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From Theory to Action: Developing Student Creativity through Project Learning in Chemistry

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ABSTRAK

This study aims to analyze the development of student creativity through the implementation of project-based learning (PBL) in chemistry subjects. Using qualitative methods, data were obtained from interviews, observations, and document analysis related to projects carried out in class. The results showed that PBL improved students' understanding of chemical concepts and triggered students' creativity in designing experiments and solving problems. Students felt more involved and were able to relate chemical theory to practical applications in everyday life. The findings also showed increased student motivation and a more interactive classroom atmosphere. This study emphasizes the importance of integrating a practical approach in science education to form an innovative generation. By implementing PBL, students not only learn theory but also develop critical thinking skills needed to face future challenges.

INTRODUCTION

Science education, especially in chemistry, faces the challenge of not only conveying theoretical information but also preparing students to be able to apply this knowledge in everyday life contexts. Creativity is one of the important skills that must be developed among students, because innovation and problem solving are key to addressing today's global challenges. Project-based learning (PBL) has emerged as an effective approach to connecting theory with practice, allowing students to engage directly in the learning process and encouraging exploration and experimentation (Miller & Rudd, 2021; Capraro et al., 2019).

PBL invites students to engage in projects that require them to design, conduct, and evaluate their work. Through this approach, students not only learn chemical concepts but also develop critical and creative thinking skills that are essential for careers in STEM (Science, Technology, Engineering, and Mathematics). Research shows that PBL can increase students' motivation and engagement, as well as improve their understanding of the subject matter (Blumenfeld et al., 2020; van den Akker, 2021). Therefore, this study aims to explore how PBL can be applied in chemistry education to develop students' creativity and connect theoretical learning with practical applications.

Thus, it is important to understand how students interact with the PBL process and how it affects their creativity development. Through this study, it is hoped that deeper insights can be gained into the effectiveness of PBL in the context of chemistry education and how this method can be more widely integrated into the science curriculum. The results of this study not only contribute to educational theory but also provide practical recommendations for educators in designing more effective and engaging learning experiences.

METHODOLOGY

This study uses a qualitative approach to explore the development of students' creativity through project-based learning (PBL) in chemistry subjects. The research location was carried out in several high schools that implement the STEM curriculum. Participants consisted of 30 students and 5 teachers involved in PBL activities. Data were collected through in-depth interviews with students and teachers, as well as classroom observations during the implementation of the project. The selected projects focused on the application of chemical concepts in the context of everyday life, such as simple chemical experiments related to the environment. Observations were conducted to assess student interactions, their involvement in discussions, and the collaborative process in completing the project. Data analysis was conducted using thematic analysis techniques to identify patterns and themes that emerged from interviews and observations. The results of student interviews are expected to provide insight into how PBL affects their creativity and motivation in learning chemistry. In addition, interviews with teachers will reveal their views on the effectiveness of PBL in improving students' understanding of the material. The findings of this study are expected to provide recommendations for the development of curriculum and teaching methods in the field of chemistry education.

RESULTS AND DISCUSSION

The results of the study showed that the implementation of project-based learning (PBL) significantly increased students' creativity in chemistry subjects. Based on thematic analysis of interviews and observations, students reported that the projects carried out not only deepened their understanding of chemical concepts but also encouraged them to think creatively in designing experiments and finding solutions to problems faced. Students felt more involved and motivated to actively participate in learning, which was reflected in increased interaction and collaboration in groups. Projects related to real issues, such as waste management and renewable energy, became very interesting for students and helped them connect theory with practice (Blumenfeld et al., 2020; Miller & Rudd, 2021).

In addition, interviews with teachers showed that they felt a significant increase in students' critical thinking skills and creativity after implementing PBL. Teachers observed that students were more confident in expressing their ideas and opinions during class discussions. PBL also provides an opportunity for teachers to assess students' skills and understanding more comprehensively, not only through written exams, but also through the final product of the project produced. This finding is in line with previous studies showing that PBL can improve students' motivation and learning outcomes in STEM fields (Capraro et al., 2019; van den Akker, 2021).

DISCUSSION

The results of the study showed that project-based learning (PBL) not only improved students' understanding of chemistry concepts but also strengthened their creative thinking skills. PBL creates an interactive learning environment, where students are encouraged to collaborate and explore new ideas. The practical experience gained through real-life projects allows students to see the relevance of chemistry in everyday life, which in turn increases their motivation and interest in the subject. This study is in line with previous findings stating that contextual learning can increase student engagement in science learning (Capraro et al., 2019; Blumenfeld et al., 2020).

On the other hand, the increase in students' creativity can also be seen from the way they solve problems faced during the project. Many students show initiative in designing experiments and finding alternative solutions, which reflects their ability to think critically and innovatively. Interviews with teachers confirmed that the PBL method provides opportunities for students to show their potential more clearly compared to traditional teaching methods. Thus, teachers can observe and evaluate students' critical and creative thinking skills more holistically, not only based on written exam results (Miller & Rudd, 2021; van den Akker, 2021).

This study confirms that in order to prepare students to face the challenges of the modern era, it is important for educators to integrate PBL into the science curriculum. With this approach, students not only learn to memorize chemistry facts, but also develop the skills needed to think critically, innovate, and work collaboratively in groups. Therefore, the development of a curriculum that includes PBL elements is highly recommended to improve the quality of education in chemistry and science in general.

CONCLUSION

This study shows that the implementation of project-based learning (PBL) in chemistry subjects significantly increases students' creativity and engagement. Through hands-on experience in designing and implementing projects, students not only deepen their understanding of chemical concepts but also develop critical and collaborative thinking skills. These findings emphasize the importance of connecting theory with practice to create more meaningful and relevant learning for students, as suggested by previous studies (Capraro et al., 2019; Blumenfeld et al., 2020).

Furthermore, this study also underlines the need for support and training for teachers in implementing PBL in the classroom. With the right approach, teachers can facilitate an innovative learning process, allowing students to explore their creative ideas freely. Therefore, recommendations for the integration of PBL into the chemistry education curriculum are essential, in order to prepare students to face complex and dynamic future challenges. In this context, science education should focus on developing critical and creative thinking skills as an integral part of learning (Miller & Rudd, 2021; van den Akker, 2021).

Overall, this study makes a significant contribution to the understanding of the effectiveness of PBL in chemistry education. The results not only have implications for educational theory, but also provide practical guidance for educators in designing more engaging and relevant learning experiences, with the aim of producing students who are more creative and ready to face real-world challenges.

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