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The STEAM Model as an Approach to Developing Students' Collaborative Skills

Amanda Syahri Nasution[1*], Juli Yanti Harahap[2], Lisa Septia Dewi Br Ginting[3]
[1,2,3]Universitas Muslim Nusantara Al-Washliyah

***Correspondence:** amandasyahri@umnaw.ac.id

Abstract: Collaboration is an important skill that students need. This study aims to analyse the STEAM (Science, Technology, Engineering, Arts and Mathematics) learning model as an approach to develop students' collaborative skills. This qualitative research with a case study design involved 20 undergraduate students who attended STEAM-based lectures. Data were collected through observation, interview, and document study. The results showed that the STEAM model can improve student collaboration through interdisciplinary projects that demand teamwork, active communication, and complementary expertise. The effectiveness of collaboration is influenced by individual characteristics such as openness and communication skills. This study concludes that STEAM is an appropriate learning model to develop students' collaborative skills. Recommendations for collaborative methods that suit individual characteristics need to be considered for optimal results.

Keywords: STEAM Learning Model, Collaborative Skills, Student Characteristics

A. Introduction

Collaboration has become an essential skill needed in the 21st century. The ability to work together effectively is essential to solving complex problems in various fields of science and profession (Partnership for 21st Century Learning, 2015). Therefore, the development of collaborative skills needs to be a major concern in higher education so that students are ready to enter the workforce.

The STEAM (Science, Technology, Engineering, Arts, and Mathematics) learning model has become a popular approach to integrating disciplines and developing 21st-century skills such as critical thinking, creativity, and collaboration. STEAM encourages active learning and collaborative projects across disciplines. Several studies have shown that STEAM has the potential to enhance student collaboration. However, there has been little research specifically related to the implementation of STEAM for the development of collaborative skills in higher education.

Lack of collaborative skills of students is a problem that is often complained about by lecturers and industry. This is because the learning system in higher education is still dominated by conventional models that do not encourage student interaction and teamwork. While on the other hand, college graduates are required to have collaborative skills in order to succeed in the work environment. An innovative learning model is needed to answer this challenge. Research on the implementation and effectiveness of the STEAM model in developing students' collaborative skills needs to be conducted in order to provide solution recommendations.

Answering these problems, a form of appropriate and efficient lecture model is needed to overcome them, namely by combining conventional lectures (face to face) with online lectures or what is known as Blended learning. Dwiyogo (2016) defines blended learning as referring to learning that combines or mixes face to face learning and computer-based learning (online and offline). This definition means that Blended Learning describes an opportunity that integrates innovation and technological advantages in online learning with interaction and participation from the advantages of face to face learning. Hasamah, who quoted Semler, stated that blended learning is a learning facility

that combines various delivery methods, teaching models, and learning styles, introducing various choices of dialogue media between facilitators and people who receive instruction (1). Blended learning does not mean replacing conventional learning models in the classroom, but strengthening the learning model through content enrichment and development of educational technology (2). The syntax of Blended learning is as follows:

1) Seeking of Information, searching for information from various sources of information available in ICT (online), books, or delivery through face to face in class.
2) Acquisition of Information, interpreting and elaborating information personally and communally. 3) synthesizing of knowledge, reconstructing knowledge through the process of assimilation and accommodation based on the results of analysis, discussion and formulation of conclusions from the information obtained (3).

Several studies have shown an increase in the use of Blended Learning for various student ability outcomes (4) has proven in her research at IKIP Mataram that learning using blended learning can improve student learning outcomes including improvements in the affective domain. (5) proved that blended learning-based lectures have an impact on lecture follow-up plans if the lectures use the right evaluation strategy. The use of Blended learning is able to meet the demands of the Industrial Revolution 4.0 where lectures can be carried out throughout life, this makes lecture time not only limited to the weight of the SKS in the course and this learning is the use of appropriate technological developments and the internet of things so that students can explore their knowledge in total. In this lecture, the Telegram application media is used. This application was chosen because it has advantages over other applications, namely 1) easy to operate, 2) can be opened via smartphone or computer, 3) data storage is done in two places, namely smartphone/computer memory and in the telegram itself. So if the smartphone or computer memory is deleted, data in the form of images, files or documents can be downloaded again.

