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Project-Based Learning Innovations to Improve Students' Creative Thinking Ability in Chemistry Learning Process Development Courses

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Abstrak

Model Project Based Learning dipilih sebagai solusi yang ditemukan peneliti di lapangan terkait rendahnya kemampuan berpikir kreatif siswa. Model Project Based Learning berbasis proyek dengan mengamati video pembelajaran guru yang diunduh siswa calon guru kemudian dianalisis bersama teman kelompok. Penelitian ini bertujuan untuk menganalisis kemampuan berpikir kreatif mahasiswa melalui model Project Based Learning berbasis proyek dengan merancang RPS dan SAP perkuliahan, kemudian mengimplementasikannya dan terakhir melakukan evaluasi. Penelitian ini merupakan penelitian tindakan kelas yang dilaksanakan dalam beberapa siklus. Instrumen berupa aktivitas siswa berupa lembar observasi dan alat evaluasi berupa tes pilihan ganda untuk mengumpulkan data hasil belajar untuk melihat kreativitas siswa dalam menganalisis video pembelajaran. Ketiga instrumen tersebut dibuat berdasarkan grid yang diturunkan dari kerangka konseptual. Hasil yang ditemukan secara garis besar, dalam satu siklus terdapat empat tahapan umum, yaitu: tahapan perencanaan, tahapan pelaksanaan, tahapan observasi, dan tahapan refleksi. Pembelajaran dilakukan dengan menggunakan model pembelajaran berbasis proyek. Kegiatan siswa diamati oleh observer dan direkam (dibuat video). Berdasarkan hasil observasi dan rekaman video, dilakukan refleksi untuk perencanaan pembelajaran siklus selanjutnya. Pada setiap akhir siklus diadakan post-test untuk melihat data aktivitas yang dikumpulkan dengan metode observasi dan data hasil belajar dengan metode tes.

Kata kunci: *Model Pembelajaran Berbasis Proyek, Penelitian Tindakan Kelas, Keterampilan Berpikir Kreatif.*

Abstract

Project Based Learning model was chosen as a solution found by researchers in the field regarding the low creative thinking ability of students. Project Based Learning model based on projects by observing teacher learning videos downloaded by prospective teacher students and then analyzed together with group friends. This study aims to analyze students' creative thinking skills through a project-based Project Based Learning model by designing RPS and SAP lectures, then implementing them and finally evaluating. This research is class action research, which is conducted in several cycles. Instruments in the form of student activity are observation sheets and evaluation tools in the form of multiple-choice tests to collect data on learning outcomes to see student creativity in analyzing the learning videos. The three instruments are made based on a grid derived from a conceptual framework. The result found broadly speaking, in one cycle there are four common stages, namely: the planning stage, the acting stage, the observation stage, and the reflection stage. Learning is carried out using a project-based learning model. Student activities were observed by observers and recorded (video was made). Based on the results of observations and video recordings, reflection is carried out for planning the next cycle of learning. At the end of each cycle a post-test was held to see the activity data collected by the observation method and the learning outcomes data by the test method.

Keywords: Project Based Learning Model, Classroom Action Research, Creative Thinking Skills.

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1. INTRODUCTION

The demands for significant improvement in society, pioneers of education, arts, and science are the main focus in the 21st century. Society is required to do things differently by creating and implementing innovative ideas and actions (Gürkan & Dolapçioğlu, 2020; Stenberg, 2016). This makes the ability to think creatively one of the essential skills that need to be continuously developed in the 21st century (Kupers et al., 2019; Lin & Shih, 2016). This makes the ability to think creatively one of the essential skills that need to be continuously developed in the 21st century to create new, valuable and useful educational

innovations (Fatmawati, 2016; Seechaliao, 2017). Creative thinking in general is a mental activity in the form of thinking that can produce concepts, ideas, knowledge, understanding, and discovery. In addition, creative thinking is the ability to solve a problem and develop a logically structured thought pattern related to cognition (Madyani et al., 2020; Maharani et al., 2017; Reilly, 2015). The characteristics of creative thinking skills related to cognitive are 1) thinking fluently; 2) thinking flexibly (thinking flexibly); 3) thinking original (thinking original); 4) thinking in detail (elaboration); 5) thinking to evaluate (evaluation) (Chen et al., 2019; Hong & Milgram, 2010; Madyani et al., 2020; Ningsih et al., 2020).

