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The Implementation of TPACK Learning in Human Movement Systems Materials to Improve Students' Critical Thinking

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ABSTRACT

Natural Sciences is the study of natural phenomena. In science learning, students are expected to have scientific knowledge, high-level thinking, critical and creative thinking, so that they become independent learners. The purpose of this study was to describe students' critical thinking skills through environmental-based TPACK learning on the human motion system material. This research method is done by lesson study with 3 learning cycles. The results showed that TPACK learning can improve students' critical thinking, especially in identifying, linking, analyzing and concluding in this study the application of TPACK learning to improve thinking skills in categories can be very good.

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1. INTRODUCTION

Critical thinking is one component of supporting competence. Critical thinking skills were important to be taught and developed as a fundamental process that allows students to solve an existing problem. Efforts to improve critical thinking skills are important because in biology problem solving is needed in learning. The role of the teacher is needed to encourage students in the learning process so that students become more active and able to increase their level of critical thinking (Setiawati et al., 2017). Along with the times and advances in technology, teachers are required to have knowledge and understanding of technology. This technology was considered to be able to assist teachers in developing learning media and connecting in learning to improve students' critical thinking skills (Wijaya et al., 2016).

Based on the analysis of daily tests of science subjects for class VIII SMPN 1 Tuban, in the early semester of the 2020-2021 school year it is known that students' ability to take tests in the high-level cognitive domain is still low, 90% of students can solve questions in the easy category, but more than 50% of students have not been able to reason well on questions in the form of analysis. This showed that further efforts were needed to improve students' critical thinking skills. improvement of critical thinking skills

can be applied through the integration of technology. Technology was needed in distance learning because during the covid 19 pandemic. This was expected even though in the Covid-19 pandemic situation learning continues and students' critical thinking skills that also honed.

The integration of technology in classroom learning has the potential to support the teaching and learning process. Many studies showed that technology had the capacity to improved students' understanding and critical thinking skills, increase students' motivation to learn and develop students' 21st century skills (Cheng & Xie, 2018). The used of technology in learning has a positive effect on the continuity of learning. The integration of technology in learning has a positive influence on the results and learning processes inside and outside the classroom, can lead to enrichment, acceleration, individualization, expansion, productivity and effectiveness of learning so that the quality of education can increase, stimulate students to increase their skills and potential. owned and demands the independence and creativity of students so that they can develop their potential (Chai et al., 2019). However, the ability to use technology alone was not enough. Therefore, in learning the teacher must also have the ability to master content, material and pedagogy. TPACK was known as a theoretical framework to understand teacher knowledge in using technology in the learning process effectively. Knowledge of pedagogy, technology and content knowledge are basic competencies that must be mastered by teachers in the 21st century (Santos & Castro, 2021). So that teachers need to master Technological Pedagogical Content Knowledge or commonly referred to as TPACK in learning.

The concept of Technology, Knowledge, Pedagogical Content (TPACK) to address the relationship between content, pedagogy and technology. TPACK is a conceptual framework that describes the knowledge domains that are essential for effective technology integration. The underlying assumption of TPACK is that effective teaching with technology requires a "nuanced understanding" of the complex relationship between technology, content, and education. A careful consideration of the interactions between these three components of knowledge is important to develop appropriate concept representations through technology to facilitate student learning. With an emphasis on the interactions between different knowledge domains, the TPACK framework not only highlights the importance of the components of knowledge: pedagogical, content, and technological logical knowledge (PK, CK, and TK) but also the integrative components of knowledge: pedagogical content knowledge (PCK), technological content knowledge (TCK), technological pedagogical knowledge (TPK), and technological pedagogical content knowledge (TPCK) in technology-enhanced instruction. The process of learning education is of the essence so that the reader is required to improve the character of the class, one of the learning process that can be employed as alternative answers to this problem is the process of inquiry based learning because can improve the process of critical thinking and self discovery concepts that can improve student comprehension (Nurtjahyani, et al, 2013).

