

## STEM Learning: The Way to Construct Undergraduate Students' Oral Communications Skills in Science Learning

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### Abstract

Communication skills are one of the skills that a person must have when entering the world of work. The workforce in a company that lacks mastering 21st century skills will be at a disadvantage to compete globally, and will have difficulty in dealing with challenges that arise along with the with the development of science and technology. So, in higher education such as university, the curriculum, course, and learning should provide the activities that could improve and construct students' communications skills. STEM is one of the learning approaches that could help to construct students' communication skills. Research objective is to investigate how is the development of oral science communications skills of undergraduate students in Environmental learning by using STEM learning approaches. The method of this research is qualitative research by the data taken from observation and teaching learning video recording transcriptions. The transcription is coded by the assessment of science communication rubrics adapted from Baltimore University for oral science communication. The data are taken from students' presentation activities in environmental courses. This research result shows that responsiveness indicators is 88,3%, multimedia supported as technology skills is 83,3%, and conclusions indicators is 50,0%. It could be concluded that STEM learning approaches could be constructed students' oral communications skills. Responsiveness and multimedia support of oral communications skills indicators are outperformed than conclusion as the least performed of oral communications skills.

**Keywords:** STEM Learning; Oral Communications Skills; Science Learning

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## INTRODUCTION

The demands of the 21st century encourage every individual to have specific skills that are better known as 21st Century Skills. These skills consist of several specific skills that will support an individual to be able to face challenges in the 21st century, one of which is communication skills. Communication skills are one of the skills that must be a person must have when entering the world of work (Bybee, 2013). Another study conducted by Andrew & Taylor, (2009) stated that the workforce in a company that lacks mastering 21st century skills will be at a disadvantage to compete globally, and will have difficulty in dealing with challenges that arise along with the with the development of science and technology (Andrew & Taylor, 2009).

Communication in learning itself is formulated Iriantara & Syaripudin (2013) as "the process by which teacher builds an effective and affective effective and affective communication relationship with students so that students have the opportunity to achieve maximum success in the learning process" (Iriantara & Syaripudin, 2013). Communication itself is basic principle of a learning process, when someone has a very high understanding of knowledge they will clear when their express their opinion during discussions (Lubis et al., 2020) but if they cannot communicate what is in his mind or he cannot convey his ideas both orally and in writing, then it will hinder their process in learning and facing the challenges that come with the demands of the 21st century. In addition, in general, communication is one of the human rights.

It is found that generally, from others higher order thinking skills beside critical thinking, creativity, and collaboration, communication is the one of skills that sometimes overlooked and just an ordinary skill. Somehow, this skill is one of the important skills which could face in the workface and figure out the people who could convince others with his or her argument (Kamaruzaman et al., 2020) to invite them to join in saving the earth with their brilliant ideas.

Communication skills should be practiced in the learning process. One learning approach that is considered good is STEM-based learning. This approach relies on a Project Based Learning approach, so students are often required to be able to communicate their ideas either with their peers or with the teacher or other audiences to communicate the results of the learning process

that they have gone through. Therefore, STEM learning is believed to improve students' 21<sup>st</sup> century skills, including communication skills (Baharin et al., 2018; Setiawan et al., 2020; Widiastuti et al., 2022).

STEM learning approach has several steps that asked students to construct their 21<sup>st</sup> century skills, one of them is communications skills. The steps are students identified the problem, design the project as a solution based on the problem, present the design, make a project, and present the project or product results. Present the design and present the product of project steps are the activities that could construct students' communications skills. Because in this step, students are asked to communicate two directions interactions between them with their audience, convince their ideas to the others, and how they could receive the others idea and advice (Arlinwibowo et al., 2021; Pradhananga et al., 2022; Wardani et al., 2021).

