the form of mastery of student concepts regarding joint material which can be seen from the online written test scores through the quizzis application.
- Qualitative, qualitative data analysis can be obtained from the assessment of joint project designs that are in accordance with the concepts that can be seen in the LKPD carried out by each study group.

Results and Discussion

Biology subject in class XI IPS 1 is a specialization subject that is taken by all students. The implementation of biology learning is carried out based on lesson study. The stages of activities carried out by the teacher team include the Plan Stage, Do Stage, and See Stage.

A. Plan Stage

In this activity, the teacher team analyzed the problems that occurred in class XI IPS 1, developed learning strategies, and learning tools. The problems faced in this class include students having difficulty understanding biology concepts, low motivation to learn biology, and lack of good cooperation between students. The learning strategy developed to overcome these problems is by selecting the STEM learning approach and the Project Based Learning model. To support the implementation of these activities, student worksheets are prepared for learning activities as much as 2 meetings and cognitive learning outcomes instruments that will be used at the end of the lesson. Observation sheets were also developed to record student learning activities and student creativity in carrying out projects.

B. Do Stage

The implementation of learning activities in class XI IPS 1 was carried out in 2 meetings in Limited Face-to-face Learning (PTM-T) involving 14 students. The first meeting, learning activities focused on the scientific process where students studied the concept of joints in the movement system through observation and group discussions. At this meeting, data on students' conceptual mastery were also obtained from formative tests at the end of learning and student worksheets. The results of the assessment on aspects of student concept mastery on the joint material are presented in Table 2 below.

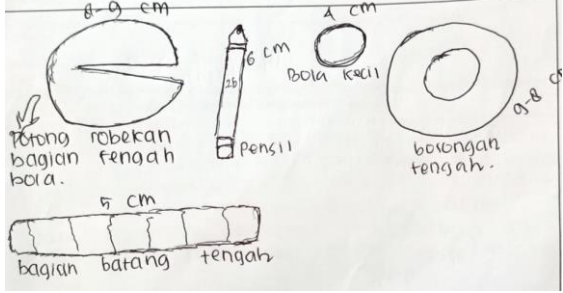

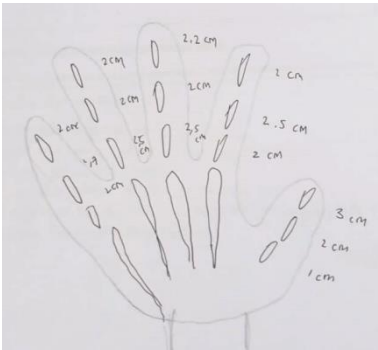

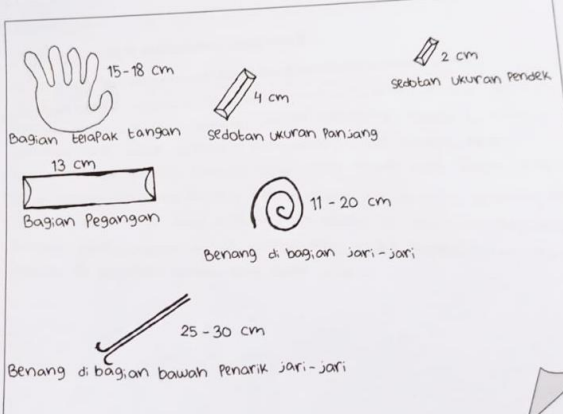

Table 2. Student Concept Mastery Data

No.	Criteria	Amount
1.	The number of students	14
2.	Minimum value	55
3.	Maximum value	80
4.	Average	70

Based on the data in Table 2, the students' conceptual mastery data obtained a maximum score of 80 and a minimum score of 55 with an average score of 70. Based on the school's internal KKM for biology lessons with a KKM > 65, it shows that many students have completed. This is due to the activeness of the teacher and students, the teacher at the beginning of the lesson provides a stimulus by showing a video first such as a gymnastics video. Through the video, students should be able to identify each movement that is demonstrated and analyze the types of joints associated with each movement. Next, students carry out group discussions to analyze the movement mechanism of each individual and the location of the joints in the human movement system. This activity helps students understand joint material, as stated by Purwanti (2021) that audio-visual learning has advantages including: 1) it can attract the attention of students, 2) With a video tape recorder a large number of students can obtain information from experts. , 3) In teaching the teacher can focus attention and presentation, 4) save time and the recording can be played over and over again, 5) the loudness of the sound can be adjusted and adjusted if it will be inserted with comments, 6) the teacher can adjust the movement of the picture/video.

The second meeting focuses on the engineering process where students determine joint projects to be carried out with group members. Students determine the tools, materials, design of the joint model, how the joint model works, as well as the project implementation time. The joint designs and models made by students are presented in Table 3 below.