. According to the results of Cam & Erdamar Koç's research, (2021) revealed that the application of TPACK in teacher learning showed a positive attitude towards lessons carried out in accordance with TPACK. The practice of TPACK attracts the attention of teachers and teachers actively participate in learning used TPACK learning. This showed that the application of TPACK in learning has two contributions to both students and teachers. In addition, science learning has a great opportunity to improve learning outcomes because science learning was learned that contains the concept of facts and biological products. The purpose of this study was to describe students' critical thinking skills through environmental-based Tecknological Pedagogical Content Knowledge (TPACK) learning strategies on the human movement system material.

2. METHODS

This research is a qualitative descriptive study that was carried out for 2 months, from August to September 2021 with lesson study as much as 3 learning cycles, which was carried out by providing material on the human movement system online and face-to-face meetings were limited to the 3rd learning cycle, then gave assignments. practicum by taking advantage of the environment around the house, the results of the practicum are photographed and then presented. The subjects of the study were

students of class VIII SMPN 1 Tuban T.A 2020/2021 a total of 32 people. The research data were analyzed descriptively qualitatively.

The first step in this research is to make an action plan for 3 learning cycles whose stages include Planning, Implementation, Observation and Reflection. Then make an instrument for critical thinking skills, then make a questionnaire sheet via google form that was in accordance with the indicators of critical thinking ability, then the results of the questionnaire were analyzed to determine the critical thinking ability of class VIII B students on the human movement system material. Indicators of critical thinking ability assessment include:

1. Ability to identify
2. Problem solving ability
3. Analyzing Ability
4. Evaluating Ability
5. Linking Ability

During learning the teacher provides online and offline material for eight (8) face-to-face then on the human motion system material gives independent practicum assignments at home by utilizing environmental media around the house. The results of student assignments was collected in the form of videos for assessment, then a questionnaire to determine students' thinking skills was given in the form of google form then an analysis of critical thinking skills is carried out with a score of 1-4 criteria, a score of 1 category is lacking, a score of 2 is sufficient, a score of 3 good category and score 4 very good category

The first step in this research is the planning stage, namely the preparation of learning scenarios in the form of a Lesson Implementation Plan which emphasizes student learning outcomes in the TPACK strategy. The learning model used was the STAD type cooperative model. The learning steps included formulating goals and motivations, conveying information, organizing students in study groups, guiding groups to work in learning, evaluating and giving awards. Then the second is the Implementation Phase, where in this cycle the lesson plans used as a reference for learning the lesson plans for the first meeting are bones in the human movement system. The learning strategy used environment-based TPACK, because the results in cycle 1 will be used in the next cycle. The teaching and learning activity lasted for 60 minutes and was observed by 3 observers, namely observing the activities of teachers and students in learning, and at the end of the lesson a formative test (quiz) was held. The third stage is the observation of teacher and student activities.

3. FINDINGS AND DISCUSSION

Based on the description of the activities and observations, the teacher has implemented the TPACK strategy in the first stage so that information about deficiencies is obtained. Weaknesses that need to be revised in the next round. Based on the observations of teacher activities shown in Figure 1, it can be stated that the most prominent teacher activity is the activity of observing students, which is 60%. Another activity that stands out is guiding students in study groups, which is 30%. In teaching and learning activities the teacher often observes student activities, ensuring that in this online learning students actually learn and work on the LKPD. Another activity whose frequency needs to be increased in the next round was guiding students in study groups so that students can understand concepts correctly.

