Collaborative Skills in Natural Science Practicum: A Student Perspective

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Abstract. This study aimed to investigate students' perceptions of collaboration skills in natural science practicum learning. A cross-sectional survey was conducted with 104 students who had participated in integrated natural science practicum both offline and virtual. The data were collected using a questionnaire via Google form with five response criteria, and the data analysis technique used descriptive statistics. The results showed that students' perceptions of collaboration skills in natural science practicum were generally positive. The ability to work effectively and respectfully with diverse teams was categorized as very collaborative, exercise flexibility and willingness to be helpful in making necessary compromises to accomplish a common goal was categorized as collaborative, and assume shared responsibility indicator for collaborative work, and value the individual contributions made by each team member with a very collaborative category. The study's implication highlights the importance of collaborative thinking skills in science practicum learning and encourages future research to focus on improving collaboration skills through learning models, methods, and strategies.

Keywords: Collaboration skills · Natural science · Practicum · Student perceptions · learning

1 Introduction

Collaboration skills are said to be important because they are one of the skills that must be developed in the 21st Century [1]. According to Greenstein [2], collaboration skills are skills in working together in groups, leadership, and decision making. Collaboration skills show respect for diverse groups, develop fluency, and make decisions for common goals [3]. This collaboration skill is important because it supports one's success for a career in society and is one of the 21st Century skills.

The demands of the 21st Century state that there are 4 skills or 4Cs that a person must develop including critical thinking skills, creative thinking, communication, and collaboration [4]. These four skills are interrelated with one another. Collaboration skills can be developed through several learning models/methods/strategies, for example cooperative learning or group learning [5], on the basis of social constructivist learning theory.

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Social constructivist learning theory is stated as learning that is based on adaptive problem solving in real life which is carried out socially, namely by sharing experiences or discussions with others [6], so new ideas will emerge from matching the experiences each has each individual. One of the applications for training collaboration skills in tertiary institutions can be seen in practicum lectures. In several lecture activities, it is practicum activities that make it possible to explore more collaboration skills [7]. In the teacher training program, there are generally subjects with the substance of Natural Sciences.

Natural science is a branch of science that systematically studies natural phenomena and the interactions within them [8]. Proof of natural science concepts is generally carried out with practicum activities, both in the laboratory and outside the classroom or outdoor learning. In order to find the natural science concept in tertiary institutions, generally through practicums that are set up in small groups that are directly guided by lecturers or laboratory assistants [9]. The objectives of forming practicum groups include maximizing collaboration skills, availability of tools and materials, efficiency of space, time, and so on.

Natural science practicum in the teaching study program at Universitas Muhammadiyah Sidoarjo is set to be included in theoretical courses, where apart from studying theoretical concepts it is also proving theories through practicum activities regulated in Rector's Decree No. E.6/503/01.00/KEP/II/2018 which was translated into policies in the realm of Faculties and Study Programs became standard operating procedures for practicum learning. Practicum activities run with the practicum module as a practicum reference which is carried out through a series of activities starting from pre-laboratory, data collection, interim report collection, final report collection, and result seminars. These activities must be passed one by one from a number of practicum subjects.

Relevant research results include Nuwahidah & Sari [10], student skills in conducting practicums and collaborating are stated to be good, but need to improve leadership aspects and skills in preparing tools and materials. According to Cahyani [11], project-based biology practicum can improve students' critical thinking skills, communication, collaboration, and creativity. Research by Nuzalifa [12], the application of the think pare share learning model can improve student collaboration skills. Malik and Ubaidillah's research [13], experimental-based learning using a model of multiple skills laboratory activities has a positive impact on laboratory critical thinking skills, as evidenced by increased communication and collaboration skills. The results of research by Utami, et al. [14], digital electronics practice visual media are able to accommodate the needs of aspects of convenience, accelerated understanding, and group independence, so as to improve 21st Century learning skills and help prepare graduates to work in the future. Based on the research results, it can be stated that collaboration skills can be improved from several learning models/methods/strategies, for this reason this research will examine how important collaboration skills were students through natural science practicum learning.

2 Methodology

The type of research used is quantitative survey type research with a cross sectional survey design. Survey research is a quantitative research method used to collect data from a

panel or group of respondents [15]. The study population was students who programmed courses in which there were science practicums in several teacher training programs, namely students of Pendidikan IPA Study Program and Pendidikan Guru Sekolah Dasar Study Programs in Universitas Muhammadiyah Sidoarjo. Samples were selected randomly by distributing questionnaires and obtained 104 respondents. The data collection technique used a questionnaire consisting of 12 statements based on indicators of collaboration skills when conducting science practicum, namely 1) demonstrate ability to work effectively and respectfully with diverse teams, 2) exercise flexibility and willingness to be helpful in making necessary compromise to accomplish a common goal, and 3) assume shared responsibility for collaborative work, and value the individual contributions made by each team member. The questionnaire was adapted from [16] with indicators of collaboration skills from [2], which were then adapted to the research objectives. The data analysis technique uses descriptive statistics, the questionnaire given a scale of 1–5 is then presented and categorized, being very collaborative, collaborative, quite collaborative, less collaborative, and not collaborative [17].

