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Collaboration and communication skills of pre-service mathematics teacher in designing project assignments

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Abstract. Collaboration and communication skills are an important skill in the 21st century. The study aims to acquire a description of collaboration and communication skills designing project assignments created by pre-service mathematics teachers. This study used a qualitative approach to observe the phenomenon of participants in making a project task. The participants were 43 pre-service mathematics teachers who took a course on teaching-learning strategies. Collaboration and communication skills are demonstrated by students when the process of planning products, making products, presenting, and evaluating products. The results obtained in this study are students can figure out their level of understanding of the results of the presentation he has done. This can help students to plan to make the next teaching material appropriately. Project assignments in groups can promote collaborative learning. This is very helpful to students who are weak to build confidence. These results suggest that project assignments not only test students' understanding of a particular topic but also develop student collaboration and communication skills.

1. Introduction

The purpose of 21st-century learning emphasizes the mastery of significant academic content, which is also the foundation of every well-designed project. Students learn important academic content through well-designed projects by investigating questions, generating and evaluating solutions, and delivering products that demonstrate what they have learned. At the same time, students deepen their ability to think critically, collaborate, communicate, and solve problems creatively [1]. Thus, students must possess skills called 21st-century skills, including critical thinking, creative thinking skills, collaboration, and communication, to uncover real-world problems [2]. All of these competencies are regarded as important preparations for lectures and careers [1, 2]. The development of students' ability to study mathematics must be undertaken continuously to test its effectiveness [3].

Good planning of learning will be able to achieve learning objectives. In this case, teachers must select and use the learning model by observing the subject matter characteristics, the availability of learning media, the mental and physical development of students. Some criteria in designing the learning process, including (a) the interaction between teachers, students, and learning resources; (b) inspiring each other between teachers and students; (c) fun and challenging learning activities; (d) motivate students to actively participate; (e) availability of opportunities for students to produce work and creativity; and (f) develop self-reliance following student interests, talents, mental and physical development [4].

Based on some research that has been done, learning using the project is considered to be able to help improve students' skills in the 21st-century [1, 5, 6]. Project assignment design should be in line with the learning principles in the 21st-century, with attention to aspects of the interdisciplinary



approach, focus on information literacy, competence (creativity, communication, collaboration, and critical thinking), attitudes and values needed to solve complex problems [7]. Project assignments involve students in designing, problem-solving, decision making, or research activities. This allows working together within a certain period and eventually produce real products, reports, and presentations [8].

Project assignments can empower students to acquire new knowledge and understanding based on their experiences through various presentations. Given that each student has a different learning style, learning use project allows students to dig in content (material) using a variety of meaningful ways for him, and conduct a collaborative experiment [9]. Through the delivery of the project, students will engage in an active and independent learning process, and students will be accustomed to collaborating and communicating with his friends [10].

Working in groups to accomplish project assignments can help students build collaborations. This puts them in a situation that requires teamwork to help them succeed in a team situation. Schrage states that collaboration is not just about the agreement but on the creation of [11]. Collaboration is a process of co-creation, two or more individuals with complementary skill-related skills to create a shared understanding that was not previously owned or possessed by others.

Collaboration creates a common meaning of a process, product, or event [1]. To make collaboration effective, team members need to know how to share information and exchange ideas. Students often consult with experts as part of their research or when making authentic products. The mathematical standard also strengthens the ability of communication. Students who are proficient mathematically try to communicate appropriately to others. They try to use clear definitions in discussions with others and use their own opinions. Therefore, this study aims to acquire a description of the skills of collaboration and communication designing of project assignments.

2. Method

The study used a qualitative approach to observing the phenomenon of collaborative skills and communication of pre-service mathematics teachers in designing project assignments. The population is all students of the Mathematics Education Study Program from a private university in Indonesia. The subject of this study took courses on teaching-learning strategies as much as 43 students. Since March 16, 2020, the study was conducted online due to a COVID-19 pandemic. The projects undertaken by the students are to make math learning videos for junior high school and senior high school levels. Project results are presented as part of learning simulation activities using google classroom.

