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Research Article

Application of Genetic Problem-Based Online Discussion to Improve Communication and Collaboration Skills for Teacher Candidates

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Abstract.

Communication and collaboration skills are important skills that prospective teachers need to have. This ability is trained in genetics courses through online discussion activities based on genetic problems. The purpose of this study was to determine the effect of applying genetic problem-based online discussions on communication and collaboration skills among prospective teachers in discussing genetic problem solving. This research was conducted experimentally in three different classes in applying genetic problems, namely problems from students, problems from students and instructors, and problems from instructors. Students' communication and collaboration skills were measured through the observation of online discussion activities. Discussion activities were carried out during four genetic lecture meetings, with four discussion themes on the basic material of chromosomal inheritance. Analysis of students' communication and collaboration skills using MANOVA tests and post hoc differences tests with SPSS 22 to determine differences in students' communication and collaboration skills in each class. The results showed that there was an increase in students' communication and collaboration skills with the application of online discussions based on genetic problems, with the highest increase in classes that implemented online discussions with students' problems.

Keywords: Genetic Problem-Based, Communication and Collaboration Skills, Teacher Candidates

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1. INTRODUCTION

Communication and collaboration skills are essential skills in the 21st century. Both of these skills are very much needed in the world of work in the 21st century. Communication and collaboration skills need to be possessed by prospective teachers as a provision for their future life in the world of work. Communication and collaboration

How to cite this article: Yuyun Maryuningsih*, Taufik Hidayat, Riandi Riandi, and Nuryani Rustaman, (2024), "Application of Genetic Problem-Based Online Discussion to Improve Communication and Collaboration Skills for Teacher Candidates" in *International Conference On Mathematics And Science Education*, KnE Social Sciences, pages 809–818. DOI 10.18502/kss.v9i13.16003

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skills need to be trained in the learning process. Learning in the 21st century with all the conveniences of information technology, learning is also carried out online, one of which is through online discussions. Online discussion activities are carried out using various platforms both social media and mobile learning applications such as Gen 21cs which have been developed by the author [1]. Various educational literature reports that online discussion activities in learning, in addition to increasing student activity, can also improve critical thinking skills [2]. In online discussion activities, prospective teachers are trained in communication and collaboration skills. Discussion participants communicate and collaborate to provide feedback and solve problems in online discussion activities. Online discussion activities with a problem-based approach with the theme of genetic inheritance are one of the strategies in learning genetics. Genetic learning has various concepts, especially regarding trait patterns that are inherited in humans. This concept is interesting to discuss because of its contextual and applicable nature in human life.

In mobile learning-oriented group work with online discussion, group interaction increases group dynamics, which is indicated by a shift in individual attention to the group [3]. Collaborative learning, collaborating social attitudes and cognitive control in the learning process, involves participatory individuals in groups to solve problems through learning with digital devices [4]. Learning that collaborates problems in discussion activities requires social attitudes and mastery of concepts. A person's social attitude is influenced by active participation, perspective and self-regulation in social society, while mastery of concepts is influenced by the arrangement and development of knowledge built by students. Learning with digital information technology is supported by network networks, network productivity, social networks and intellectual-intelligence network capabilities [4]. With this explanation, group problem-based learning with online discussion can improve collaboration skills between students and support, strengthen or refute each other by communicating and collaborating to increase knowledge. Students' perceptions in the practice of mobile learning towards critical thinking, creative thinking, and authentic problem-based thinking are more dominant than their perceptions of ordinary learning [5]. While for communication and collaboration skills there is no coherent information through problem-based online discussion activities. For this reason, it is necessary to study and analyze how the application of genetic problem-based online discussions can improve the communication and collaboration skills of prospective teacher students. Genetic material is an abstract concept, and genetic inheritance is an interesting problem to research, by applying online discussions to solve various genetic problems in genetics lectures for prospective teachers. This encourages active participation of students in online discussion activities, so that the profile of

students' communication and collaboration skills can be observed in problem-based online discussion activities and analyzed.

