STEM-BASED SOCIAL INTERACTION MODEL IN BUILDING COMMUNICATION RESIDENTS OF SOCIAL INSTITUTIONS ON BOGOR REGION

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Abstract

Social interaction based on science, technology, engineering, and mathematics (STEM) is one of the steps in building communication for each individual in facing the 4.0 era. Every student is required to have various skills, especially in the fields of science, technology, engineering, and mathematics. The objective of this study is to find out how the influence of STEM-based social interaction models in building communication for residents of the Azka Azkiya orphanage in the Bogor Region. The method in the study used a quasi-experimental *pretest-posttest with nonequivalent groups* and corroborated by the results of the interview. The respondents involved in the experiment were 24 students and in-depth interviews with two junior high school students. The result, based on the results of data analysis using independent t-test samples, found a value of t = -5.98; p < 0.05, meaning that there is an influence of STEM-based interaction models in improving students' communication skills. When the results of the thematic analysis were found, four themes showed good interaction with stem approaches, namely (1) interaction between students, (2) interaction between students-teachers, (3) interaction between student-content, and (4) interaction between student-environment. In conclusion, STEM-based learning processes can build student interaction and communication in their lives properly. In addition, it encourages students and teachers to be literate in science, technology, and engineering literacy in the face of the times. This research implies that STEM education needs to be included and made by education practitioners, namely teachers, and especially by the ministry of education into the curriculum in force in Indonesia. Future studies are necessary to conduct more samples from various regions in Indonesia to see the importance of STEM-based education is important to implement.

Keywords: *STEM, Interaction, Communication, Environment, Content*

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INTRODUCTION

The COVID-19 pandemic has forced the majority of countries to adapt to new habits in carrying out social interactions, including Indonesia. This rapid and sudden change has caused various polemics in the community, especially the community of people who live in social care institutions throughout Indonesia. Throughout the pandemic, all students have been carrying out learning activities at home for a long time. Limited social interaction between schools, children, and social caregivers resulted in constraints on personal communication. Limited communication skills are often an obstacle for social care institutions in providing solutions to the skills and life skills of nursing home residents in the future. This situation causes some nursing home residents to feel bored, and even groups of students who lack digital facilities tend to be anxious about a large number of school learning lags. Various factors that trigger student anxiety are (1) the cost of buying an internet package for students who have economic limitations, (2) an unstable internet connection, especially for students who live in the interior, (3) difficulty understanding the material, (4) difficulty doing tasks, (5) concerns about subsequent tasks, and (5) technical obstacles faced (Oktawirawan, 2020).

Since the pandemic broke out, another problem is that many children have been forced to lose their parents. Even some of them have to be residents of social care homes because of the family's economic limitations. The Johns Hopkins University Coronavirus center recorded, as many as 3.3 million covid cases in Indonesia, and there were 89 thousand deaths. 15% of them are aged 19-45 years (BBC News Indonesia, 2020). At this productive age is estimated that as many as 11 thousand children lost their parents. By law, the State under the Ministry of Social Affairs is the most responsible for addressing this problem. If this big family of children who has lost their parents can't afford to take care of it. Of course, orphaned houses are their choice of residence. The mental state of children who experience pressure after losing their parents certainly affects their interaction ability. Psychologically troubled children tend to have difficulty undergoing social interaction in society. It takes time for adaptation and patience of surrogate parents so that the child can continue to live his life normally.

For people who want change for the better, of course, it is important to build healthy social interactions. After a prolonged pandemic, the community, especially residents of social care institutions, certainly has the right to rise and adapt to various social changes that occur. With the presence of ICT, it is hoped that it can provide convenience for residents of social institutions to increase their capacity. Currently, most companions in social care institutions carry out the role of mentors for children's character. The companion does not yet have any specific skills academically or life skills. Their pedagogical ability to assist school learning is still very weak, especially in learning that uses *digital platforms*. The interaction of companions with children in social care institutions greatly affects their self-development motivation.

