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Research Article

PEDAGOGICAL ANALYSIS AND ESSENCE OF MULTI-VECTOR APPROACHES IN IMPROVING STUDENTS' COLLABORATIVE SKILLS BASED ON THE EDUCATIONAL PROGRAM

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ABSTRACT

In the era of Industrial Revolution 4.0, teachers are required to facilitate learning that provides opportunities for students to develop essential skills needed in the real working world. Employees need to perform strong collaboration skills to work productively on a team to accomplish complex assignments. Project Based Learning (PBL) is one of the learning models that give opportunities for students to develop collaboration skills. This study aims to describe how students' collaboration skills develop through PBL in statistics.

KEYWORDS

Computer science education, collaborative learning, computer uses in education, distance learning.

INTRODUCTION

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To succeed in the era of Industrial Revolution 4.0, Indonesian youth generations have to possess essential skills to answer future challenges and to compete globally in the real working world. Thus, teachers are required to design and implement new models of learning that encourage students to develop 21st-century skills. On the contrary, most teachers still focus only on students' academic achievement and only a few of them who have attention on students' 21st-century skills. In many common situations, students do their own task and get their own scores. This kind of learning model does not prepare students well to face challenges in the real working place, where they are required to work on teams to accomplish complex tasks. Real project work often requires individuals to perform strong collaboration skills to work productively on a team and effectively incorporate individual ideas to complete the project. Therefore, teachers are required to design learning activities that can develop students' collaboration skills. Teachers also need a framework as their reference in designing the learning activities and examining students' collaboration skills.

METHODS

SRI International was funded by Microsoft Partners in Learning to develop a framework namely the 21st Century Learning Design (CLD) that used for the Innovative Teaching and Learning (ITL) research project (2012). The purpose of the 21st CLD framework is to help teachers design learning activities that give students opportunities to build 21st-century skills. The 21st CLD framework contains rubrics that examines 21st-century skills: collaboration, knowledge construction, self-regulation, real-world problem solving and innovation, the use of ICT for learning, and skilled communication. There are two types of rubrics to examine each skill: the learning design rubric, and the student work rubric.

RESULTS AND DISCUSSION

Based on the preliminary observations in a mathematics classroom at one of the public schools in Jakarta, it was found that the teacher has designed the learning activities which provide opportunities for students to work together to solve mathematics problems. The students were encouraged to share responsibilities while doing group discussion. The design of the learning activities has achieved level 3 of the collaboration- learning design rubric. But in fact, most of the students did not share responsibilities during group discussion. They rely on high achievers to solve the given problems. Thus, it can be concluded that the students' works were only in level 2 of the collaboration- student work rubric. Meaning that students did not get sufficient reinforcement to do collaboration through group work activities. Therefore, the teacher may need to revisit other learning activities that can be better in developing students' collaboration skills to the fullest level.

According to the Buck Institute for Education (BIE) Research Summary: PBL and 21st Century Competencies (2012), PBL can develop students' ability to do collaboration and resolve conflicts (Beckett & Miller; Chan Lin, 2008). As students work on the project, students develop the fundamental skills of productive communication, respect each other, team-work while generating ideas together, and negotiation to solve the problems (Bell, 2010). The National Council of Teachers of Mathematics (NCTM) Principles and Standards for School Mathematics (2000) also support inquiry, or discovery- based learning, which are part of PBL components. Students are actively engaged in PBL that promotes the inquiry of new knowledge, experiences, and skills in mathematics. In addition,

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students gain important skills in problem-solving, reasoning, and communicating mathematics, while learning how to conduct the project, manage resources, and collaborate with others. Moreover, by referring to the Regulation of the Minister of Education and Culture of the Republic of Indonesia Number 69 the Year 2013, it is stated that one of the characteristics of 2013 Indonesian curriculum is the learning activities must encourage students to develop their positive attitudes, knowledge, and essential life skills, and apply them in the real situations within schools and communities. Thus, it is relevant for the teacher to use PBL in order to develop students' collaboration skills as well as their applying their knowledge in the real situation in the school context.

Based on the explanation, this study is aiming to discover, describe, and compile in-depth information about the development of students' collaboration skills through PBL in mathematics class, specifically in statistic topic. The statistics topic was selected because it has many real-life applications that offer more flexibility for students to generate ideas in determining the project topic. The study was conducted in a public senior high school in Jakarta where most of the teachers did not pay much attention to students' collaboration skills. It is expected that students' collaboration skills can be developed to the fullest level of the collaboration- student work rubric through PBL in statistics topic.

