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# Inquisitive Ability on Chemistry Material Gamification with Project Based Learning Approach

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**Abstract:** *This study aims to evaluate the use of gamification in increasing students' inquisitive ability on chemistry material with project based learning approach. In this research, an analysis of students' inquisitive ability will be carried out which consists of three indicators, namely wondering and questioning, exploring and investigating, and challenging assumption. The research was carried out using a classroom action research approach consisting of 3 cycles, where research data was collected by giving a questionnaire consisting of 4 statements for each indicator with 5 options for each research instrument. Apart from the questionnaire method, research data was collected through random interviews and structured observation. Based on data analysis, students' inquisitive ability was highest in the wondering and questioning indicator at 83.68 in cycle 3. Meanwhile, students' inquisitive ability was lowest in the challenging assumptions indicator at 41.25 in cycle 1. In general, gamification activities were able to increase students' inquisitive ability between 9% - 50%.*

**Keywords:** *Gamification; Inquisitive Ability; Project Based Learning*

## INTRODUCTION

Education is an attempt to improve the quality of individuals so that it can become a productive contributor in society, and is able to experience self-transformation and have a positive impact on the surrounding environment. Quality human resources are considered as vital assets for the progress of a country. Law of the Republic of Indonesia No. 20 of 2003 Paragraph 1 concerning the National Education System (Sisdiknas) defines education as a conscious and planned usaya to create a learning environment that allows students to actively develop their potential. The purpose of education is so that individuals have strength, spirituality, self-control, personality, moral intelligence, and skills that are useful for themselves, society, and the country.

In the days of the industrial and digital revolution today, education is not just about the transfer of knowledge, but also about preparing individuals with relevant skills to face the challenges of daily life (Sandong et

al., 2023). One aspect of very important skills in the context of education today is the 21st century competence. This competency includes the ability to think critically (critical thinking), creative (creative), callaboration and communication (communication), which is often known as "4c skills" ((Zubaidah, 2018);(Nurhayati et al., 2024)). In learning chemistry students must be able to develop scientific skills. One of the skills that must be possessed is creativity. Creativity according to (Mulyani et al., 2023) is the ability to produce new ideas, innovative solutions, and original works during learning. This requires the use of imagination, discovery, and problem solving creatively to understand, process, and apply knowledge in various situations. Chemical materials that are abstract and difficult to understand are not enough to use one-way method and conventional models but must be able to use strategies that have interactions and build their ideas to be able to provide encouragement, motivation, interest in solving problems.

Strategies that can develop creativity using digital technology such as gamification effectively used in learning ((Kurniawan et al., 2023);(Isma et al., 2023); (Hasanbasri et al., 2023)). Gamification is a process that combines elements of the game into the non-performance context to change the learning landscape by including interactive and immersive elements of chemical materials such as those found in the game, so that educators can utilize students' imaginative abilities to improve understanding and retention ((Lutfi et al., 2021); (Panggabean et al., 2021); (Panggabean et al., 2022)). Gamification can provide opportunities for students to interact and have the courage to think out of the box so that students can creatively participate in collaborating to find new ways to apply chemical concepts into interesting game scenarios. Therefore, learning through gamification is not just receiving information, but also actively participating in the creative process that builds deeper understanding.

In addition, according to (Sulistyaningsih et al., 2022) the integration of gamification elements into chemical education serves to bridge the gap between theory and application. By contextualizing abstract concepts in interactive scenarios, students are better prepared to understand the relevance and implications of chemical principles in the real world either navigating virtual laboratories or starting a search to uncover scientific mystery ((Wulandari & Vebrianto, 2017); (Harefa, 2020)). Gamification provides dynamic platforms for learning based on experience, encouraging deeper conceptual understanding and increasing intrinsic motivation and growing mindset develops among students. By framing learning as a journey full of challenges and appreciation, gamification experience instills a sense of curiosity and perseverance ((Dreimane, 2019); (Gulinna & Lee, 2020); (Christopoulos & Mystakidis, 2023)). When students start the search, solve puzzles, and overcome obstacles, they develop resilience in facing academic challenges, thus fostering positive attitudes towards learning.

The project-based learning approach is able to stimulate students to express their ideas into a product related to learning material and content ((Farooq et al., 2022); (Aldalur & Perez, 2023);(Angelelli et al., 2023)). The integration of gamification as a project is able to optimize the stimulus for student creativity, where gamification is able to accommodate digital-based ideas, so that the scope of projects that can be developed is increasingly diverse (Harefa, 2023). These gamification-based projects have a broad scope that is able to accommodate and facilitate students' ideas from various aspects that are directly related to learning content and other relevant content (Cheng et al., 2023); (Fonseca et al., 2023)).

## METHODS

This research is classroom action research which was carried out in September – December 2023. The research sample consisted of 35 class XI students at Abdi Siswa High School, Jakarta. The research was

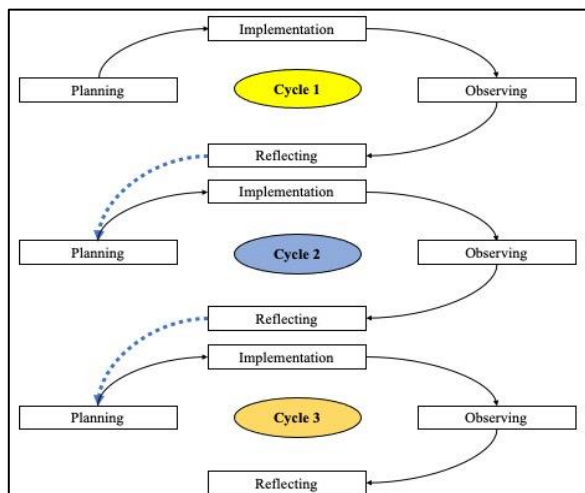carried out in 3 cycles as in the following Figure 1.