2. RESEARCH METHOD

A The research was conducted experimentally through genetics lectures conducted in online discussion forums with a problem based genetic approach using the Gen 21cs learning application developed by the author. The study was conducted in three different classes. This class division is related to differences in research treatment applied when conducting online problem-based discussions. The first class is a class that applies problem-based learning with students' problems as experiments (E1), the second class with problems from students and instructors as experiments (E2), and the third class with problems from the instructor as control (C). The subjects of this study were students of biology education in the fifth semester at the State Islamic University of West Java which were divided into three classes with the same number of people in each class, namely thirty people consisting of ten males and twenty females. The learning implementation is applied to genetics lectures on the basic concepts of inheritance and is carried out through problem-based online discussions for four weeks, with the discussion themes shown in Table 1.

TABLE 1: Themes for online discussion of genetic inheritance in learning genetics.

Week	Discussion theme	Learning objectives
1	Inheritance of the blood group	Solve the problem of crossovers related to the inheritance of the blood group trait
2	The genes associated with sex chromosomes show a unique inheritance pattern	Solves the problem of crossovers related to genes linked to sex chromosomes and which are delimited by sex chromosomes.
3	Genes associated with autosomal chromosomes show a unique inheritance pattern	Solves the problem of crossover related to genetic disorders of autosomal chromosomes
4	Genetic testing and counseling	Troubleshooting genetic testing and genetic case counseling

The problems of genetic inheritance are discussed online with a problem-based learning step [6] which is shown in Table 2.

Online discussion activities are carried out in groups with students in class. Class differences in applying different problem focuses to find out the differences in communication and collaboration skills of each student from different classes in establishing genetic

TABLE 2: Steps to problem-based in online learning.

No	Syntax	Online discussion participant activities
1	Clarify and agree working definitions unclear terms and concepts	Communicate and collaborate among discussion participants, committed to solving unsolved problems and concepts
2	Define the problem and agree which phenomena require explanation	Discussion participants describe the problem, define the problem and choose a focus problem that requires solving
3	Analyse the problems	Analyze problems from multiple sources
4	Arrange explanations into a tentative solution	Set a tentative solution to the problem in terms of various alternative solutions to the problem
5	Generate and prioritize learning objectives	Generate and prioritize learning objectives to solve problems
6	Research the objectives through private study	Evaluating goals and solving problems through reference studies and investigations independently
7	Report back, synthesize explanations and apply new information to the original problems	Reports original problems, describes solutions to problems, synthesizes problem solutions and applies new information as solutions to problems

problem-based online discussions. Students' communication and collaboration skills were observed from students' responses as group members in responding to discussion activities in solving genetic inheritance problems. Their responses are communication skills and their cooperation in solving genetic problems is a group collaboration skill. Students' communication and collaboration skills were measured using the framework shown in Table 3 which has been tested and is a valid instrument and also to measure communication and collaboration skills in online discussion activities [7].

TABLE 3: Indicator communication and collaboration skills.

Variable	Indicator
Communication Skills	communicate in writing, interact and communicate with others positively and productively, demonstrate working in diverse teams effectively and with a full sense of responsibility
Collaboration skills	play a role in groups, respect group members, prioritize group goals, contribute to the achievement of group goals.

The technique of collecting data on communication and collaboration skills was carried out by observing student responses in online discussion activities based on genetic problems. Assessment of student interaction and interpersonal, communication and collaboration activities is carried out through responses in online discussion activities [8]. The maximum score for each of the communication and collaboration skills indicators is three, and the minimum score is one. The total score of students' communication and

collaboration skills was measured in each discussion activity. Online discussion activities were carried out for four weeks so that students' communication and collaboration skills were the average of the total score of four weeks of online discussion activities. Student's communication and collaboration skills scores are then converted into grades with a maximum score of one hundred. The average value of communication and collaboration skills of each student in each class was analyzed using SPSS 22, namely the Manova test and post hoc LSD. The first analysis is the Manova test which aims to determine the differences in students' communication and collaboration skills in all classes, as the impact of applying problem-based online discussions on students' communication and collaboration skills. Furthermore, the analysis was continued with a post hoc LSD follow-up test to determine the differences in students' communication and collaboration skills in each class. This was done to determine the effect of the problem approach on online discussions based on genetic problems with a different problem focus in each class, namely E1, E2 and C in improving communication and collaboration skills between classes.