Thinking fluently can be done by: a) generating ideas in problem-solving, b) providing many answers to a question, c) providing many ways or suggestions for doing things, d) working faster, and e) doing more. what other people do. Thinking flexibly can be in the form of a) generating a variety of ideas in problem-solving or simply answering a question, b) being able to see problems from different perspectives, and c) presenting a concept in different ways. While original thinking includes: a) providing new ideas in solving or answering a problem uniquely and different from what is usually an answer or solution to a problem or question, and b) creating unique combinations of parts or elements. Thinking in detail can be in the form of a) developing or adding other people's ideas, and b) adding and organizing or specifying an idea to improve the quality of an idea. While thinking to judge can be done by: a) finding the truth of a question or plan for problem-solving or justification, b) generating problem-solving ideas and being able to implement them appropriately, and c) presenting reasons that can be included in decision making (Chen et al., 2019; Madyani et al., 2020; Ningsih et al., 2020).

The ability to think creatively is very beneficial for life and the world of work in the 21st century. The ability to think creatively is very important to have because it is a source of human strength in controlling the search, development, and discovery in the field of science and technology (Madyani et al., 2020; Malik, 2018). However, the creative thinking ability of the Indonesian people according to the 2010 global creativity index data is very low at only 0.037. Indonesia is ranked 81 out of 82 countries (Florida et al., 2012; Malmquist & Collins, 2016). Based on field findings at the Chemistry Education Study Program, Jambi University, especially in the chemistry learning process development course, students have low creative thinking skills. After being traced, this is because learning is still using the lecture method. So innovative learning is needed to improve students' creative thinking skills.

One of the innovative learning that can be used in learning is the Project Based Learning (PjBL) model. PjBL has the potential to provide relevant and interesting learning experiences for students (Afriana et al., 2016; Ningsih et al., 2020). Students are required to actively explore the challenges and real problems that exist in the surrounding environment. PjBL gets students involved in problem-solving investigations and other meaningful tasks. Students are allowed to learn independently in constructing knowledge and making products. This will increase the thinking power and ability of students in the classroom such as the ability to do analysis (Marianti & Rahayuningsih, 2022; Ningsih et al., 2020).

Previous research related to PjBL and creative thinking skills has been conducted by previous study show that students' creative thinking skills are better when taught using the PjBL model than when taught only by lecture (Gunawan et al., 2017; Ningsih et al., 2020). Another study showed that PjBL had even more influence on students' creative thinking skills than Problem Based Learning (PBL) (Anazifa & Djukri, 2017). Furthermore, in a study conducted by previous study PjBL has a significant effect on students' creative thinking skills, especially on fluency, flexibility, and novelty (Sari et al., 2017). However, there has been no specific research to see whether the application of PjBL in the classroom improves students' creative thinking skills. Even the ability to think creatively is also a relatively new trend in education so related academic research is limited, especially those using

visualizations such as videos in learning activities at the level of analysis, evaluation, and creativity, especially at the higher education level (Chen et al., 2019; O'Flaherty & Phillips, 2015; Petrova & Zaripova, 2007). Based on this, a Classroom Action Research (CAR) was conducted by applying PjBL in learning in the chemistry learning process development course to improve students' creative thinking skills. CAR was chosen because an effective way to improve the teaching and learning process and provide effective teaching and learning documentation. CAR will be done in at least 2 cycles. Thus, this study aims to describe the design of the PjBL model application in the chemistry learning process development course. Then this study analyzes the implementation of the PjBL model implementation in the chemistry learning process development course.

2. METHODS

This research is a CAR using a qualitative descriptive approach. CAR was carried out in 3 cycles for 19 students in the chemistry learning process development course. The CAR stages are shown in Figure 1.