Guided inquiry as the basis of the Blended learning process, this is used to provide stimulus to the main problem for students to discuss and provide direction and guidelines for correction by the Lecturer. Piaget stated that the inquiry model is a model that prepares in a situation to conduct their own experiments widely in order to see what happens, want to find their own answers and connect one discovery with another, then compare what is found with what is found by other students (6). The main characteristics of guided inquiry are as follows: 1) students learn starting from making specific observations that can direct them to make inferences or make generalizations; 2) learning activities aim to facilitate students in learning or strengthening the process of testing an event or object and then finding the right generalization from observations; 3) lecturers control the specificity of learning in the form of events, data, materials, objects and act as leaders in the class; 4) each student is directed to try to build meaningful patterns based on the results of their own observations and the findings of their friends in the class; 5) the class must be conditioned to function as a learning laboratory; 6) Lecturers must try to encourage students to practice communicating the generalizations that have been developed through presentation activities and other students can benefit (7).

The development of the 21st century learning framework requires students to have skills, knowledge and abilities in the fields of technology, media and information, learning and innovation skills and life and career skills. The explanation of the 21st century learning framework includes the following: Communication and Collaboration Skills, able to communicate and collaborate effectively with various parties. Information and Communications Technology Literacy, able to utilize information and communication technology to improve daily performance and activities, and able to understand and use various communication media to convey various ideas and carry out collaborative activities and interactions with various parties (8). Communication Skill consists of two types, namely Written and Oral. The indicators of written communication skills are: explaining the meaning of reading, finding the main idea of reading, distinguishing and analyzing media messages, explaining a problem reasonably and adequately, conveying ideas/concepts through writing, interpreting the meaning of symbols, creating and reading tables, creating and reading graphs, creating and reading numbers. Meanwhile, for oral communication skills, the indicators are: conveying ideas verbally, restating the results of the discussion, identifying the mood of the interlocutor, influencing the interlocutor positively, giving a presentation according to the plan to the

audience (9). The indicators of collaboration skills are as follows: using agreements, appreciating contributions, taking turns and sharing tasks, feeling in a group, feeling in a task, encouraging participation, inviting others to speak, completing tasks on time, respecting individual differences, showing appreciation and sympathy, expressing disagreement in an acceptable way, listening actively, asking questions, summarizing, interpreting, organizing and organizing, accepting responsibility, reducing tension (9).

The study used a combination of quantitative and qualitative methods. The quantitative method was carried out by taking measurements using a Likert Scale questionnaire with 4 (Four) Standards and the respondents were students, then converted into numerical data to be tabulated. The qualitative method used observation sheets and questionnaires which aimed to obtain information on the implementation of the treatment by the Lecturer and efforts to obtain information on improving the implementation of the model, as well as students as research objects and parties who felt the impact. Direct observation to obtain data on the development of Student Written Communication Skills. and instruments that have been validated by three expert validators and adjusted to the information needed according to the stages of the research flow.

B. Result and Discussion

This research was conducted in two research cycles. This research was conducted at the Al-Qur'an Science University in the Elementary Madrasah Teacher Education study program, semester IV in 2020. At the planning stage, the description of the mechanism for implementing blended learning based on guided inquiry to improve communication skills and collaboration skills is as follows: 1) Compiling the RPS for the information technology media course with a blended learning model based on Guided Inquiry and adding a WhatsApp group as its media. 2) The researcher created a WhatsApp group consisting of students taking the information technology media course and created small group groups in it to facilitate supervision and control. 3) At the first meeting, the researcher explained what we would learn in the next semester, what kind of products would be produced as a result of the lecture, dividing the class into several groups along with the tasks that had to be done, and how the WhatsApp group functioned during the lecture process, including in this process is discussing lecture problems. This activity was carried out before the Covid pandemic health protocol was implemented, but during the implementation of the health protocol, an additional application was needed, namely Google Classroom, as a substitute for virtual face-to-face activities due to the Covid pandemic which required the use of health protocols. 5) Students are asked to prepare lecture materials or references according to the previously obtained theme and discuss them in a WhatsApp group and present them using Google Classroom. 6) Each student who takes the initiative to discuss what has been done is given a separate point. And researchers see the development of communication and cooperation skills of each student. 7) Researchers evaluate the development of communication and cooperation skills of each student through WhatsApp groups and Google Classrooms at all times. And find solutions to solve these problems. 8) Reflect on the process that has been carried out for two cycles and make decisions about what changes are needed in the use of WhatsApp groups.