Tabel 3. Joint Design and Model

No.	Group Name	Joint Design	Joint Model
1.	Group 1		
2.	Group 2		
3.	Group 3		

Based on Table 3, the design and model table shows that class XI IPS 1 students can make their creative ideas in making joint models and are more active compared to face-to-face learning even though biology is a cross-interest biology subject for them. This can be seen by students being more initiative in imagining to create models, daring to express opinions, daring to appear, enthusiastic about expressing ideas,

not afraid of making mistakes. Creative students have the following characteristics : 1. Have a strong imagination. 2. Have initiative , 3 have broad interests, 4. Free in thinking (not rigid or inhibited, 5 Curious, always wanting to get new experiences, 6. Confident. Enthusiastic, 7. Dare to take risks (not afraid to make mistakes, 8. Dare to express opinions and beliefs (Asri, 2016). These characteristics can be raised in learning by using STEM Project based learning .

Student creativity data per group that was captured through the project assessment observation sheet is presented in Figure 1 below.

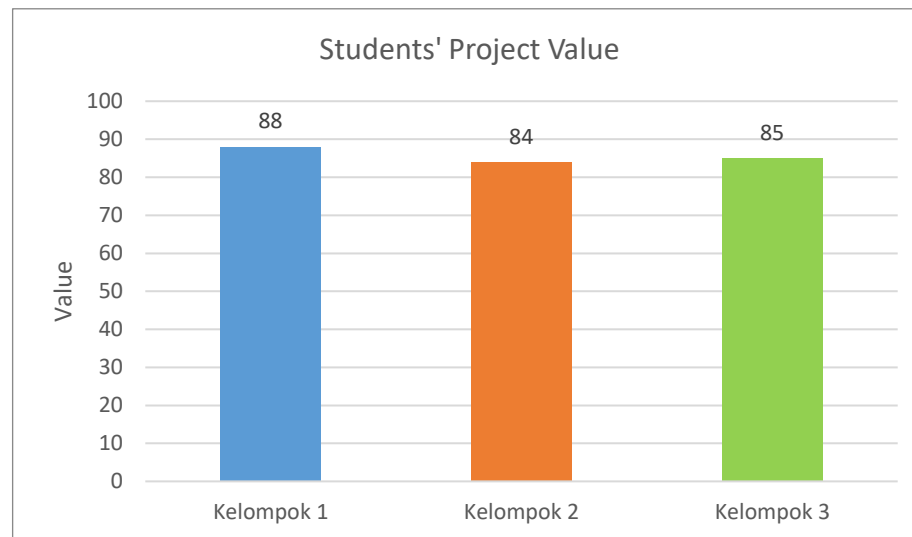


Figure 1. The Value of Student Creativity on Joint Projects

Based on the data presented in Figure 1, the value of students' creativity in each group is different, this is group 1 is 88, the value of group 2 is 84 and the value of group 3 is 85. This is because of the child's ability to imagine and the level of self-confidence and courage and initiative in express different opinions. This has something to do with visual, auditory, and kinesthetic learning styles that can help improve children's creativity. Luthfiyah (2011) shows that basically it is known that students learn according to their learning styles, and each learning style affects the thinking process and in the learning process, the success of learning in solving a problem that can be achieved by students does not only depend on the learning process, but also depends on from the student factor itself. The data above shows that learning using STEM-

PjBL can be useful for students in creativity and understanding of student concepts because students are invited to explore through a project activity, so that students are actively involved in the process which makes students grow their creativity (Capraro & Slough, 2013).

C. See Stage

At this stage, reflection activities related to student learning activities were carried out involving model teachers and observers. The results of the reflection activity showed that the enthusiasm and learning motivation of class XI IPS 1 students increased during the learning activities. Student cooperation is also established during discussion activities. Some students still have difficulty in understanding the concept of joints. This is because the student is still passive and does not have the courage to ask his group friends or ask the teacher about the concepts being studied. In line with research conducted by Astuti et al., (2019) and Ejiwale (2019) that STEM has little effect on students' mastery of concepts because it may be caused by obstacles to implementing the STEM approach, and although the results of the National Assessment of Educational Progress (The latest NAEP) shows improvements in students' math and science knowledge in the US, but some students still fail to achieve an adequate level of proficiency. However, most of this research shows that the learning process with the STEM approach and Project based learning models has stimulated students to be able to design projects through design planning to the working mechanism of the model prepared by students.

Conclusion

Based on the results of the analysis and discussion that has been carried out, it can be concluded that STEM learning with a project based learning model can increase students' mastery of concepts and can hone students' creativity. In limited face-to-face learning in the new normal era, students face a process of adaptation to learning at school so that the role of the teacher in guiding students during the STEM learning process with a project based learning model is crucial. The form of biology learning that applies the principle of lesson study is also able to increase the cooperation of teachers in the field of study in schools to be able to design creative, innovative, and solution learning activities to students' problems that occur in the classroom.

Acknowledgment

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