THE IMPLEMENTATION OF ROLE PLAY ON STEM IN THE NUCLEAR MATERIALS OF HEALTH TO IMPROVE STUDENTS' PARTICIPATION

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Abstract

This study aims at increasing students' participation in role play strategy on STEM at Physics Education FKIP Unsri. This kind of research differs from other research designs. The issues raised are the problems faced by teachers during the classroom activities and some strategies are implemented to cope with the problems. Classroom Action Research is a sort of qualitative research even though the data collected may be quantitative. The data gained are described into words. The writer designed three cycles during the study The results showed that the 26% out of 14 students in the first cycle participated during the implementation of the strategy; 54% students' participation were described, and gradually 83% students applied the strategy. Then, the students' ability to comprehend and filter the information of Science, Technology, Engineering and Mathematics in each cycle was 26, 53 and 86. The study showed profoundly students got 60, 70, and 87 for technology; 50, 60 and 88 for engineering, and 25, 40 and 60 for mathematics. To conclude, the implementation of role play strategy on STEM can significantly increase students' participation and ability to understand nuclear material in the environment.

INTRODUCTION

Physics study program is one of the majors in the Department of Mathematics and Natural Sciences Education. Here,environmental physics, an option in the physics major, is the application of principles of physics to equip the students for their teaching activities in the high school level. This elective course is devoted by students to understand, analyze, and even to explain the facing environmental concerns related to the concept of physics, especially nuclear. As agents of information, students are expected to be able to figure out what is true with the misuse of nuclear energy, either as a part of community or professional, so at last that they can convey the knowledge [1]. This course discusses about environmental sustainable development, global warming, greenhouse effect, thermodynamic concepts in the environment, nuclear applications on nuclear power plants and health, solar energy and their effects, alternative sources of bio-gas, acoustics and environmental concerns. The teacher transfers the knowledge by applying a variety of appropriate strategies. To shorten, role playing on STEM expectedly gives positive contribution toward students' participation since it relates to social issues. The implementation of the environmental physics lecture in the previous semester was carried out by applying cooperative learningthat the students were assigned to seek and understand the material before the class begins. After the lecture, only students who were accustomed to expressing their ideas had participated in classroom discussions A student-centered learning approach (SCL), one that can be done cooperatively [2]. Role-playing in cooperative learning can encourage students to actively participate in individual work and can help students to implement their knowledge of nuclear physics either in small group discussion or open discussion [1]. After examining the topics to be given in physics

lectures in the environmental physics, nuclear materials in the field of health is given by using role-playing strategy on STEM. This strategy not only invites students in role-playing, but also encourages students' hard work to understand every aspect of STEM on nuclear material in the field of health and adapt and adopt, and also to deliver the results of team work according to the course objectives. The aim is to increase students' participation and active participation during role play in comprehending the material.

Role Playing is a learning strategy that can encourage learners to play a role related to the subject, both social and science discussion [3]. In detail, the steps of role playing are described as follows:

Teacher prepares / develops scenarios to be displayed
Teacher appoints some students to study the scenarios before the class begins
Teacherdivides the students into a group of three
Teacher explains about the learning competence
Teacher calls the assigned students to play the scenarios
Each student sits in his / her group while observing the scenario being played
Each group draws the conclusion
Teacher gives general conclusions
Evaluation.

Planning role playing begins at dividing the class according to the assigned group. The students are asked to search the information before the class in order that the students understand the STEM-based information.

STEM is an interdisciplinary learning between science, technology, engineering (engineering) and mathematics. Torlakson (2014) states that the approach of these four aspects is a harmonious match between real-world problems and problem-based learning [4]. According to Amal in Rebublika [5] states that STEM-based learning seems to focus solely on aspects of science learning in the realm of science, technology, engineering and mathematics. However, on a broader level, STEM-based education can be used in other scientific fields by utilizing the rules of science, technology, engineering and mathematics as a basis for learning and development of student potential. Pfeiffer, Ignatov and Poelmans (2013) stated that STEM requires skills and knowledge to be used simultaneously by learners. Each aspect of STEM has special features that distinguish between these four aspects. Each aspect helps learners solve problems far more comprehensively if integrated. [4]The four characteristics are based on the definition described byTorlakson are: 1) Science that represents knowledge of laws and concepts that apply in nature; 2) technology is a skill or a system used in organizing communities, organizations, knowledge or designing and using an artificial tool that can facilitate employment; 3) engineering is the knowledge to operate or design a procedure for solving a problem; and 4) mathematics is the science that links between quantities, numbers and spaces that require only logical arguments without empirical evidence.

