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Collaborative skills of prospective teachers in laboratory activities related to the concept of elasticity

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Abstract. The collaborative is a skill needed in facing challenges and opportunities in the era of industrial revolution 4.0. Therefore, universities must prepare prospective graduates to have collaborative skills. The purpose of this study was to describe collaborative skills that are trained and developed through laboratory activities. This study used descriptive quantitative methods. The research sample amounted to 250 teacher candidates from several Islamic Universities in Indonesia. The sampling technique used random sampling, which represents Islamic universities on four islands in Indonesia. The research instrument used was a performance assessment supplemented by a rubric of assessment. The results of research prospective teacher collaboration skills were a good category. Thus, laboratory activities can train and develop collaborative skill skills of prospective teachers.

1. Introduction

The 21st century has brought a positive change to the learning paradigm. Today's global developments demand that students be able to study and work collaboratively with individuals from diverse cultures, religions, ideologies, and lifestyles in an environment of openness and mutual respect [1]. Collaborative skills can be called interpersonal skills [2]. Collaborative skills have been linked to future economic prosperity for individuals and countries, as they provide the key qualities necessary to succeed in global skill competitions [3,4]. Collaborative skills are considered important for future labour [3].

State Islamic University and Institute of Islamic State of religion as part of the Institute of Educators and Education (LPTK) who prepare prospective teachers to have the role of preparing graduates who can compete in the era of globalization. Prospective physics teachers must master the



skills of the 21st century. 21st-century skills that need to be trained and developed by LPTK in preparing prospective teachers to face opportunities and challenges in the era of Revolution 4.0 industry including learning and innovation skills consisting of 4 aspects, namely thinking skills Critical, creative thinking, communication, and collaboration [5-8].

21st-century skills can help students to learn and adapt to all forms of change occurring over time [9,10]. This change is related to the mechanisms of economic development, environmental and political ecosystems globally. This condition requires students to learn to communicate, collaborate, and resolve problems with people around the world. Students require seven skills for survival including critical thinking and problem solving, leadership and collaboration, dexterity and adaptability, vigorous initiative and entrepreneurship, the ability to communicate effectively both oral and written, easy access to information and information analysis, imagination and curiosity [11,12].

Collaborative skills can be trained and developed in classroom and laboratory learning. Laboratory activities are an integral part of the teaching and learning activities of physics that can inspire motivation and performance of learning physics; develop basic skills of experimenting; become a learning vehicle to apply scientific methods; develop high-level thinking skills; provide practical capabilities; rides confront student preconception [13-17]

Laboratory activities oriented to the investigation conducted in groups potentially develop collaborative skills. Laboratory activities offer prospective teacher students to solve collaborative problems in collaboration. Laboratory activities undertaken in collaboration can improve individual performance, make it easier to achieve common goals, improve teamwork, synchronicity, explicit coordination, and implicit coordination [18].

Elasticity topics are an important part of the basic physics course taught in the physics education program. Understanding the concept of elasticity material is very important to master by students. Physics phenomena related to the topics of elasticity are found in everyday life. Students can study a variety of phenomena related to elasticity can be used as a valuable experience to communicate concepts that have been learned. The concepts associated with elasticity include Hooke's law and its application, application of the arrangement of series and parallel of spring.

2. Methods

The research method uses quantitative descriptive. Sampling techniques using random sampling. The research sample consists of students of physics teacher candidates who spread at 4 state Islamic religious colleges on 4 islands consisting of 250 students of physics teacher candidates. The research site was conducted in physics education study Program IAIN Palangka Raya, UIN Alauddin Makassar, UIN Imam Bonjol Padang, and UIN Sunan Gunung Djati Bandung. Research instruments use a collaborative skills observation sheet with scoring criteria of 1-3. Observation of the retrieval of research data involves 20 observers. Each observer performs an observation of 1 group consisting of 5 students of physics teacher candidates. Collaborative skills data collection techniques are conducted by observing the laboratory activities related to elasticity topics. Aspects of collaborative skills assessed are the results of the modification include 7 aspects consisting of actively contributing in the group, working collaboratively with different types of people, responsible for completing tasks, solving problems, showing respect for friends or teams, working together, accepting advice and mutual decisions and research techniques [19,20]. Data on collaborative skills of collaboration are analysed and described using scale criteria consisting of very less good, less good, good enough, good and very good. Every collaborative aspect that students achieve is calculated and aggregated and then presented in value. The interpretation of the percentage achievement of every aspect of the student's collaborative skills is guided on the criteria shown in Table 1 [21].

Table 1. Category of achievement of student collaboration skills.