3. RESULT AND DISCUSSION

Communication and collaboration skills are obtained through observing the responses of prospective teachers to online discussion activities from the three classes from the first to the fourth discussion activities as shown in Figures 1 and 2.
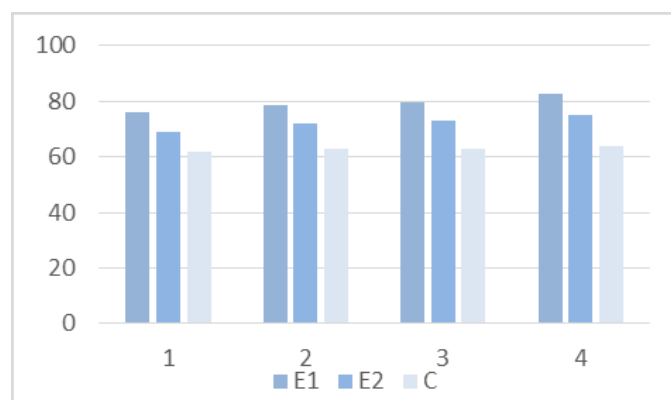

Figure 1: Graph of student communication skills scores.

Figures 1 and 2, it can be seen that there is an increase in students' communication and collaboration skills at E1, E2 and C from the first online discussion activity to the fourth activity. This shows that the application of genetic problem-based online discussions can improve students' communication and collaboration skills in all classes.
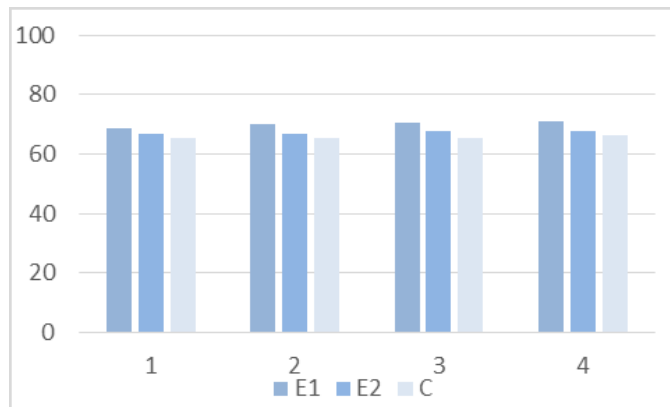
Figure 2: Graph of student collaboration skills scores.

The average communication and collaboration skills of students in the three classes are shown in Table 4.

TABLE 4: Average scores of students' communication and collaboration skills.

Variable	Learning treatment		
	E1	E2	C
Average Communication skill	79.39	72.11	62.81
Average Collaboration skill	70.14	67.40	65.62

Table 4 shows that there are differences in the mean score of communication and collaboration skills in the three treatments. Communication and collaboration skills are better at E1 with the highest average, that is, the class implements problems from students when compared to the other two classes, namely problems originating from students and educators at E2 and problems from educators at E3. To find out the differences in students' communication and collaboration skills between classes, a difference test was conducted using the Manova test. The results of the test for differences in communication and collaboration skills between classes are shown in Table 5.

TABLE 5: Manova test results for communication and collaboration skills.