The implementation of STEM approach in learning is of course integrated during the learning process. The four aspects of STEM take part in each learning steps. [7]The steps are as follows; 1) The science aspect in the STEM approach defined by Hannover is the skill of using knowledge and the process of science in understanding natural phenomena and manipulating the symptoms so that it can be implemented; 2) Aspects of technology is the skills of learners in knowing how new technologies can be developed, the skills of using technology and how technology can be used in facilitating the work; 3)

The engineering aspect has five phases in the learning process; and 4) Aspects of mathematics are skills used to analyze, reason, communicate ideas effectively, solve problems and interpret solutions based on computations and data mathematically. Real-life nuclear utilization materials such as health require a comprehensive understanding of the students on the basis of nuclear physics, the use of nuclear radiation, the public perception of nuclear radiation. Role play is made in an appropriate or near-real state in the form of material exposure, debate or open discussion[8].

The assessment is done from the understanding of the concept presented, like how toask questions, provide answers toward a question and confront constructive arguments, systematics of delivery, variations of tools and group cooperation. To facilitate the assessment of understanding of the content in role playing, the teacher applies “ask with the cards” method [1]. Participation assessment was also evaluated on papers and power points compiled in depth study of each component of STEM, referral clearance.

Slavin suggests that focusing on cooperative learning groups can change the cultural norms of young people and make cultures more acceptable in academic learning tasks [9]. The contextual approach is a concept of how to relate matter to the real conditions that exist in the environment. This approach focuses on the student rather than on the lecturer, in this case the lecturer can choose the learning strategy that will be used depending on the condition of the material and the condition of the student, one of the strategies that can be used is role-play strategy on STEM with cooperative model. [9] Cooperative learning model aims at:

1. developing academic learning outcomes
2. accepting of diversity
3.developing of social skills.

RESEARCH METHODE

The study was classroom action research of spiral system introducedKemmis and Taggart model as in figure 1 below.

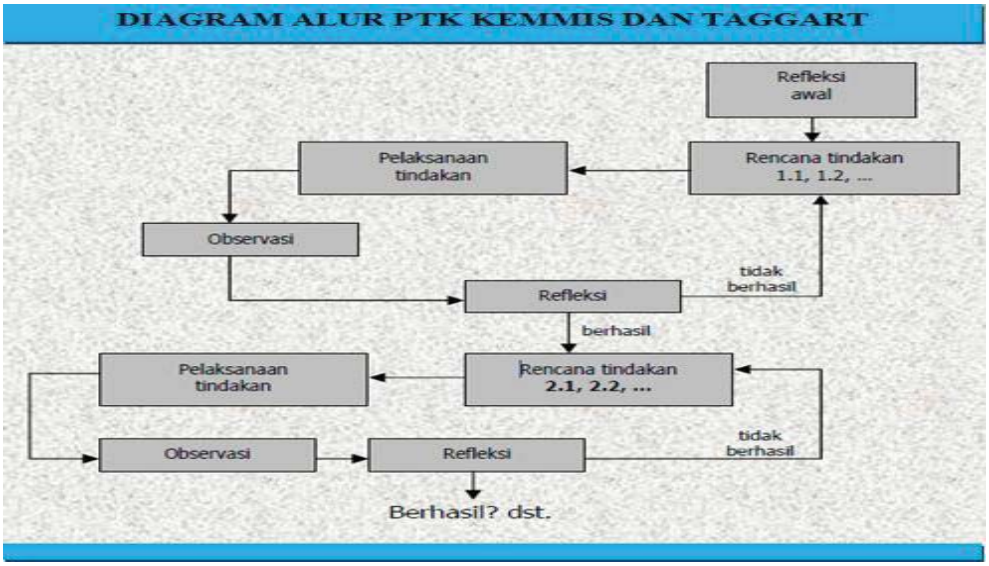

Figure 1. Kemmis and Taggart Models of PTK Design

This research is carried out in accordance with the design of Kemmis model that begins with preliminary actions in the form of initial reflection and then proceed with planning, action, observation, and reflection. The study was conducted in 3 cycles. If the results of evaluation in cycle 1 have not reached the set goals, the improvements were made in the cycle 1 and 3. Reflection of Cycle 1 was done to determine the steps in cycle 2 and 3.

Stage 1. Preparation

Preparation before face-to-face class starts are preparing SAP, reviewing nuclear material in the field of health, dividing groups and preparing evaluation forms. The subject of the study will be provided with role playing strategy on STEM that is the application of nuclear in the field of health. Implementation of the topic of nuclear utilization for medical treatment requires students' understanding of the unstable core properties, the concept of radioisotope, the benefits of radiation, and the detection of imaging results with nuclear radiation. Furthermore, students are assigned for one week to seek for information (searcing for information) to understand the science, technology, engineering and mathematics and supporting material needed in playing the role that will be sung and made in the form of scientific manuscripts, posters, banners and other forms that can be used to strengthen arguments in role play [8].