Research data is derived from project design results and interviews. Design project results analysis to see students' ability to use collaboration and communication in designing project assignments. Interviews are intended to know the purpose of content use in delivering material as an effort to develop students' skills in mathematics learning.

3. Result and Discussion

Participants working in groups (4-5 people), namely groups of G-1, G-2, G-3, G-4, G-5, G-6, G-7, G-8, G-9, and G-10. Collaboration and communication skills are demonstrated by students when the process of planning a product, creating a product (building knowledge, understanding and skills, developing a product), presenting and evaluating the product. The product produced by group G-1 is math learning videos for the eighth-grade. The videos are created to introduce new content, develop mathematical capabilities, and define the term solid (geometry). The steps for creating a product from group G-1 are:

- (1) Determine material content to make learning videos
- (2) Make a PowerPoint about the solid (geometry)
- (3) Create a YouTube account to upload learning videos
- (4) Create a video's opening, core view, and cover view
- (5) Video merging and video editing process
- (6) Video uploading process on YouTube account

The result of a project created by group G-2 is a seventh-grade mathematics learning video about social arithmetic. The videos are generated to introduce new content through simple modeling that students meet in everyday life. The learning video steps from group G-2 are:

- (1) Greetings
- (2) Initiate material with problems
- (3) Explaining the material
- (4) Provide examples of problems
- (5) Provide exercise
- (6) Close

The product produced by group G-3 is nine-grade math learning videos about congruence and similarity. The purpose of making this video is to introduce new content and provide some examples and problem-solving. The product creation steps produced by group G-3 are:

- (1) Preparing the materials to be discussed/will be studied
- (2) Create a PowerPoint
- (3) Record sound (prepare video script)
- (4) Edit videos to be interactive

The result of a project created by group G-4 is math learning videos for the ninth-grade about the powers of numbers. The goal is to introduce new material content and solve the problem of rounded rank, root form, and its properties. The steps for creating a product from group G-4 are:

- (1) Preparing the material to be discussed about the equation and the difference of power of a number
- (2) Preparing several examples of questions so that students can know the similarities and differences in the power of a number

The product produced by group G-5 is math learning videos for the tenth-grade about relations. The resulting video introduces new content about the relationship between a set and another set. The product creation steps produced by group G-5 are:

- (1) Explaining the relation definitions
- (2) Showing part of relation (domain, codomain, and range)
- (3) Introducing students to the definitions and examples of domains, codomain, and range
- (4) If you have done a thorough explanation, the students are given examples of problems

The project assignment generated by group G-6 is math learning videos for the tenth-grade. The purpose of making the video is to introduce new material content about linear functions. The steps for creating a product from group G-6 are:

- (1) Determining the material to be created
- (2) Create a PowerPoint about linear function material
- (3) Make a sound recording about the opening, explanation of material and closure
- (4) The process of merging sound and material recording effects in PowerPoint

The product produced by group G-7 is a math learning video for the eleven-grade about linear program material. The resulting video to introduce new content, develop and improve student skills solve the problem using a linear equation or inequality that has many resolutions, taking into account the requirements to obtain maximum/minimum results (optimum completion). The learning video steps generated by group G-7 are:

- (1) Designing mathematical models
- (2) Draw charts according to mathematical models
- (3) Specify the corner point of the chart
- (4) Specify the maximum or minimum value

The project assignment created by group G-8 is a math learning video for the eleven-grade about geometry transformations. The material covered is translation and rotation. This video consists of three parts, namely a basic explanation of geometry transformation, proof of formula or concept of translation and rotation, and giving the problem of HOTS along with an explanation. The steps for creating a product from group G-8 are:

- (1) Determine the material
- (2) Search for material materials
- (3) Search for reference materials for HOTS exercises
- (4) Create PowerPoint for video materials
- (5) Initiate a recording of both visuals and audio
- (6) Editing the appropriate learning software

(7) Export video and upload videos

The product produced by group G-9 is math learning videos for the twelfth-grade. The resulting video to increase understanding of different types of solid (geometry), extensive formula, and the volume of solid (geometry), and the ability to solve the problem of solid (geometry). The product creation steps of group G-9 are:

- (1) Preparing the material
- (2) Create a material summary in PowerPoint
- (3) Preparing video material from PowerPoint added explanation and audiovisual
- (4) Create learning videos with Kinemaster apps
- (5) Uploading videos

The project assignment generated by group G-10 is math learning videos for twelve-grade. The video is produced to explain the definition of a matrix, sorts of a matrix, and change the question of real-word problem into matrix form. The learning video steps from group G-10 are:

- (1) Explaining the definition of matrix
- (2) Explaining the row and column matrix
- (3) Shows a variety of matrix
- (4) Indicates the operation found on the matrix
- (6) Introducing matrix formulas
- (7) Provide examples of problems
- (8) Provide problem-solving questions

Product results from project assignments show that pre-service mathematics teachers have good creativity in making learning videos. The resulting products can be used to carry out distance learning through online learning, i.e. learning with the help of internet-based technologies that are often called electronic learning. Some groups upload their videos on YouTube for easy access to their use. In general, product results in the form of instructional videos are intended to introduce new content, train students to solve problems, develop mathematical abilities, and create generalizations.

The resulting product is a learning video for junior and senior high school levels. G-1, G-2, G-3, and G-4 groups produce math learning videos for junior high school students. It consists material of a solid (geometry), social arithmetic, congruence and similarity, and power of number. The G-5, G-6, G-7, G-8, G-9, and G-10 groups produced math learning videos for senior high school students. It consists material of relation, linear function, linear program, geometry transformation, solid (geometry), and matrix.

One of the goals of creating learning videos is introducing new content. In this study, some project results used real-world problems. For example, group G-2 introducing the new content of social arithmetic through the simple modeling of problems in everyday life. The learning videos generated by group G-6 introduce new content by explaining the material of linear functions. Group G-10 introduces new content by transforming real-world problems into matrix form.

Activities are training students to solve problems and provide opportunities for students to apply procedures into new situations. For example, products produced by group G-3, G-4 can accelerate students' understanding of the completion of congruence and similarity, and power of number. Students can use examples of the discussions found in the learning video. Students can understand the material by utilizing their own experience or the results of its observations directly.

Products produced by group G-8 can develop students' mathematical abilities. In the learning video consists of three parts, namely a basic explanation of geometry transformation, proof of formula or concept of translation and rotation, and giving the problem of HOTS and explanation. A mathematical situation that often arises or routine is often not called a problem for some individuals, it is said the problem if the situation is new (non-routine problems) [12]. Problem HOTS using real-word problem. Students are given exercises about HOTS with explanations using learning software.

Another goal of making project assignments is to increase generalization. For example, the learning videos generated by G-1, G-5, G-7, and G-9 groups are in the form of problem-solving aimed at the generalization of rules. The G-1 and G-9 groups produce a learning video featuring a variety of forms of solid (geometry), group G-5 shows the relationship between a set with the other set, and group G-7

uses a linear equation or inequality that has many solving, taking into account the requirements for maximum/minimum results (optimum completion).

Project assignment creation is expected to develop student collaboration and communication skills. Collaboration and communication skills observed include three stages, namely planning products, making products (building knowledge, understanding, and skills, developing products), as well as presenting and evaluating products. In the planning stage of the product, students have prepared and demonstrated readiness to work with the team. Students make effective discussions by expressing ideas clearly, asking probing questions, making sure everyone is heard, responding attentively to new information and perspectives. At the stage of creating a product, students can develop ideas and create products with the involvement of all team members. Besides, students create detailed task lists by dividing the project work evenly between teams. The results of this study show that students can discuss collaboratively with the group.