Variable	Difference Test between Classes	
	P count	Information
Communication skill	0.00	Significant Differences
Collaboration skill	0.00	Significant Differences

Table 5 shows that the communication and collaboration skills of students in the three classes differ significantly both at E1, E2 and C. This shows that communication

and collaboration skills are better at E1, namely the class implements problems from students when compared to the other two classes, namely problems that are comes from students and educators at E2 and problems from educators at E3. The next stage is the post hoc LSD further test. The results of the Manova post hoc LSD advanced test of communication and collaboration skills between classes are shown in Table 6.

TABLE 6: Different test results post hoc communication and collaboration skills.

Class		Communication skill		Collaboration skill	
		P count	Information	P count	Information
E1	E2	0.02	Significant Differences	0.00	Significant Differences
	C	0.00	Significant Differences	0.00	Significant Differences
E2	E1	0.02	Significant Differences	0.00	Significant Differences
	C	0.00	Significant Differences	0.00	Significant Differences
C	E1	0.00	Significant Differences	0.00	Significant Differences
	E2	0.00	Significant Differences	0.00	Significant Differences

Table 6 shows that there are significant differences in communication and collaboration skills in classes E1, E2, and C. This proves that the application of problems from students in online discussions triggers students to be actively involved in communicating and collaborating in discussing various genetic inheritance problems. The best teacher candidate communication and collaboration skills are shown in E1, which implements online discussions based on genetic problems with problems from students. Online discussion activities with problems from students, improve communication and collaboration skills among students. In the practice of community learning genetics through problem-based discussion forums, students interact and communicate with others positively and productively and are able to work in diverse teams effectively and with a full sense of responsibility, so that students increase their interventions to actively communicate in complex ways [9].

Genetics learning through problem-based online discussion forums is the right learning to be applied as 21st-century learning wherein learning trains students to solve various problems through discussion activities. Students solving genetic problems by giving responses are problem-solving skills, communication skills, and critical thinking [10–12]. The study of the concepts of genetic inheritance has become an interesting and effective discussion theme, especially genetic consultation [13], compared to the classical genetics concept of the concept of genes [14]v.

The ability to collaborate with the best prospective teachers is also found in class E1 which implements online discussion forums with problems from students compared to E2 and K. Online discussions with problems from students, students are free to explore knowledge and find solutions to different problems. Discussion activities become fun activities and discussion participants actively take part in collaborating in their groups. Collaboration is the ability to interact between individuals and other individuals. Some things in life require always be in groups and get things done in groups. Self-activity in online learning is an authentic activity. Authentic activities include active participation in discussion activities both from the number of opinions in each discussion activity and the quality of the content of their opinions [8, 15]. Students actively collaborate virtually in group performance. This is a revolutionary learning environment [16] and collaboration to achieve group goals to solve various problems about genetics, presenting a cognitive understanding of genetics [17]. E-learning learning environments and online learning in both distance and near environments differ in the strategies and methods applied [18], online learning theory and practice need to be implemented in higher education [19] to prospective teachers, where online learning can present cognitive understanding through online learning activities [20].

Problem-based online discussion, which is learning that involves group collaboration in group discussions [21], is pragmatic learning in 21st-century learning. Collaboration in a group in learning trains discussion participants to express opinions. In the discussion activity, it was found that the participants value each other's responses and respect the opinions of others, this is good cooperation in a discussion. The ability to work together in groups or between groups is a life skill needed in life and to support careers in the 21st-century era [22]. The performance of online discussion participants obtained from responses is the performance of discussion groups [23] and how to collaborate through groups [3], namely by combining the responses of discussion participants in online discussion forums, both responses that support, support, and evaluate other people's responses which are collaboration [24].

4. CONCLUSION

Genetic problem-based online discussion activities can improve communication and collaboration skills among students. The application of the inheritance theme in discussion activities is an interesting theme and increases the active participation of discussion participants. The constraints in this study were found in the control class with problems from educators, some participants were late in giving responses in online discussion

activities. This is because of problems from educators so they only respond to problems. The best student communication and collaboration skills from the group of participants who apply online discussions with problems from students.

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