Stage 2. Implementation

Lectures are carried out according to what has been planned before. Implementation of role-play strategy starts with an explanation of the objectives to be achieved after the lecture, and then provides an opportunity for each group to deliver the material according to its role. The material used of nuclear in health is divided in four roles, like as a scientist, nuclear engineer, engineering, and community (as the sufferer of one disease) according to what has been planned previously. During the classroom activities, each group in turnplays its role in the form of material exposure, group discussion and open discussion.

Stage 3. Observation

This stage requires the students to work on how to deal with all the gained information supporting the assigned role, the ability to understand the assigned role, to watch the students' active participation in asking questions, delivering the answers, or interrupting someone's opinion on the topics conveyed is also observed. To facilitate the activity, the teacher applies "ask with the cards" method [1]. Students are asked to prepare a small card with their student number and handed it over to the lecturer each time doing constructive activity during role play. Lecturers provide information on the card in accordance with the activities carried out, illustrated from exposure, rebuttal and or other supporting arguments.

Stage 4. Reflection

Reflection is done after completion all of face-to-face classroom activities accompanied by the results of the gained material, roles displayed and activities during the role play.

RESULTS AND DISCUSSION

The results obtained on the role play of 14 students for nuclear material in the field of health can be seen in the following table.

Table 1. Results of assessment of the capability of packaging nuclear material in the field of health

Cycle	Sains	Technology	Engineering	Mathematics	Averange
1	26	60	50	25	40,25
2	53	70	60	40	55,75
3	86	87	88	60	80,25

Tabel 2. Results of assessment of the ability to display roles

Assessment Criteria	Cycle 1	Cycle 2	Cycle 3
Systematic Delivery of Roles	80	83	86
Mastery of Role Played	87	87	95
Source Update	90	90	90
Variation in Media Displyed	84	85	85
Average	85,25	86,25	89

Tabel 3. Observation results of student participation when playing a role

Observation Criteria	Cycle 1	Cycle 2	Cycle 3
Asking Question	14	53	81
Deliver the Refutation	23	54	78
Provide Additional Information	38	57	89
Average	26	54	83

Cycle 1

The result showed that the students' abilityto work on or understand the concept of nuclear was not adequate. The science aspect in the STEM approach was defined in accordance with Hannover as skills using the knowledge and process of science in understanding natural phenomena [7]. In order to understand natural phenomena required more references and processing skills so that there would be no misunderstanding toward the concept of nuclear material. Assessing science on the basic concept of radioactive as a source of radiation was still lacking. In order to play the role,student who understood the basic concept of nuclear physics must be able to extract information from various sources about nuclear and being discussed with mathematical calculations to explain clearly that radioactive emit radiation that could be used to detect or to treat a disease.

Then, the study explained that the study of nuclear technology was still very shallow. Students were urged to search the information from BATAN in order to know how to get a radionuclide nucleus that could be used to detect or for the treatment of a type of disease and could also utilize the basic knowledge obtained in the introductory course of core physics. At last, the result in Cycle 2 can be more profoundly understood and more detailed. Not only the incomplete gained information, but also the students' report was needed to be done with a assigned scheme for technology and engineering as well.

The teacher observed the students by applying "ask with the card" method [1]. Based on the observation, the ability to play the role in accordance with the task had not been well-structured with supporting media and the latest sources. Participation during

Cycle 1 wasonly 26% of 14 students, even the students who are accustomed to being active in the classroom participation. This was because not all members of each group had mastered the material they played yet. Students who were courageous were just accustomed to speaking but the quality of questions was still in the level of knowledge. To play a role in Cycle 2, more students were expected to master well their duties so that more people could participate with higher quality questions or answers.

Reflections on the first cycle of lecture reinforced that all of the related roles were presented as assessments ranging from the preparation of papers, the ability to understand the content and then the performance of the assigned roles and the participation of all members either in the group or as participants during the role play and also supporting media. Each member involved in the role must really master the material.

Cycle 2

In the second cycle,the advanced nuclear material was more emphasis on the role as a nuclear expert to get radioisotopes (Technology) needed for health (engineering), as well as the role that cannot be ignored was as a member of people who were suffering from disease. After the students' performance on role-playamong the groups of technology, engineering, people with disease were done, the ability to process information was much better and more activeshown inthe quality. Each group had more profound understanding toward the material giventhat they had played as shown in mastering all relevant additional information they referred to from variety of valid sources.

The condition of Cycle 2 was said to be better than the previous cycle, even though the ability to process the material to be played still needed to be refined for the best result in Cycle 3 as expected.

CONCLUSION

Role play strategy can encourage students to shape both their individual and group learning ability.

The "ask with the card" method can be applied as the supporting strategy during the implementation of role-playing strategy in order to further facilitate the participation assessment.

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