**Figure 1**. Research procedure

Research data was collected by giving students a questionnaire prepared using the Linkert scale, which consists of 12 statements with 5 options for each statement. Apart from the questionnaire method, data was collected by conducting random observations and interviews with the research sample. Through the exploration and elaboration of gamification, an analysis of the dimensions of creativity, especially inquisitive ability, is carried out, which consists of 3 indicators, namely wondering and questioning, exploring and investigating, and challenging assumption (Lucas et al., 2023).

The research instrument consists of 4 statements for each indicator which are prepared using a Linkert scale approach, where each statement is given 5 choice options. Observations were carried out thoroughly during the learning process. Interviews were conducted randomly on representative samples. Research data was analyzed and interpreted using SPSS 24 for Windows and Microsoft Excel.

## RESULT AND DISCUSSION

The dimension of creativity that is the object of research study is students' inquisitive ability ((Lucas, 2016); (Harefa et al., 2024)). The inquisitive ability analyzed include wondering and questioning, exploring and investigating, and challenging assumption.

Data was collected by giving a questionnaire to the research sample which was prepared using a Linkert scale approach, each indicator consisting of 4 statements with each statement given 5 choice options. Apart from using questionnaires, structured observations and random interviews were carried out with representative research samples (Situmorang et al., 2024). The research was carried out using a classroom action research approach consisting of 3 cycles. Based on data analysis, the average students' inquisitive ability shown in the following Figure.
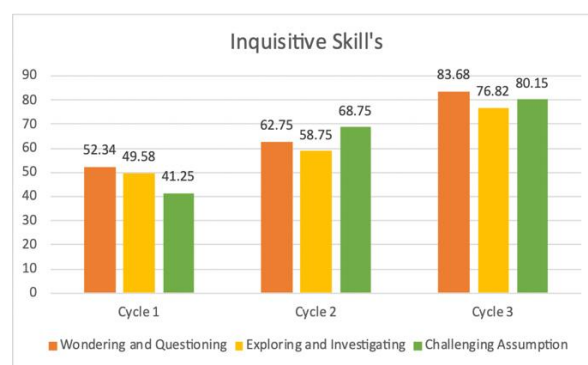


**Figure 2.** Students' inquisitive ability

Based on Figure 2, the average score of students' inquisitive abilities in cycle 1 was 47.72, in cycle 2 it was 63.42, and in cycle 3 it was 80.22. Students' inquisitive abilities are highest on the wondering and questioning indicator of 83.68 in cycle 3. Meanwhile students' inquisitive abilities are lowest on the challenging assumption indicator of 41.25 in cycle 1. Overall, there is an increase of students' inquisitive abilities between cycles as in Figure 3.
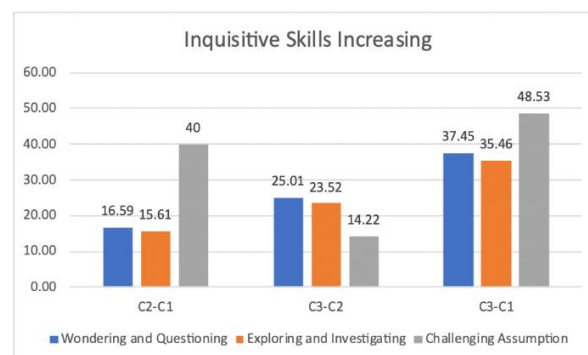


**Figure 3.** Inquisitive ability increasing

Based on Figure 3, there was an increase in the wondering and questioning indicator between cycle 1 and cycle 2 by

16.59%, between cycle 2 and cycle 3 by 25.01%, and between cycle 1 and cycle 3 by 37.45%. In the exploring and investigating indicator, there was an increase between cycle 1 and cycle 2 by 15.61%, between cycle 2 and cycle 3 by 23.52%, and between cycle 1 and cycle 3 by 35.46%. In the challenging assumption indicator, there was an increase between cycle 1 and cycle 2 by 40%, between cycle 2 and cycle 3 by 14.22%, and cycle 1 and cycle 3 by 48.53%. The highest increase in inquisitive ability occurred between cycle 1 and cycle 3 amounting to 48.53% on the challenging assumption indicator. Through the elaboration of gamification-based projects, students can be stimulated to improve their inquisitiveness, especially in the context of providing assumptions about the relevance of the gamification content created with the learning material ((Huang & Yeh, 2017); (Lamrani & Abdelwahed, 2020); (Zainuddin et al., 2020); (Purba et al., 2024)).

**CONCLUSION**

Implementing gamification as a project in the learning process can increase students' creativity, especially inquisitive abilities. Based on data analysis, the average score of students' inquisitive abilities in cycle 1 was 47.72, in cycle 2 it was 63.42, and in cycle 3 it was 80.22. Students' inquisitive abilities are highest on the wondering and questioning indicator of 83.68 in cycle 3. There was an increase in the wondering and questioning indicator between cycle 1 and cycle 2 by 16.59%, between cycle 2 and cycle 3 by 25.01%, and between cycle 1 and cycle 3 by 37.45%. In the exploring and investigating indicator, there was an increase between cycle 1 and cycle 2 by 15.61%, between cycle 2 and cycle 3 by 23.52%, and between cycle 1 and cycle 3 by 35.46%. In the challenging assumption indicator, there was an increase between cycle 1 and cycle 2 by 40%, between cycle 2 and cycle 3 by 14.22%, and cycle 1 and cycle 3 by 48.53%. The highest increase in inquisitive ability occurred between cycle 1 and cycle 3 amounting to 48.53% on the challenging assumption

indicator. Overall, gamification can increase students' inquisitive abilities between 9% - 50%.

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