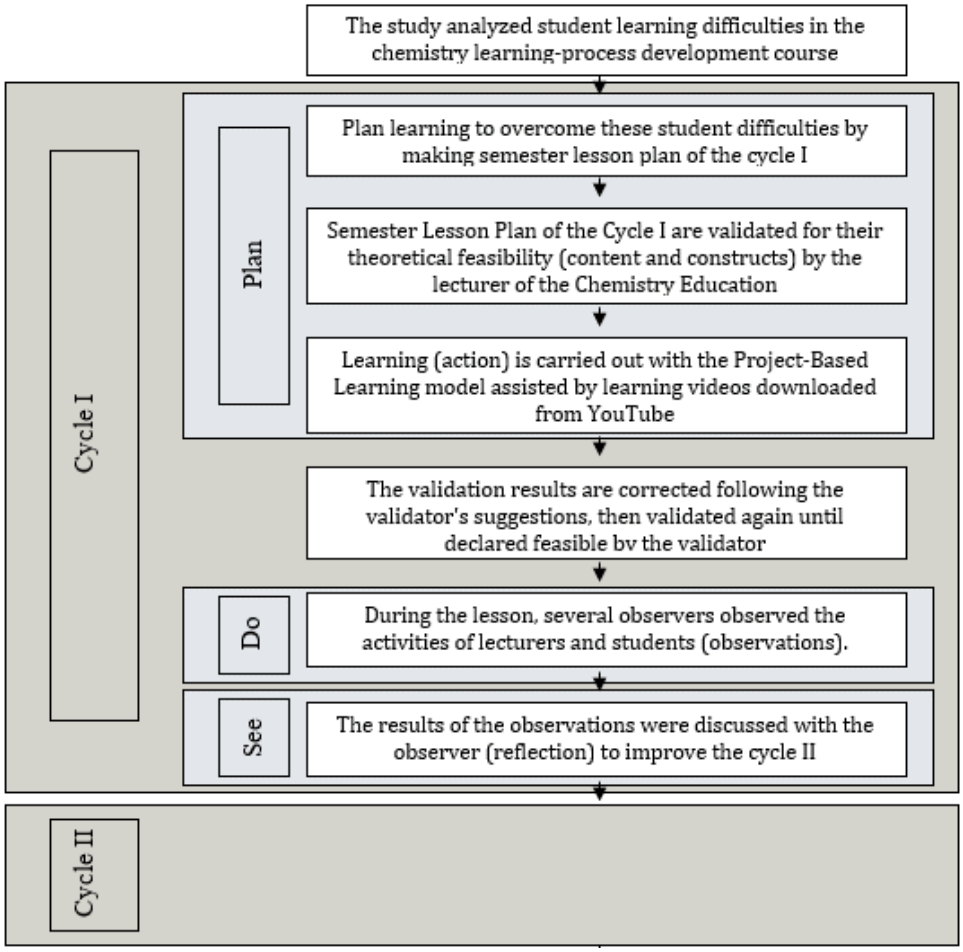

Figure 1. Stages of CAR

Data was collected using observation sheets and tests (4 essay questions) which were carried out at the end of each CAR cycle (Irving, 2006; Mettetal, 2002). Data analysis was carried out descriptively by calculating the percentage. The study began by analyzing student learning difficulties in the chemistry learning process development course. Next, plan learning to overcome the student's difficulties by making the first cycle RPS (Semester

Learning Plan). The Semester Lesson Plans that have been made are validated for their theoretical feasibility (content and constructs). The validation results are corrected in accordance with the validator's suggestions, then validated again, until declared feasible by the validator. Furthermore, learning (action) is carried out with a Project Based Learning model assisted by learning videos downloaded from YouTube. During the lesson several observers observed the activities of lecturers and students (observations). The results of the observations were discussed with the observer (reflection) to make improvements to the second cycle.