3 Result and Discussion

Based on the analysis of the results of the questionnaire, student perceptions of collaboration skills in natural science practicum are divided into 3 indicators, namely:

a. Demonstrate ability to work effectively and respectfully with diversed teams

Based on Table 1, it is obtained that the percentage of students' perceptions on the indicator demonstrate ability to work effectively and respectfully with diverse teams

Table 1. Distribution of Percentage of Student Perceptions on Indicators Demonstrate Ability to Work Effectively and Respectfully with Diverse Teams

Sub-Indicators	**Percentage (%)**				
	Very Agree	**Agree**	**Doubtful**	**Disagree**	**Don't agree**
Assemble the tools and materials provided in accordance with the practicum module with the group.	67.31	31.73	0.96	0.00	0.00
Documenting practicum activities.	65.38	33.65	0.96	0.00	0.00
Write down the results of the experiment into the table in the interim report.	66.35	32.69	0.96	0.00	0.00
Respect different opinions among practicum group members.	56.73	41.35	0.96	0.96	0.00
Giving opinions in groups when encountering difficulties during practicum.	47.12	50.00	2.88	0.00	0.00

which includes 1) assembling the tools and materials provided in accordance with the practicum module with the group with a percentage of strongly agreeing at 67.31%; agreed at 31.73%; undecided by 0.96%; disagree by 0%; and do not agree by 0%, 2) document practicum activities with a percentage of strongly agree by 65.38%; agree at 33.65%; undecided by 0.96%; disagree by 0%; and disagree by 0%, 3) write down the experimental results into the table in the interim report with the percentage of strongly agreeing 66.35%; agreed at 32.69%; undecided by 0.96%; disagree by 0%; and did not agree by 0%, 4) respecting different opinions among members of the practicum group with a percentage of strongly agreeing at 56.73%; agree at 41.35%; doubtful by 0.96%; disagree by 0.96%; and disagree by 0%, and 5) give opinions in groups when experiencing difficulties during practicum with a percentage of strongly agreeing at 47.12%, agreeing at 50%; undecided by 2.88%; disagree by 0%; and disagree by 0%.

The results in Table 1 have shown that in the indicator Demonstrate the ability to work effectively and respectfully with diverse teams which consists of 5 indicators, the largest percentage of respondents strongly agree and agree thus Demonstrate the ability to work effectively and respectfully with diverse teams is an important thing in skills collaboration. The results of Junita's research, et al. [18] found that the collaboration skills of high school students in the excretion system virtual practicum were generally in the very high category, where students were able to work productively; many students contribute actively; being able to balance listening and speaking; students demonstrate a commitment to prioritizing group goals; show responsibility; value the contribution of each group member; control one's own emotions; participate respectfully; mutual trust in the ability of group members; and able to make decisions together. Utami's research [14], the collaboration abilities of biology students class 2020/2021 at Universitas Nusantara PGRI Kediri for indicators of commitment, respect for others, deliberation and participation are quite high. This is enough to explain that collaboration skills are quite appropriate when trained in practicum activities.

b. Exercise flexibility and willingness to be helpful in making necessary compromise to accomplish a common goal

Based on Table 2, it was found that the percentage distribution of student perceptions on the indicator Exercise flexibility and willingness to be helpful in making necessary compromise to accomplish a common goal includes 3 indicators, namely 1) giving examples of assembling tools and materials in the practicum group with the percentage strongly agree is 43.27%; agree at 50.96%; undecided by 4.81%; disagree by 0.96%; and disagree 0%, 2) help other groups to arrange tools and materials with a percentage of strongly agreeing 20.19%; agree at 66.35%; undecided by 7.69%; disagree by 5.77%; and disagree by 0%, and 3) become a laboratory assistant in practicum activities that have been exceeded with a percentage of strongly agreeing at 16.35%; agreed at 43.27%; undecided at 32.69; disagree by 3.85%; and disagree by 3.85%.

The results obtained in Table 2 indicate that the largest response is in the agree category. It can be stated that on the Exercise flexibility and willingness to be helpful in making necessary compromise to accomplish a common goal indicator it is also important to develop. Pujani's research states that practicum learning includes exploration of simulation programs, drafting practicum designs for Earth and Space Sciences

Table 2. Percentage Distribution of Student Perceptions on Indicators Exercise Flexibility and Willingness to be Helpful in Making Necessary Compromise to Accomplish a Common Goal

Sub-Indicators	Percentage (%)				
	Very Agree	Agree	Doubtful	Disagree	Don't agree
Give examples of assembling tools and materials in the practical group.	43.27	50.96	4.81	0.96	0.00
Help other groups to assemble tools and materials.	20.19	66.35	7.69	5.77	0.00
Being a laboratory assistant in practicum activities that have been exceeded.	16.35	43.27	32.69	3.85	3.85

Table 3. Percentage Distribution of Student Perceptions on Indicators Assume Shared Responsibility for Collaborative Work, and Value the Individual Contributions Made by Each Team Member