The roots of social interaction begin with the ability to communicate when interacting in their social environment. In addition, most social care homes do not have effective learning media that make it easier for nursing home residents to increase their capacity. Research related to the importance of developing communication skills in building healthy social interactions has been carried out by Mata et al. (2018) explaining that communication is the main foundation of all human interactions in society, with various approaches, communicators need to ensure the creation of interactive communication so that messages can be accepted by the audience. It can be described that a teacher plays a role in creating comfort throughout learning. Successful communication between teachers and students will have an impact on academic achievement. In the success of communication, it becomes a benchmark in the creation of harmonization in the social life of the community. effective pedagogical abilities are born from interactive communication. Interactive communication between teachers and students throughout the face-to-face class will create a harmonious atmosphere throughout the learning activities.

Interactive communication is an effort to convey messages so that they are easily understood by others that the form of this success is in the form of communicative actions such as direct reactions when the message is delivered. The success of the other party in interpreting the message conveyed can also be seen through certain symbols such as when a person calls a response by switching his face to the source of the sound. Emotional reactions and cognitive processes become signs of interactive occurrence in the communication carried out. In this way, communication can be understood as the process of organizing a social system. Self-awareness is created through communication, by participating in the lives of others, so the ability of the individual to understand the roles

and perspectives of others is important to develop collaboration and interaction in social systems. If people do not understand the perspectives of others, then they also do not understand how they think and act as they do (Bonaduce et al., 2021).

In the Bogor region, there is currently no legal umbrella that is the standard for the development and empowerment of citizens with social welfare problems. Children in social care institutions generally have very weak thematic abilities, especially basic thematic abilities. Another major obstacle experienced by residents of social care institutions is the ability to communicate well so it has an impact on their social interaction ability. Based on the above problems, it is important to prepare effective learning in overcoming barriers to the social interaction of social caregivers. Thus, redesigning digital learning practices with systemized guidelines that can be accessed digitally is a very urgent need for social care institution assistants to be able to provide more targeted teaching materials. Therefore, it is necessary to carry out a study to overcome these problems by the formulation of the problem, namely how the STEM-based social interaction model influences building communication for residents of social care institutions in the Bogor Region.

METHODS

The design used in this study is *research and development* (R&D). Development of modules based on Science, Technology, Engineering, and Mathematics - Communication (STEM-K) using model *analysis, design, development, implementation, and evaluation* (ADDIE) (Dick, Carey & Carey, 2015). But in this paper, the author only explores the implementation of the ADDIE model. Therefore, this paper only focuses on answering how the influence of STEM-based social interaction models in building communication for residents of social care institutions in the Bogor Region. To see if there is an influence of STEM-based social interaction models, the study used quasi-experimental *pretest-posttest with nonequivalent groups* and corroborated with interview results. The research procedure is found in Figure 2.