At each step of the project's implementation, students are encouraged to actively build knowledge and have the awareness to collaborate in groups. Collaborative activities can optimize the process of absorbing knowledge while studying [13]. So students can solve the problem and become active learners [5, 9, 14].

The communication skills observed in the first step are students can choose information to develop ideas and use styles that fit the objectives, tasks, and participants. In the second step, the students can communicate with the group to provide explanations or to convey ideas. Students can use well-produced audio/visual aids or media to improve understanding of findings, reasons, evidence, and to add interest. In the last step, all team members can answer questions about the topic as a whole. Related to the learning experience, project activities are believed to be able to increase student involvement in the learning process. Students build knowledge by communicating with his group to provide explanations or express ideas [5, 9].

4. Conclusion

Project assignments utilization can help improve 21st-century skills development, such as collaboration and communication. Through the group, activities are able to increase motivation and facilitate students to optimally obtain meaningful learning for better results. The products produced in this article suggest that pre-service mathematics teachers try to create creative learning videos that introduce new content, train students to solve problems, develop mathematical abilities, and create generalizations. Students make project assignments according to learning objectives. Collaboration and communication skills of pre-service mathematics teachers in making project assignments play an important role in achieving that goal.

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6. References

- [1] Boss S 2013 *PBL for 21st century success: teaching critical thinking, collaboration, communication, and creativity* (California USA: Buck Institute for Education)
- [2] Kivunja C 2015 Teaching students to learn and to work well with 21st century skills: unpacking the career and life skills domain of the new learning paradigm *International Journal of Higher Education* **4** 1-11
- [3] Zakiah N E 2017 Pembelajaran dengan pendekatan kontekstual berbasis gaya kognitif untuk meningkatkan kemampuan metakognitif siswa *Pedagogy* **2** 11-29
- [4] Zakiah N E, Sunaryo Y and Amam A 2019 Implementasi pendekatan kontekstual pada model pembelajaran berbasis masalah berdasarkan langkah-langkah polya *Teorema: Teori dan Riset Matematika* **4** 111-120
- [5] Bell S 2010 Project-based learning for the 21st century: skills for the future *Routledge Taylor & Francis Group* **83** 39-43

- [6] Zakiah N E and Fajriadi D 2020 Hybrid-PjBL: creative thinking skills and self-regulated learning of pre-service teachers *Journal of Physics: Conference Series* **1521** 032072
- [7] Acedo C and Hughes C 2014 Principles for learning and competences in the 21th-century Curriculum *Prospects* **44** 503-525
- [8] Thomas J W, Margendoller J R and Michaelson A 1999 *Project-based learning: a handbook for middle and high school teachers* (Buck Institute for Education)
- [9] Widyantini T 2014 *Penerapan model project based learning* (Jakarta: Pusat Pengembangan dan Pemberdayaan Pendidikan dan Tenaga Kependidikan Matematika)
- [10] Kokotsaki D, Menzies V and Wiggins A 2016 Project-based learning: a review of the literature *Improving Schools* **19** 267–277
- [11] Schrage M 1990 *Shared minds* (New York NY: Random House 140)
- [12] Fatimah A T and Zakiah N E 2018 Kelancaran prosedural matematis dalam pemecahan masalah konteks pemasaran *Mathline* **3** 141-150
- [13] Lin L 2015 Exploring collaborative learning: theoretical and conceptual perspectives In investigating Chinese HE EFL classrooms: using collaborative learning to enhance learning pp. 11–28 (Verlag Berlin Heidelberg: Springer)
- [14] Rambely A S, Ahmad R R, Majid N, M-Suradi N R, Din U K S, A-Rahman, I., ... Abu H S 2013 Project-based activity: root of research and creative thinking *International Education Studies* **6** 66–71