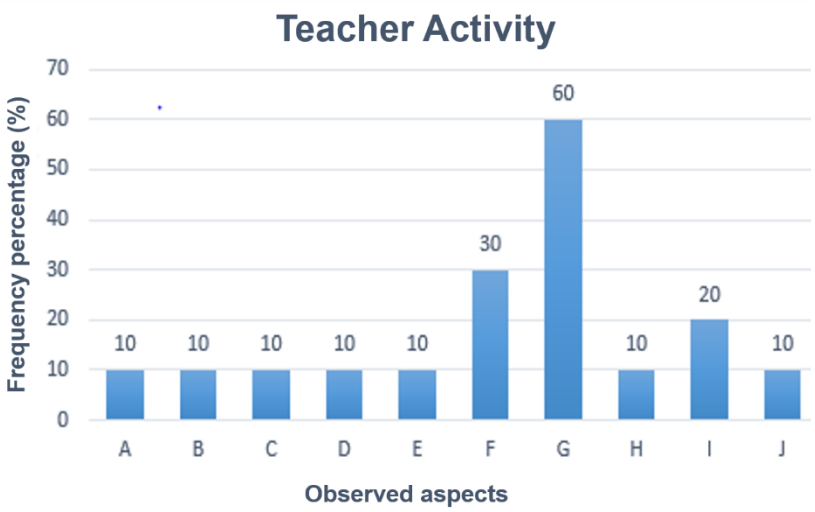

Figure 1. Graph of teacher activity in the first stage of teaching and learning activities (A. Motivating students B. Exploring students' prior knowledge C. Informing the learning objectives D. Divide students into several groups E. Distributing LKPD to students F. Guiding students in study groups G. Observing student activities H. Giving evaluations to check understanding I. Guiding students make conclusions J. Give awards)

Based on Figure 2, it can be stated that the student activity that stands out is the activity of listening to the teacher's explanation, which is 54.4%. Other activities that stand out are discussing with friends and other activities that are not relevant at 8.8%. It was hoped that this irrelevant behavior will reduce in frequency in the next round by improving teaching and learning activities in the next round. Revisions are made after learning activities and after data analysis, the shortcomings that need to be corrected in the second stage are:

1. The teacher must check the students' prior knowledge which was not done in the first stage. At this stage, YouTube media learning only used to motivate students, while the media when the teacher conveys information only uses power point slides. Learning to use the new youtube video media will be carried out in rounds II and III.
2. The teacher should direct students more about what activities they will do, so that it was cleared. In addition, it also needs to be improved in guiding students independently in group work and guiding in concluding the results of the discussion.

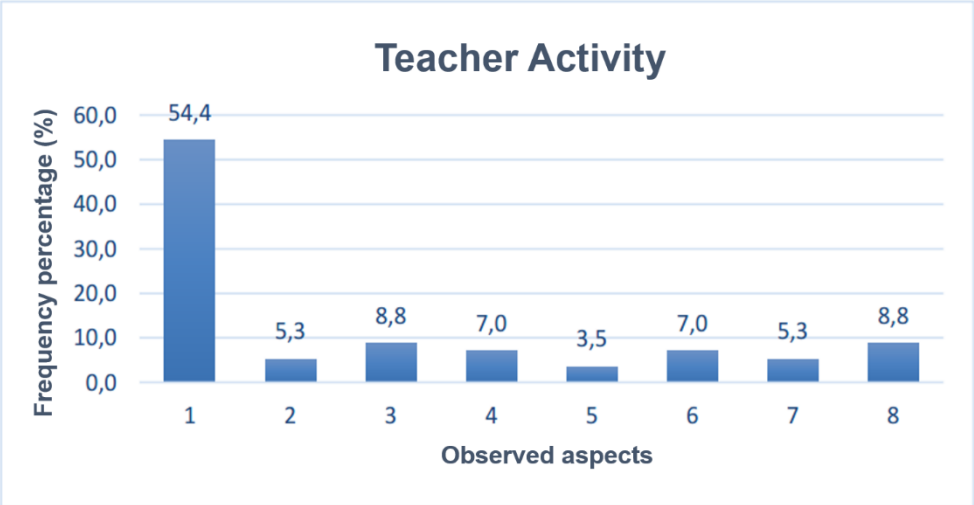

Figure 2. Graph of Student Activities in Teaching and Learning Activities (1. Listen to the teacher's explanation 2. Answering questions/expressing opinions 3. Discuss with friends in groups 4. Answering questions in LKPD 5. Presenting the results of group discussions 6. Ask the teacher 7. Making conclusions 8. Acting irrelevant 9. Critical Thinking Ability)