Quantitative Phase

The instruments to measure the influence of STEM-based social interaction models in building communication for residents of the Azka Azkiya orphanage in the Bogor Region are 16 items. The indicators used to consist of (1) science-communication, (2) technology-communication, (3) engineering-communication, and (4) mathematics-communication. The questionnaire will be tested for validity by two experts. This questionnaire uses a Likert scale with five categories (Strongly Disagree = 1; Disagree = 2, Agree = 3; Strongly Agree = 4 and No Opinion = 5). The reliability of the question items was analyzed using the Rasch Model program involving 15 students outside the research sample. The result of the reliability of the question item is 0.95 (reliable category) or instruments can be used to conduct this research. The sample involved was as many as 24 junior high school level students who came from residents of the Azka Azkiya Foundation orphanage in Bogor. The collected data were analyzed using inferential statistics, namely t-test analysis. The normality test in this study used Kolmogorov-Smirnov with the values found to be $0.200 > 0.05$ (normal sprinkled data). While the homogeneity test used is Levene's test with the value obtained being $0.867 > 0.05$ (the data variance is homogeneous). *Fishbone* diagrams are researched by Heston (2018) and adapted to research needs such as Figure 1.
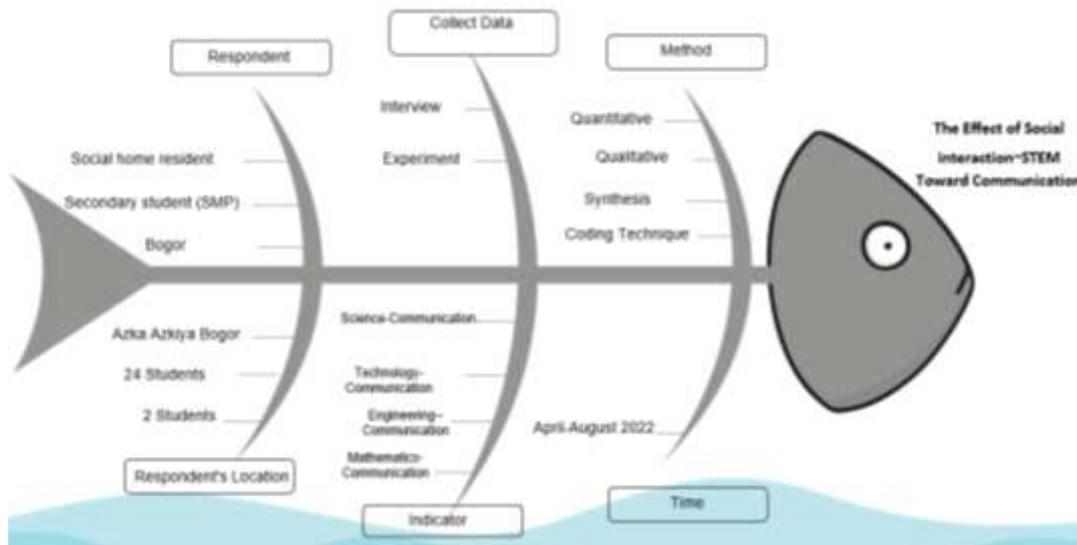
Figure 1. Research procedure

Qualitative Phase

The data collected in this study used interviews with two students from Azka Azkiya social care institutions which are equivalent to secondary schools (SMP). The interview technique is conducted face-to-face. The implementation time is in August 2022 around 30 minutes to 60 minutes for each student.

Coding

The data sourced from informants (study participants) consisted of two students (F and T). The data were analyzed according to the concept of thematic analysis proposed by Braun et al. (2016). This analysis uses six stages as shown in Figure 2.

Thematic Analysis

Familiarization: This step is the process of immersing the author in the results of the interview data in depth so that the author is more familiar with the content to be discussed. Coding: this step is the process of transforming the results of this interview data into a systematic and thorough process. Coding is a key process in thematic analysis. All interview data from the two respondents were themed as a whole. Then the theme obtained is identified in detail again so that it has the potential to answer the formulation of the research problem. Theme development, Improvement, and Naming: the third, fourth, and fifth steps in the thematic analysis process. This process organizes themes and revises themes that are not related to the focus of the problem in the study. This process is carried out to develop answers to the focus problem in a detailed, correct, and quality manner. Writing: the writing process is carried out by carrying out qualitative research. The stages carried out by researchers in the writing process are compiling, developing, editing, and placing appropriate themes to answer the focus of research problems.
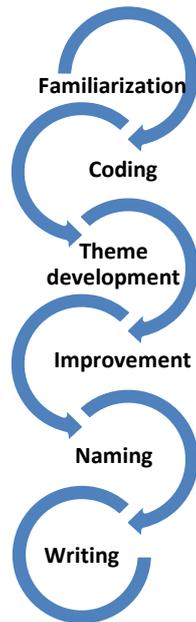
Figure 2. Thematic analysis process

RESULTS AND DISCUSSION

Based on the results of data analysis using independent t-test samples, it was found that the value of t = -5.98; $p < 0.05$. In other words, there is an influence of STEM-based interaction models in improving students' communication skills. In line with the results of previous research, it has been found that STEM-based activities can improve student communication skills and facilitate students to be the ability to interact between students and other students, teachers with students, students with the environment, and content with student needs and can train students to be literate with technology and wise in using it (Abouhashem, 2021; Atanasova & Todorova, 2021; Borowczak, 2015; Carrino & Gerace 2016; Hussein et al., 2020; Nopiyanti et al., 2020; Michalek et al., 2020; Peterson et al., 2018; Ridlo, 2020; Wan Husin et al., 2016; Rosli & Siregar, 2022; Siregar, 2020).