Data collection technique consist of 1.) Observation, in this study, the researcher used participant observation where the researcher was also a lecturer and observer. Where the lecturer observes students who are involved in lectures. 2.) The Documentation Study in this study uses cases related to lecture material for the development of the chemistry learning process, which will be integrated into a project. 3.) Literature studies needed in this research are books or written works related to the ability to think creatively. 4.) Field notes are written notes about what is seen, heard, experienced and thought in the context of collecting data and reflecting on the data in this classroom action research. These field notes make it easier for researchers to remember events in the lecture process during research

Data analysis techniques used in this study include qualitative and quantitative techniques. Quality techniques are used to describe the implementation of the action plan, describe the obstacles that arise during the lecture process. and describe the activities of students' creative thinking skills during lectures. as for data validation in qualitative data collection using member check, expert opinion and triagulation. Quantitative techniques are used to describe the effectiveness of lectures which include students' creative thinking skills. Quantitative data will be obtained from the results of scoring the application of the Project Based Learning method and the students' creative thinking skills. The data is then calculated and written in the form of tables and diagrams so that the development or improvement of students' creative thinking skills will be seen. The success indicator in this research is the increase in creative thinking skills in the chemistry learning process development course for the chemistry education study program using a project-based learning model. This research will be said to be successful when the average score of students' creative thinking skills if they have obtained a project score, their discussion gets a score of 80 with a good category. Acquisition category value is show in Table 1.

Table 1. Acquisition Category Value

No	Criteria Indicator	Description
1	Very good	SB
2	Good	B
3	Enough	C
4	Less	K
5	Less Once	KS

The design of project-based learning strategies that can improve students' creative thinking skills will be illustrated in learning tools (lecture contracts, semester lecture plans and teaching materials), and will be implemented in learning the development of the chemistry learning process. The chemistry learning process development course is designed in 16 meetings including the Mid-Semester Examination (UTS) and the Final Semester Examination (UAS). The lecture begins with a lecture contract that discusses everything that is the obligations and rights of students as well as the duties of the lecturer in charge of the

course. The stages of implementing learning that build systems during lectures are project-based learning steps and creative thinking.

3. RESULTS AND DISCUSSION

Results

Cycle I. Analysis and Reflection Results

Cycle II Project Based Learning based on video learning in the creativity of students trying to develop and improve their creativity there are four groups that get good scores, namely groups 3, 6, 8, 9, 10 and 11. Judging from the observations of the Implementation of the Project Based Model Learning video-based learning to improve the creative thinking ability of Chemistry Education Study Program Students in the Chemistry Learning Process Development Course is good because this Project Based Learning model is based on video learning. So, it is not surprising that in the first cycle, students received good ratings from 11 groups, as listed in table 1 above. 6 groups are in good position. In general, the obstacles faced by students in the ability to think creatively using credible sources are because students are not accustomed to looking for reputable journals which are then linked to their learning tools. If depicted in a graph, the result of the 1st cycle is show in Figure 2.

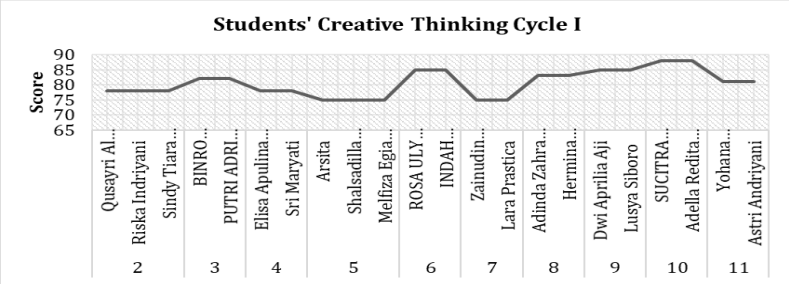

Figure 2. Score Graph of the Acquisition of Creative Thinking Ability Cycle I

Figure 2 shows that the majority of students' scores are still at the moderate or complete level with an average score of 81.47. The learning process in Cycle I was good, the learning process was conducive, the creativity was also good, but not all of it could improve student learning outcomes. Thus, students' creative thinking needs to be improved. This improvement can be realized by carrying out cycle II actions with learning through a project-based approach. The lesson plan in the next cycle must of course be further matured so that the negative behavior that stands out becomes positive behavior. Thus, students' creative thinking must reach the standard of completeness competence. This increase can be realized because the learning process using a project-based approach is carried out correctly.