There are several research that has been done pertaining communications skills in physics (Asih & Ellianawati, 2019; Yulianti & Handayani, 2021), improvement of science communications skills by using project-based learning (Saenab et al., 2018; Walters & Sirotiak, 2011), communications skills in STEM learning in school such as elementary school, junior high school, and senior high school (Shamdas et al., 2023; Susanti et al., 2020), but there is still rare to discuss how the undergraduate students especially preservice science teachers' oral communications skills by using STEM learning approaches in environmental learning. whereas communication skills are very important for prospective teachers to equip them in educating the next generation of the nation in sharpening science content with scientific arguments. especially in the current conditions that require each individual to play a role in the campaign to save the environment so that other individuals can be convinced of the knowledge we have (Göksün & Kurt, 2017; Ichsan et al., 2019). So that, this research aims are to investigate how is the development of oral science communications skills of undergraduate students in Environmental learning by using STEM learning approaches.

## METHOD

This research method is that is used in this research is qualitative. Qualitative researchers collect data themselves through examining documents, observing behaviour, or interviewing

participants (Creswell, 2014). The data in this research taken from observation and teaching learning video recording transcriptions.

The transcription is coded by the assessment of science communication rubrics adapted from Baltimore University (University of Baltimore, 2023). This assessment for oral science communication. In this assessment there are 6 indicators, there are: Organizations, Delivery, Conclusion, Eye Contact, Responsiveness, and Media Support. The oral science communication data are taken from students' presentation activities in environmental courses. Each indicators have 4 criteria with score. Score 1 with percentages (0%-25%) for Beginning, 2 with percentages (25%-50%) for Emerging, 3 with percentages (50%-75%) for Developing, and 4 with percentages (75%-100%) for Demonstrating.

This research subject are the 15 students of science study program, 2 male and 13 female that took environmental learning courses as general lecturer. In this learning the students are asked to made the project based on the topics in the whole semester. There are 3 topics, i.e., climate changes, food, and recycle which related to the environmental learning by using STEM (*Science, Technology, Engineering, and Mathematics*) approaches. The students identified the problem surround them, then they designed the project as a solution of their problem, after that they presented the design to the others. Then they revised it to continue to the project making. After

that, they present the project to the others and lecturer. Analysis for this research using percentage in each indicator and mean for oral science communication assessment in every project. Then, it would be figure out the development of oral science communication of undergraduate science students.

## RESULT AND DISCUSSION

Research results are found that oral students communication is improved by the time in environmental learning. The progress is described in percentages that calculated from activities in three topics. Most of the students has already reached in demonstrating criteria, which is the students outperformed in oral science communication. Five students got developing criteria, means that they have already reached the good skills of science communications, but they have to develop this communication skills. While one student, still in emerging criteria, means that these students are too quiet. These students prefer to dig the science communications more and more in order to achieved the skills optimally. If the students could achieve oral communications skills optimally, they will face the globalization era easily. They could deliver their argument in the right positions and convince the other people to the right direction for environmental issues. The data explained based on table .

Table 1. Students Communications Each Respondents

	<b>Organi zation</b>	<b>Deliver y</b>	<b>Conclu sion</b>	<b>Eye Contact</b>	<b>Respons iveness</b>	<b>Multim edia Support</b>	<b>Mean</b>	<b>Description</b>
Respondent 1	58,3	58,3	33,3	58,3	83,3	75,0	61,1	Developing
Respondent 2	83,3	100,0	66,7	100,0	100,0	75,0	87,5	Demonstrating
Respondent 3	91,7	100,0	66,7	100,0	100,0	83,3	90,3	Demonstrating
Respondent 4	91,7	100,0	75,0	100,0	100,0	83,3	91,7	Demonstrating
Respondent 5	83,3	91,7	58,3	91,7	100,0	75,0	83,3	Demonstrating
Respondent 6	66,7	83,3	50,0	58,3	83,3	75,0	69,4	Developing
Respondent 7	75,0	91,7	50,0	66,7	75,0	75,0	72,2	Developing
Respondent 8	41,7	58,3	33,3	50,0	75,0	75,0	55,6	Developing
Respondent 9	33,3	25,0	25,0	33,3	75,0	75,0	44,4	Emerging
Respondent 10	66,7	100,0	50,0	91,7	83,3	91,7	80,6	Demonstrating
Respondent 11	58,3	50,0	41,7	66,7	75,0	75,0	61,1	Developing
Respondent 12	91,7	100,0	50,0	100,0	100,0	100,0	90,3	Demonstrating
Respondent 13	75,0	75,0	41,7	83,3	91,7	100,0	77,8	Demonstrating
Respondent 14	91,7	100,0	58,3	100,0	100,0	100,0	91,7	Demonstrating