This quantitative result was also corroborated by interview data from two students, namely F and T. Based on the results of the thematic analysis, it was found that a STEM-based interaction model in building communication for the residents of the Azka Azkiya orphanage in the Bogor Region in Figure 3.
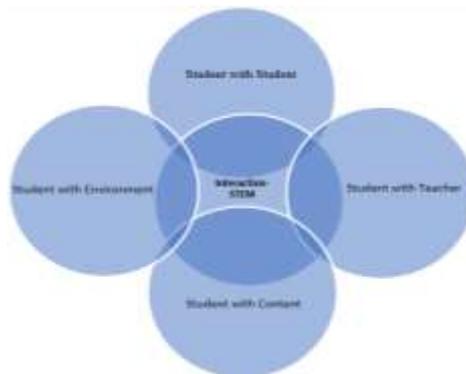
Figure 3. STEM-based interaction model

Student interaction with students

The theme of "students" stem-based social interaction in building communication is well established, in other words, interaction is realized between learners during the learning process. This interaction can be felt by students during group learning. During the learning process, each student can express their respective opinions regarding the topics discussed. Students are not afraid of being wrong in answering problems because all opinions are used as lesson materials to get the right answer to the problem. The most fixed answers will be confirmed by the time of the final session of the learning process. The correct answer is confirmed directly by the teacher (facilitator). This theme is following the upload of the interview results of two students (F and T).

... the most interesting experience is that I am free to express opinions without having to be afraid of my wrong answers. Learning to sneeze science, technology, engineering, and mathematics is very interesting because it is carried out in groups so that each student can complement the other. With this learning process, each student's communication skills are more developed than if we studied without a group. In addition, students are also directly involved (actively) with the learning process [F]

... I feel that during this time my learning process was just practice and did not interact optimally with other students, especially when carrying out the exercises given by the teacher as assignments at home (homework). So, this STEM-based learning process, makes me more active in learning in class. In addition, with this learning process I learned not to be ashamed if the opinions I expressed were not right because each student was free to express their own opinions, I felt that I was not depressed by studying this group *[T]*

Based on previous research, it was found that the STEM learning process can increase the knowledge of students in these four subjects who apply group-based activities, with group learning each student must have good communication, and interaction between students is well established (Husein et al., 2020). In addition, the results of a two-year study conducted by Carrino and Gerace (2016) found that the implementation of learning with STEM can increase student participation in group work (learning communities) and realize good interaction between teachers and students.

Student interaction with the teacher

Interaction with STEM-based can be well established between students and teachers (facilitators), in other words, there is good communication between students and teachers during the learning process. Good interaction can bring a good influence on students, especially on aspects of cognitive experiences that improve. The specific themes found were engagement and types of exercises.

The involvement of teachers in the learning process is very active in guiding students such as asking questions about what students know related to science, technology, engineering, and mathematics. Providing concrete examples that are close to student life such as how to make bottled water bottles that are ready to be marketed (sold). This is in line with the interview results obtained as follows:

... teachers (facilitators) are very active in asking questions about the application of science, technology, engineering, and mathematics in our lives. The first time I followed this learning process, I was confused, because I didn't understand these four sciences in

everyday life. However, thanks to the teacher who is very active in giving questions and real examples, in the next meeting I just understood the importance of these four sciences in human life. Therefore, very interested in learning about stem [T]

During the STEM learning process, I just understood that the water I use daily for bathing (the water in the bathtub) is part of the application of STEM science. The teacher gave us many examples that were close to the needs of our lives [F]

Types of exercises; This sub-theme explains that the implementation of a STEM-based learning process applies a type of exercise that is directly in contact with the student's life. The provision of the types of exercises known to students makes them excited and feel satisfied to do the exercises given by the teacher. This is in line with the results of the interview, namely:

The exercises given by the teacher are very interesting. Interesting in the sense that all the exercises I can encounter easily in my life such as calculating the volume on a mineral water bottle. I have only had my first experience in calculating volume and I immediately came into contact with the object I calculated, namely the volume of water in the package. It is very interesting for me [F]

STEM-based learning is very interesting because the teacher brings up examples and practice questions that can be encountered directly in my daily life [T]

Based on the results of previous research, it has been found that the STEM-based learning process can improve communication skills well and encourage students to be directly involved in completing the exercises given by the teacher (Ridlo, 2020).