Another important thing that students get is the ability to work together in groups or teams and team communication skills. Without good cooperation and communication between group members, they will find it difficult to select videos and analyze learning videos and meet completion targets. Communication and adaptation skills are skills that are sought after in the workplace and at every stage of a career. They must fulfill member management and teamwork in learning projects because in the learning video each student must show his contribution. From this learning video project, they also learn to organize their team/group so that everything can go according to their plan. Based on the results of the above observations, it can be seen that there are quite a lot of advantages than disadvantages in the ability to think creatively. Therefore, the writer and the lecturer in charge conducted a back-to-back discussion that aims to evaluate the lecture activities in the second cycle. The results of the discussion are 1.) The lecturer at the end of the lecture again explained the

usefulness of analyzing this learning video so that students feel the benefits because of the advantages and disadvantages of the video, students can be clearer about SOPs in learning by including relevant learning tools such as lesson plans, research instruments, student worksheets and teaching materials. 2.) Lecturers must provide motivation at every lecture meeting to stimulate students' creative thinking skills. 3.) The lecturer again reminded that at this meeting to look for as many sources as possible because the average source of this credibility is still low in cycle I with the group team that has been distributed so that the assignment gets the maximum score. 4.) Students must increase their literacy in order to develop and improve the ability to argue in discussions so as to increase their creative thinking ability.While the graph of students' creative thinking ability

Cycle II Research Results

Cycle II research was carried out on November 16, 2021. Research in cycle II was divided into four activities, first, planning, second implementing action, third observation and fourth analysis and reflection. Planning in Cycle II Planning in cycle II is not much different from the previous cycle. The planning stage in cycle II consists of, 1.) Lecturer prepares teaching materials. 2.) The lecturer asks the class leader to collect the tools for the second cycle, then the lecturer determines the group that will appear based on the good PPT scores and selects group 5. 3.) Develop a questionnaire evaluation tool and group assessment in cycle II. 4.) Prepare observation sheets to see how the lecture conditions are when the Project Based Learning model based on video learning is applied in lectures on the development of the chemistry learning process.

Based on the results of the reflection in cycle II, the description of the actions taken according to the title of this action research is project-based learning innovation to improve creative thinking skills for chemical education study program students in the chemistry learning process development course with action work scenarios in cycle II including: 1.) Groups whose scores are still not good in project making and creative thinking skills will be given a stimulus so that students have the courage to argue and the day before the lecture the lecturer reminds Kating so that his classmates study the material that will be discussed tomorrow. 2.) The objectives and benefits of the lecture are explained clearly so that students feel confident about the purpose of this lecture so that the desired competence is achieved. 3.) The lecturer appoints a moderator to manage the presentation and discussion via zoom and makes two students co-hosts for the moderator and displays an analyzed learning video for the presentation.

After the presentation was done by the group, the moderator invited students from other groups to ask questions, their questions were much better than cycle II. After all the questions asked by the theme were answered by the discussion group, the lecturer added a few parts that were lacking in the student's explanation. Based on the answers to the questions posed by students to groups of three and judging by the way they answered and argued, they were able to start drawing conclusions from several sources they had read, although they were not perfect and there were still students who remained silent. Students provide conclusions at the end of the lecture and lecture closed by saying hello.

Results of Observation and Evaluation Cycle II

In general, the implementation of this second cycle went well as for the results of observations and assessments of the results of the analysis of the learning video. This was to improve the creative thinking ability of chemical education study program students, if depicted in a graph, it can be seen in Figure 3 that show the results of the cycle II test.