This mechanism is the result of the final refinement after consultation with colleagues and experts, where the most important thing in this learning mechanism is that students are well handled and well served, meaningful and can be applied to their lives. And students after taking lectures have formed skills and characters. However, to adjust to the Covid-19 health protocol, it is hoped that students will also be able to adjust quickly. It is hoped that by utilizing the development of lecture technology in this pandemic situation, it is not an obstacle, but becomes familiar and not technologically illiterate, students become proficient in operating it, especially in accordance with the objectives of this course. The form of SAP and RPS contains material that will be discussed and studied for the next semester, the meeting schedule and what main references are used, learning objectives, indicators to be achieved, characters to be brought up or improved, learning methods and strategies, and forms and methods of assessment to be carried out. In addition, before being used, SAP and RPS are consulted and approved by the Head of Study Program.

The second stage is implementation, based on the questionnaire given to the lecturers in charge of the course, information was obtained that the lecturers in charge of implementing their learning were in accordance with the objectives to be achieved in the RPS and SAP, both the

sequence of activities, and the schedule and the material presented, and had provided motivation to students, but according to the observer's view, the lecturers were lacking in receiving student responses, the lecturers still felt awkward in providing reinforcement and responding to behavior and conditioning students, the lecturers tended to ignore and lacked guidance and monitoring of student groups and during discussions via the Google Classroom. This is because lecturers also need to adjust to new learning mechanisms. In addition, the lecturers did not ensure the students' stability in the information technology products they would make, the lecturers also did not ensure that students could present their benefits and advantages. So that in presenting students are still confused about their products and what things should be presented about their products. In the first face-to-face meeting between students and lecturers, the Covid-19 pandemic health protocol had not yet been implemented. Lecturers and students were then required to be able to adapt to the habit of virtual face-to-face learning using the Google Classroom and Zoom applications.

The obstacles experienced by the lecturers in implementing blended learning in the first cycle were that lecturers and students were still not familiar with implementing learning, especially since face-to-face learning had to be assisted by the Google Classroom application due to the pandemic situation, students and lecturers were less active and responsive, students were less enthusiastic in providing responses during discussions, both in WhatsApp groups and when other groups presented on the Google Classroom application, students tended to just listen. Lecturers also lacked supervision and control, so they had difficulty controlling the class. The internet network was not good enough so that using the Google Classroom application as a substitute for face-to-face meetings did not go well, especially for students who were far from the city center or provider transmitter tower. In searching for references, students tended to just take and copy, in discussions students still conveyed their arguments jokingly, and with language that was still convoluted. The discussion on the focus of the material was lacking, and there was less respect for the group that was presenting. This resulted in improvements for learning in the second cycle.

C. Conclusion

The STEAM learning model has been proven to be effective in improving students' collaborative skills through the implementation of cross-disciplinary projects that require intensive teamwork. STEAM encourages positive collaboration through the integration of perspectives, complementarity of expertise, and active interaction between students with diverse academic backgrounds. The effectiveness of STEAM in improving collaboration is influenced by a number of factors such as challenging project design, good group management, individual student characteristics, and the facilitative role of lecturers. The STEAM model is an appropriate approach to use in higher education in order to develop students' collaborative skills. Its implementation needs to be continuously refined based on the principles of effective learning and student characteristics.

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