Student Interaction with Content

The third theme of the interview results is related to the suitability of the content to the needs of students. The STEM-based learning process encourages students to be able to apply the knowledge they had previously had in solving problems. Each student must also have good technological literacy. This third theme has a sub-theme, namely the application of knowledge and technological literacy.

In the application of knowledge, the learning process aims to educate learners to know and apply their knowledge in STEM fields. The concepts of science and mathematics lessons in theory they have learned from elementary school to college level. However, all theories studied are just knowledge without knowing the application of the theory. The application of STEM knowledge can be useful for learners to enter the world of work as well as their daily lives. This result was found from the interview as follows:

I have learned about science during elementary school and now, but I only understand the theory, as for the application, I don't understand. When I followed this STEM-based learning process, I only understood the purpose and function of the theory that I had learned before. Currently, I just understand how science and mathematics are applied in everyday life [T]

I used to only learn theory, but not with STEM. I feel that the knowledge I had in the past can only be applied now [F]

STEM-based learning can help learners to improve their knowledge and communication skills by being more confident learners at the elementary school level (Nopiyanti et al., 2020). In addition, STEM-based learning processes can present content according to the needs of students to be prepared to face their future. During the learning process, the intensity of interaction and communication between teachers and students is very necessary for realizing good achievements (Abouhashem, 2021).

Technological literacy, STEM learning processes can increase students' interest in being literate in technological developments to help the learning process be easier. This is under the results of the interview, namely:

During the learning process with STEM, interaction with technology was strongly emphasized by the teacher to make it easier for us to understand these four sciences are interrelated [T]

I just realized that studying STEM, added to my enthusiasm to find out how the four disciplines are applied in life. Especially how this technology is important at the present moment. This literacy is very important for the younger generation to continue living in the future [F]

This is in line with Borowczak's research (2015) that the STEM-based learning process requires communication tools that can support learning achievement well, the tool used is technology. Learning with STEM can encourage students to be literate with the wise use of technology. In addition, students are also trained to be proficient in teamwork, especially in solving problems.

Student Interaction with the Environment

STEM learning encourages students to be active and concerned about the surrounding environment. STEM science is very useful for the advancement of a community, especially for rural communities. Each of these disciplines is beneficial for increasing the income yield in society. Applying science, technology, and technology in farming corn plant gardens and taking into account the period of harvest and the results obtained. This can be supported by the following results:

… by learning this STEM, I care more about my environment. I also hope that I can share this knowledge with the farming community, especially in my village later [F]

I realized that while studying STEM, I was required to interact with my environment to add to my understanding of the material I was studying and apply it in my daily life [T]

Among the STEM benefits felt by students is the application of these four disciplines in the student environment. This learning process also trains students to be able to adapt and be sensitive to the environment around the learner, improve complex communication, and cultivate the social skills of the learner (Atanasova & Todorova, 2021; Siregar et al., 2022). In addition, based on the results of research conducted by Peterson et al. (2018) found that the comparison of scores from student interactions with their surrounding environment in the STEM learning process was higher than students who followed the conventional learning process (scored low scores).

CONCLUSIONS

STEM-based interactions can improve student communication in the learning process. In other words, there is an influence of STEM-based interactions on the communication skills of students in Azka Azkiya. This result is also corroborated by qualitative results consisting of themes, namely there is a good influence between students and students, the interaction between students and teachers, student interaction with content that suits their needs, and student interaction with the surrounding environment. Therefore, the learning process with STEM interactions can be applied by educators, academic circles, and the wider community to improve the communication skills of the younger generation.

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