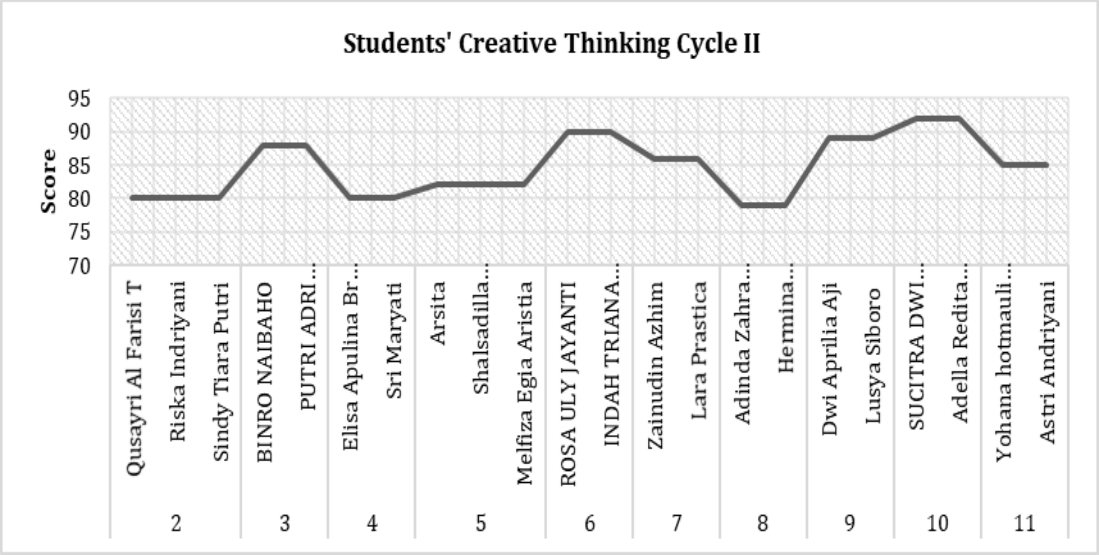

Figure 3. Graph of Scores for Creative Thinking Ability Cycle II

Results of Analysis and Reflection of Cycle II Based on Figure 3 of cycle II, the Project Based Learning table Based on video learning in the creativity of students in groups one to group of ten got a very good predicate. Groups 3, 4, 5 and 6 in the first cycle from the observation sheet got a pretty good predicate, in the second cycle, they got a very good predicate, meaning they experienced an increase in the predicate. Groups 2, 6, 8, 9, 10 and 11 experienced an increase from good in cycle I to very good predicate in cycle II. In cycle II, the students' creative thinking skills looked very good, judging from the results of the learning tools they collected. This aspect that is still low in creative thinking skills can be seen from the indicators that when there is a problem, they are more difficult to communicate with the lecturer, perhaps due to the online lecture factor so that the emotional relationship with the lecturer has not been established.

The ability to think creatively in the second cycle has increased from the first cycle, seen from the acquisition score in the first cycle is 80.59 in the second cycle, the score is 84.73. Between cycle I and cycle II there was an increase of 5%. Based on the results of the above observations, it can be seen that there are quite a lot of advantages than disadvantages in the ability to think creatively. Therefore, the writer and the lecturer in charge conducted a back-to-back discussion that aims to evaluate the lecture activities in the second cycle. As for the results of the first discussion, students' creative thinking ability has met the criteria very well, seen from the learning videos they observed and discussions when lectures were on target in the CAR design. Second, the weakness in online lectures with the help of zoom meeting is about time discipline and a lot of students going in and out of zoom may be due to a poor network. Third, in the discussion process, students in this cycle have been focused on the resources they have, hopefully they can be maintained.

Data Processing Results of Students' Creative Thinking Students' creative thinking abilities were observed during the study assessed according to the assessment rubric. The aspects of the assessment of students' creative thinking abilities include first, the ability to think fluently, the second the ability to think flexible/flexible, third, the ability to think originality, the fourth ability to elaborate. Observation of students' creative thinking ability is show in Figure 4.