Sub-Indicator	Percentage (%)				
	Very Agree	Agree	Doubtful	Disagree	Don't agree
Wear a laboratory coat when doing practicum in the laboratory.	69.23	26.92	3.85	0.00	0.00
Tidying up and returning practicum tools and materials with the group.	70.19	29.81	0.00	0.00	0.00
Representing the group to present the practicum results in the practicum results seminar.	31.73	52.88	7.69	7.69	0.00
Answering questions from other groups during discussions at the practicum results seminar.	28.85	66.35	3.85	0.96	0.00

based on generic science abilities in groups, making teaching aids, collaborating in refining and implementing group designs, making presentations and discussions, and report the results of activities independently [19]. Researcher's Hole [20], a concrete focus is collaboration, which functions as an example of how the intangible nature of some educational goals requires a theoretical response.

c. Assume shared responsibility for collaborative work, and value the individual contributions made by each team member

Based on Table 3, the percentage distribution of student perceptions on the indicators Assume shared responsibility for collaborative work, and the value of the individual contributions made by each team member is obtained, which includes 4 sub-indicators, namely 1) using a laboratory coat when doing practicum in the laboratory with a very high percentage agreed at 69.23%; agree at 26.92%; undecided at 3.85; disagree 0%; and did not agree at 0%, 2) celebrated and returned practicum tools and materials with the group with a percentage of strongly agreeing at 70.19%; agree at 29.81; hesitated by 0%; disagree by 0%; and disagree by 0%, 3) represent the group to present the practicum results at the practicum results seminar with a percentage of strongly agreeing at 31.73%; agreed at 52.88%; undecided by 7.69%; disagree at 7.69; and disagree by 0%, and 4) answer questions from other groups during discussions at the practicum results seminar with a percentage of strongly agreeing at 28.85; agree at 66.35; undecided at 3.85; disagree by 0.96; and disagree by 0%.

The results from Table 3 show that the respondents agreed and strongly agreed, thus indicating that the students' perceptions on the assume shared responsibility for collaborative work, and the value of the individual contributions made by each team member indicator were stated to be very collaborative. The research results of Patel & Herick [21] state that the instructors regularly collaborated, and when possible, incorporated elements of coteaching, to the benefit of the instructors and students alike, and discussed are the lessons learned from the process and considerations that should be made when collaborating in higher education. Research by McMillan, et al. [22], states that strategies include student learning out-comes improvement efforts as a departmental goal and expectation, dashboard communication for data-based curricular decisions, faculty workshops spotlighting successful classroom strategies, and interdisciplinary university partnerships, and then lessons learned includes recognition of the need for congruent faculty role expectations and workload, as well as awareness of the critical role of institutional support and collaboration.

Based on Table 4, the findings obtained from each indicator are further categorized into collaborative skill levels, including 1) demonstrate ability to work effectively and respectfully with diverse teams in a very collaborative category, 2) exercise flexibility and willingness to be helpful in making necessary compromise to accomplish a common goal in the collaborative category, and 3) assume shared responsibility for collaborative work, and value the individual contributions made by each team member in the very collaborative category. This categorization is based on the percentage of respondents who strongly agree and agree.

The results of the analysis in Table 4 state that each indicator of collaboration skills shows student perceptions in the very collaborative and collaborative category, meaning that collaboration skills in student perceptions are said to be important because they are facilitated in practicum learning. Research by Manouselis, et al. [23] states that to support the experimental investigation of design choices for an online collaborative filtering service for the portal's learning resources. Collaboration skills are stated to have a relationship with scientific communication. Research by Westerwick, et al. [24], collaboration interest was highest for male authors working on male-typed topics, so respondent sex did not influence these patterns.

Table 4. Percentage Distribution of Each Collaboration Skills Indicator

Indicator	Percentage (%)					Category
	Very Agree	Agree	Doubtful	Disagree	Don't agree	
Demonstrate ability to work effectively and respectfully with diverse teams.	60.58	37.88	1.35	0.19	0.00	Very Collaborative
Exercise flexibility and willingness to be helpful in making necessary compromise to accomplish a common goal.	26.60	53.53	15.06	3.53	1.28	Collaborative
Assume shared responsibility for collaborative work, and value the individual contributions made by each team member.	50.00	43.99	3.85	2.16	0.00	Very Collaborative

4 Conclusion

Based on the results of data analysis and discussion, it can be concluded that students' perceptions of collaboration skills are important in natural science practicum which are detailed in the following indicators: 1) demonstrate ability to work effectively and respectfully with diverse teams categorized as very collaborative, 2) exercise flexibility and willingness to be helpful in making necessary compromise to accomplish a common goal in the collaborative category, and 3) assume shared responsibility for collaborative work, and value the individual contributions made by each team member in the very collaborative category.

This research only uncovers students' perceptions of collaboration skills in science practicums, which were explored from a number of student samples who programmed science practicum courses. Future research is expected to be able to reveal more deeply about how to practice collaboration skills and reveal facts about the profile of student collaboration skills during practicum activities.

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