Interval percentage	Category
$80 < X \leq 100$	Very good
$60 < X \leq 80$	Good
$40 < X \leq 70$	Enough
$20 < X \leq 40$	Less
$0 < X \leq 20$	Too Less

3. Results and discussion

The collaborative skills of physics teacher students in four Islamic religious colleges were assessed by observers using observation sheets. Observer assesses students' collaborative skills during laboratory activities. The observation results for students' collaborative skills are shown in Table 2.

Table 2. Achievement student collaboration skills of every university.

Islamic Religious College	Average	Percentage	Category
IAIN Palangka Raya	15.28	72.75	Good
UIN Alauddin Makassar	16.12	76.76	Good
UIN Imam Bonjol Padang	15.86	75.51	Good
UIN Sunan Gunung Djati Bandung	16.30	77.62	Good

Student collaboration skills of physics teacher candidates on physics laboratory activities related to elasticity in four Islamic religious colleges including the good category. Student collaboration skills UIN Sunan Gunung Djati Bandung reaches the largest percentage in the good category. The student collaboration skills of IAIN Palangka Raya reached the lowest including a good category compared to other Islamic religious colleges.

These results following the demands of the 21st-century learning framework demanding prospective physics teachers possess skills, knowledge, and skills in technology, media, and information, learning skills, and innovation, as well as life skills and including collaborations. The 21st-century learning paradigm emphasizes the ability of students to find out from a variety of sources, formulate problems, and conduct analytical thinking and collaboration and collaborations in solving problems. Everyone should have critical thinking skills, knowledge, and digital literacy skills, information literacy, media literacy and Master of Information and communication technology.

The collaboration skills of students in each Islamic religious college are also analysed based on the achievement of each indicator. The achievement of each indicator of student collaboration skills is shown in Table 3.

Table 3. Achievement of each indicator of student collaboration skills at each university.

Islamic Religious College	1	2	3	4	5	6	7
IAIN Palangka Raya	2.22	2.11	2.26	2.30	2.26	2.17	1.96
UIN Alauddin Makassar	2.35	2.23	2.28	2.35	2.39	2.39	2.13
UIN Imam Bonjol Padang	2.10	2.24	2.24	2.26	2.33	2.33	2.36
UIN Sunan Gunung Djati Bandung	2.29	2.42	2.52	2.39	2.26	2.30	2.16
Average	2.24	2.25	2.33	2.32	2.31	2.30	2.15
Percentage	74.65	75.02	77.51	77.44	76.95	76.57	71.79
Category	Good	Good	Good	Good	Good	Good	Good

Description: 1. Actively contributing to the group; 2. Work with different types of people; 3. Responsible for completing tasks; 4. Solve the problem; 5. Respect for a friend or team; 6. Cooperate, receive shared advice and decisions; and 7. Investigation techniques.

Student collaboration skills indicators of physics teacher candidates in every Islamic religious college overall in the good category. Indicators responsible for completing the task reach the highest percentage including the good category. The lowest percentage achievement occurs in the research technique indicators including the good category.

The students' skills are responsible for completing the task of demonstrating the collaboration that is based on the knowledge that has been given to solve the problem. Students contribute to each other in the form of thought and cooperation. Collaboration is an interactive, constructive, and knowledge-based process, involving many participants together in problem-solving activities to achieve the desired objectives [22,23]. Collaboration is one of the social interactions that are formed in a society that is much needed by students of prospective teachers when they graduate [24].

The investigation techniques are essential for the physics teacher's student. The success of laboratory activities is not detached from the correct investigation techniques. Each student of a physics teacher has a relatively heterogeneous research technique skill. The difference in research technique skills among prospective physics teachers is due to students' experience in solving problems through laboratory activities, student creativity, physics content mastery, and mastery of Information technology to search for learning resources. Active individual contributions in the group demonstrate the collaboration skills that the physicist students have. Collaborative skills can improve students' social commissar's such as assisting behaviours in investigations, involving information exchanges and establishing academic self-concepts [25,26]

The results of this study were following previous research showing that collaborative skills affect learning and retention of student knowledge [27-29]. Collaborative problem solving has a difference in individual problem-solving. Collaborative learning has an advantage over effective work sharing; combining information from a variety of knowledge sources, perspectives, and experiences; increased creativity and quality of solutions stimulated by the ideas of other group members [3].

4. Conclusion

The skills of collaborative teacher candidate Physics in four Islamic religious colleges can be developed and trained through laboratory activities with an average of reaching above 72% in good categories. This suggests that prospective physics teachers have the potential to compete globally. The Indicator is responsible for resolving the problem of reaching the highest percentage in the good category. The lowest percentage occurs in the investigation techniques indicator. Thus, laboratory activities can improve the skill of collaboration of physics teacher candidates.

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