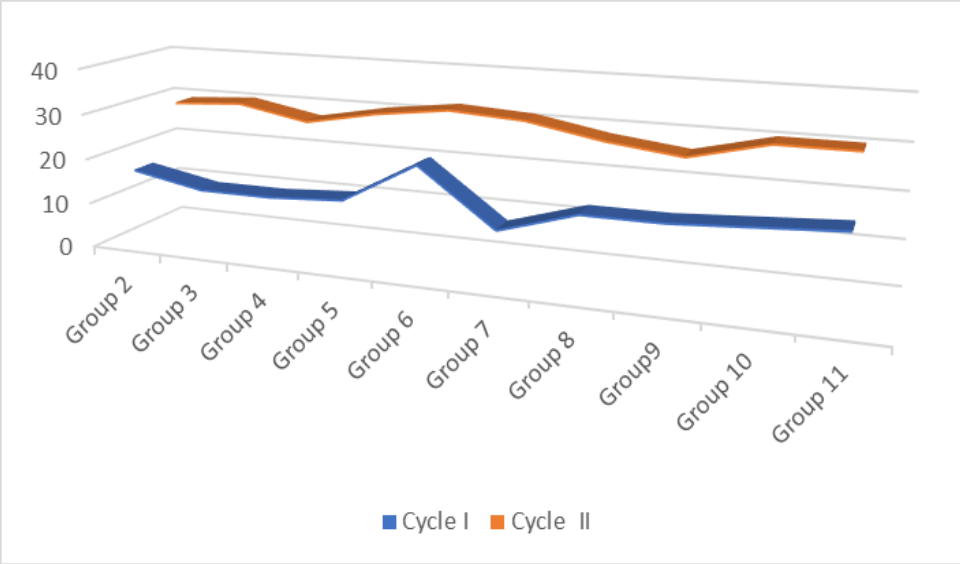

Figure 4. Score Diagram of the Acquisition of Creative Thinking Ability Each Cycle

Based on Figure 4, it can be seen that the students' creative thinking skills, which can be seen in the students' creative thinking skills in cycle one, the highest score was obtained by group 6 with a score of 24. While in cycle II all groups experienced a high increase in group 7 and group 6. Where group 7 obtained a score of 31 in the second cycle and group 6 obtained a score of 32 in the second cycle which was the highest score of all groups. Thus, in general, the second cycle of students' creative thinking ability has undergone a high change. From the scores described above, the scores will be averaged. The average results is show in Figure 5.

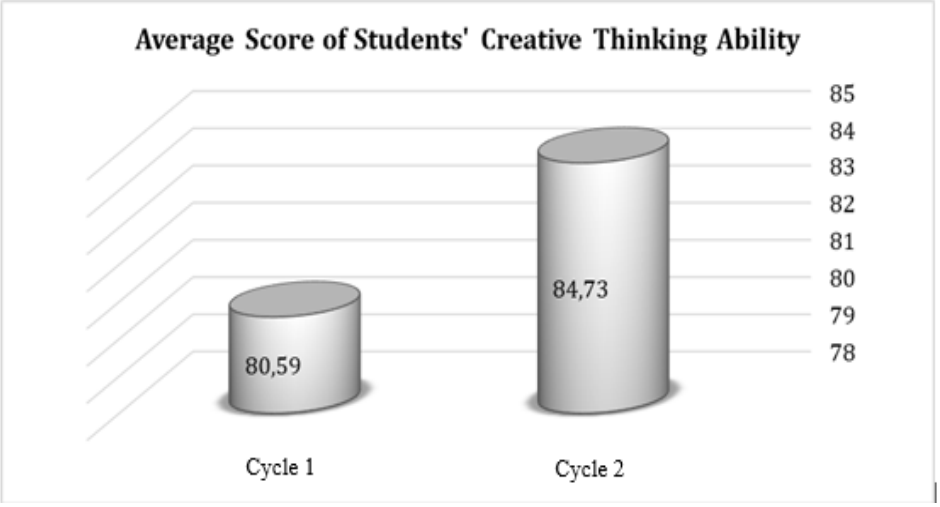

Figure 5. Diagram of the Average Score of Creative Thinking Ability in Each Cycle

Figure 5 shows the behavior of students in the development of the chemistry learning process through a project-based learning model that is getting better from cycle to cycle. The behavior improvement is in the form of: honest, disciplined, responsible, never give up, and curiosity in following the learning process. Student behavior towards learning increased by 80.59 (good) in cycle 1 to 84.73 (very good) in cycle 2.