The results of the data analysis on observing teacher and student activities with environment-based TPACK learning strategies on the human movement system material showed student creativity and innovation because students were given the freedom to do practical assignments at home by utilizing environmental media around the house according to the wishes and abilities of students so that students were more freedom to develop their thinking skills. This stimulates students' critical thinking skills. Students can be learned to identify problems, relate, look for symptoms that cause events, solve problems and evaluate. TPACK learning can facilitate students to learn actively so as to improve students' thinking skills. The development of critical thinking and creative thinking skills can be assisted through the application of appropriate and meaningful learning (Andrini, 2016; Siburian et al., 2019).

Learning the Human Movement System with an environment-based TPACK strategy can be improved higher-order thinking skills and learning from local materials that improved responses and critical thinking skills (Harahap, 2016; (Irawan & Febriyanti, 2016; Wijaya et al., 2016). This was in line with the results of research by researchers that learning the human movement system with an environment-based TPACK learning strategy can be improve critical thinking skills, especially in identifying, evaluating and relating problems.

TPACK-based learning showed the value of effectiveness for improving students' critical thinking skills during online learning, this was in accordance with research conducted by Mairisiska et al (2014) on the development of TPACK-based learning tools on the colligative nature of solutions to improved students' critical thinking skills which shows that TPACK-based learning tools can be optimized learning and improved students' critical thinking skills.

The application of critical thinking skills in the science learning process had been prepared with strategies and methods following the online learning process, with the hope of meeting the 2013 curriculum achievement target which states that there was an increasing and balancing between students' skills and knowledge which includes cognitive, affective, and psychomotor. Thus, TPACK-based science learning can be used as input for teachers to improve students' critical thinking skills. Technologies that can be used to support online learning include video conferencing applications for face-to-face learning so that students can learn optimally even if only online because students are more interested and enthusiastic about using video conferencing applications than only using whatsapp and google classroom (Wardan and Jatmiko, 2021).)

Breakthrough and novelty thinking is a challenge that must be answered in the 21st century. This challenge must be addressed by the world of education to prepare quality human resources who are literate with technological developments. The integration of information, communication, and technology in learning was known as Technological Pedagogical Content Knowledge (TPACK). The discussion described in the article covers the seven domains of knowledge in TPACK and their relation to science learning. The application of TPACK in science learning was believed to be a role model for learning oriented to changes and demands of the 21st century in responding to the era of knowledge. The organization of the material will be contextual. Teachers can develop actual material (Mutiani et al., 2021). This study proposes a new conceptualization of technological pedagogical content knowledge (TPACK) that focuses exclusively on the intersection of technology, pedagogy, and content specific to selected dimensions of 21st century learning (Schmid et al., 2021). Therefore, to maximize student learning by providing a quality online learning experience, good mastery of TPACK was required. Technology can only be a useful tool in primary school learning if it increases learning opportunities and the actualization of learning significantly. Therefore, it becomes more important than when and how technology will be used by teachers and to what extent the teacher training process should be updated continuously in mastering TPACK competencies and provided regularly in school applications (Makawawa et al., 2021).

4. CONCLUSION

Based on the results of the discussion and data analysis, it can be concluded that the environment-based TPACK learning strategy can improve students' critical thinking skills, especially in identifying, linking, analyzing, and evaluating with very good categories. Future research is recommended on students' critical thinking skills and higher order thinking skills.

Conflicts of Interest: The application of TPACK-based learning in science learning required the ability of teachers to elaborate teaching materials following the needs of the times and technological developments. Therefore, broad science learning materials need to be developed on other science materials to be applied in TPACK-based learning, such as the immune system, circulatory system and respiratory system.

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