According to Miles and Huberman (1994), qualitative data analysis consists of data reduction, data display, and conclusion drawing and verification. Data reduction can be defined as the process of selecting, focusing, simplifying, abstracting, and transforming the raw data that appear in written-up field notes. The researcher has gathered all data, then select the data by focusing on all aspects of the collaboration-students work rubric: (1) students are working together; (2) students are sharing responsibility fairly; (3) students are making substantive decisions together, (4) students work product is interdependent. The second component of data analysis is the data display. In this stage, the researcher uses a narrative text to display qualitative data that have been reduced. The third component of data analysis is drawing conclusion and verification. The researcher draw conclusion made toward the data in such a manner that the researcher is able to obtain an in-depth description of students' collaboration skills through PBL implementation (Creswell, 1998; Lodico et al., 2006). The conclusions are also verified as the analyst proceeds.

During the PBL, students were working together in their respective groups starting from the project planning stage up until creating the product and project presentation. In the project planning stage, students work in groups to discuss the statistics applications in their school environment. Then they have further discussion about: the project title, its description and objectives, step by step of project implementation, the project calendar, tasks of each group member, tools and materials needed to create the product, and etc.

Each group has distributed all tasks for its members and decided the deadline. Therefore, students were required to complete their associated tasks before the deadline. Students were sharing responsibility fairly when they took a turn to explain about what they have learned about statistics, which consist of the mean, median, mode, data representation in a form of tables, diagram, and pie charts, data analyze, and how they use the statistics to solve problems in their projects. This situation showed that each group member has the responsibility to build together their understanding of statistics concept and its application in their project. Moreover, all students also have contributed to their

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project presentation slides, whereby they have shared responsibility in developing the presentation slides and explaining the presentation materials.

Students have decided some important issues such as the project topic, the activities that students do during the project, the timeline of the project, the responsibilities of each group members, the final product, the materials and tools to be used in the project, and the best way to present their project results to others. In regards to determining the substantive decisions on content, process, and product of the project, students always conduct an initial discussion to collectively address individual ideas. The students negotiated their ideas to contribute to the final decision. It was found from the individual student' report that the student learned to express her opinions during the group project. Figure 4 representing the student' comment in the individual report.

According to the FGD results, it was found that each group member was required to develop some particular contents of power-point slides and after that, all contents integrated into coherent power-point slides. Therefore, if one of the group member unable to complete his/ her tasks, then the finalization of presentation slides can be hampered. This condition showed that students' work were interdependent in conducting the PBL. The following conversations are an excerpt of the FGD results with several research informants regarding students' interdependent works.

In addition, each group member also got tasks to prepare and bring the tools and materials needed to create the final product. If one member did not carry the tools or materials as requested, certainly it can hamper the process of product manufacture. This showed that students' works depend on each other and significantly can affect the project. This condition encourages students to understand and to be aware of the importance of students' role in accomplishing the project.

Through the completion of students' project in statistics topic, students were able to apply statistic concepts, in which students were working together in a small group to collect data, describe data by applying statistic descriptive, present the data in a form of tables, diagrams, and graphs, and perform basic interpretation of the data. The final products of the students' project were used as references representing several important school data and displayed in the counseling room, students' club room, and school wall magazine.

Collaboration skills is an essential skill that prepares students to work productively on a team in today's interconnected working world and global society (The Partnership for 21st Century Skill, 2012). Therefore, teachers as professionals are expected to design and enforce learning activities that provide opportunities for students to develop their collaboration skills. Students' collaboration skills can be developed through any kind learning activities in schools, one of which is Project Based Learning (PBL). Bell (2010) state that group projects able to develop students' skills in collaborating with others. Students are working together when they work in pairs or groups to discuss an issue, solve a problem or create a product (ITL, 2012). PBL required students to work together in small groups. It was found that during PBL students were working together in their groups to discuss the issue that related to school data to be their project topic, create the project calendar, and create a product at the end of the project. In addition, it was also known that the group discussions were not only happened face to face during the school hours but also occurred through LINE group. Through PBL, students got opportunities to work together in groups to accomplish the project.

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CONCLUSION

Based on the results and discussion of this study, it can be concluded that students' collaboration skills have developed to the highest level of the 21st century-students' collaboration skills, through Project Based Learning in statistics topic. At level 5 of students' collaboration skills, students have sharing responsibility fairly, they were making substantive decisions together, and the project-product was interdependent. Furthermore, students were also gain knowledge by applying statistics in their project.

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