Discussion

Based on the discussion on the implementation of action research for regular class A, class 2019 chemistry education, in the chemistry learning process development course, it can be stated that before the action was taken (during orientation), the lecture process was still teacher-centered, the lecturer was very dominant. The learning process, not yet student-centered, students tend to be passive in the learning process and accompanied by creative thinking and low learning outcomes. However, after the implementation of the action treatment in cycle 1, it appears that the students are already active in analyzing the learning video and this will be continued in cycles II and III. The process of improving students' creative thinking can be seen in the first cycle which is obtained in the form of the class average score in the first cycle. In the first cycle the average regular class of the chemistry learning process development course is 81.47 and research will be continued in the second cycle to achieve the results best. In the first cycle there were still some students who were less interested in the learning techniques used by the lecturers, so they would continue with the second and third cycles of learning. Because of this, the student team must exchange ideas, refute and provide feedback to their fellow group members.

In the implementation of Project Based Learning (PjBL) learning videos, prospective teacher students are able to have cognitive abilities up to the C6 level and prospective teacher students have the ability to analyze complete and accurate material (Borch, 2019; Singh. & Prasad Singh, 2021). The conclusion section should also state the implications of research results for the development of science and technology. Conclusions are presented in paragraphs, 10-15% of the total length of the article. Improvement of actions in the form of independent thinking skills, guidance in conveying ideas or ideas, guidance in choosing alternative ideas or ideas, and freedom Groups can affect the behavior of students to be more honest, disciplined, responsible, never give up, and curious during the learning process. Such an increase in behavior strengthens opinion (Miniawi & Brenjekjy, 2015; Takaria & Talakua, 2018; Wismath & Orr, 2015). From the research of education experts, it shows that the behavior of students can know deeply and widely from what is learned, seen, and heard.

This finding is similar to the CAR findings conducted by previous study that the application of PjBL can improve creative thinking skills in chemistry learning in II cycles in terms of fluency, flexibility, originality, and elaboration (Wijayati et al., 2019). Until the end of the two cycle, it appears that the average of all indicators of creative thinking skills of students is in the creative predicate, with a high increase in each indicator of fluency and elaboration. Supported by other study that analyze the influence of ProjectBased Learning (PjBL)- Science, Technology, Engineering, and Mathematics (STEM) on Students' Creative Thinking Skills (Saefullah et al., 2021). This result shows that the application of PJBL-STEM can improve students' creative thinking skills in the static fluid topic. Project-based learning can provide relevant and interesting contexts for students in studying chemistry. Positive research results can increase student learning interest and motivation, because they feel involved in a more interesting and meaningful learning process. The results of this research can contribute to the development and updating of learning methods in the field of chemistry education and education in general. Project-based learning innovations can be valuable additions to your repertoire of effective learning methods. This research may have a certain time limit, so that the long-term impact of project-based learning innovations cannot be fully evaluated. The results of this study can be influenced by the environment of certain educational institutions, so the results may not be fully relevant to other institutions that have different contexts.

4. CONCLUSION

Based on the discussion on the implementation of action research for regular class A, class 2019 chemistry education, in the chemistry learning process development course, it can be stated that before the action was taken (during orientation), the lecture process was still teacher-centered, the lecturer was very dominant. Improvement of actions in the form of independent thinking skills, guidance in conveying ideas or ideas, guidance in choosing alternative ideas or ideas, and freedom Groups can affect the behavior of students to be more honest, disciplined, responsible, never give up, and curious during the learning process.

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