Respondent 15	91,7	75,0	50,0	91,7	83,3	91,7	80,6	Demonstrating
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In general indicators of oral science communications skills, the most outperformed indicators are responsiveness by 88,3%. Means that it is include in demonstrating criteria. It could be describe that students accepted the response of dissenting opinions from colleagues, listened well, and responded with very good language. Did not interrupt in the middle of other people's conversations and invited colleagues to convey other ideas. It is illustrated when students present their design or project to the others, and revised the project or design based on peer feedback. So that the product is better and the benefits are more visible. The advice that most given to the group is about the mathematics section and engineering section from the product. It is in a line with the previous research that mathematic and engineering section or literacy are least than two other literacy, science and technology (Tati et al., 2017; Techakosit & Nilsook, 2018).

Based on the fact that is figure out that the second outperformed oral communications skills indicators is multimedia supported as technology skills by 83,3%, means that it is include in demonstrating criteria. From all three topics activities, students applied the technology on their product projects. Especially when they are made flayer for food healthy menu and environmentally friendly. They design the digital flayer by the applications on websites. It is also caused the implementation approaches STEM in the learning process that sharpening these skills optimally. And also, the students as a subject in this research is millennial generation which is digital native generations.

While, the oral science communications indicators that least performed is conclusions by 50,0%, means that it is include in emerging criteria. They find it difficult to summarize and recommend the project that has been carried out. Sometimes they deliver it not in accordance with the analysis and objectives of the project. Most students can only explain the project, but it is difficult to conclude with the connection of the project objectives and analysis they made. It is strengthening by the result that the second least outperformed communication skills indicator is organizations by 73,3%, means that it is include in developing criteria. It means that students are difficulties in deliver their project and explain briefly to their friends and lecturer. It was also

difficult to trace the explanation of their project results. The data are explained in figure 1 below.

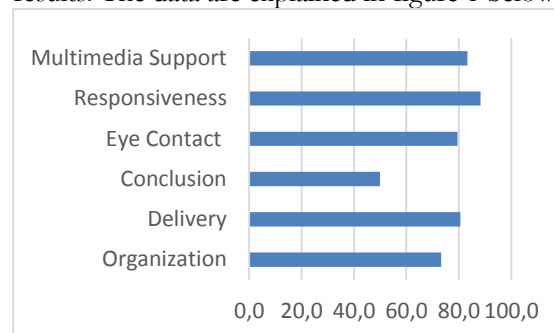


Figure 1. Graph of Students' Communications Skills in General

Based on the observations results, the students are being helpful by the learning using STEM approaches because they feel free to communicate, they are able to develop their communications skills because the steps of the learning provide them to give the argument by the data in the right way, deliver presentations about their project scientifically, using the technology, and others. This is in a line with the research that said that STEM leaning could improve the students' communications skills (Baharin et al., 2018; Setiawan et al., 2020; Widiastuti et al., 2022). The students' communications skills also depend on the student's willingness to communicate with each other, student's braveness to communicate with others or deliver their ideas, the relation between students and lecturer, also habituations. It is in a line with the research that there are many limiting factors related to efforts to improve good communication as some report that there are factors that affect communication skills, including the willingness of students to communicate (Rihardini et al., 2021), teacher-student relationship (Yunus et al., 2011), teacher communication style in teaching (Duta et al., 2015), learning approach used (Awang & Daud, 2015), and the knowledge and role of the teacher in designing learning (Bashir et al., 2011; Fuertes-Olivera & Gómez-Martínez, 2004).

## CONCLUSION

This research could be concluded that STEM learning approaches could be constructed students' oral science communications skills. The oral science communications skills that outperformed by the students is responsiveness

and multimedia support. While the least performed of oral science communications skills is conclusion. This research is useful for improving students' communication skills in higher education in environmental learning using the STEM approach

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