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The role of gamification-based learning on prospective teacher's lower order thinking abilities

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Abstract - Gamification has proved to be a highly effective educational technique for the twenty-first century. The study aims to explore the role of gamification-based learning on prospective teachers' lower-order cognitive abilities. This study used a qualitative exploratory research design, a literature review, and interviews. In order to investigate the function of gamification-based learning in prospective teachers' academic achievement covering lower-order cognitive abilities, the most recent research studies were reviewed, and a telephone interview was conducted with 12 participants. Purposive sampling was utilized to select a sample for the study. The interview data collected from prospective instructors was analyzed using thematic analysis. The literature review findings indicate that gamification-based learning contributes positively to educational success. No in-depth research has determined whether gamification-based learning practices can enhance students' academic performance in lower-order thinking skills. In addition, the main findings from the study's primary source, such as the interview with Kahoot-familiar trainee instructors, indicate that Kahoot-based gamification may provide opportunities to utilize lower-order thinking skills. It is also beneficial to enhance the lower-order cognitive abilities of prospective teachers by providing a competitive environment and immediate constructive feedback in a comfortable and enjoyable setting. Gamification-based learning can improve students' lower-order cognitive abilities. For the generalizability and authenticity of this exploratory study's findings, it is recommended to conduct an experimental study.

Keywords: gamification, kahoot, lower order thinking; thinking skills

I. INTRODUCTION

The foundation of education is assessment, which gives instructors a wide range of data about their pupils. Technology makes achieving the learning objective easier. Teachers may benefit from integrating technology and assessment to gain detailed information about students' tests and develop effective teaching methods (Pitoyo & Asib, 2020). Different technological tools are used to assess the student's performance in teaching by providing a fun and gamification-based environment. Incorporating game elements into education has become a powerful teaching method in the 21st century. Game-like elements can create more engaging and enjoyable classroom activities (Zainuddin et al., 2020).

Gamification is becoming increasingly popular in education because of its positive effects on student engagement and learning (Göksün & Gürsoy, 2019). Based on the findings of Göksün and Gürsoy (2019) and Lopez and Tucker (2019), incorporating game elements into the learning process enhances motivation and involvement. This approach promotes active participation from learners, extends their understanding, and encourages a deeper engagement with the material. Lower-order thinking skills are often referred to as basic cognitive skills. It is also considered the foundation for higher-order thinking and critical reasoning. The LOTs skills encompass fundamental cognitive processes such as remembering, understanding and applying knowledge. Developing strong lower-order thinking abilities is crucial for prospective teachers, as it forms the basis for effective teaching and instructional strategies.

Many gamification systems may support formative assessments, an essential part of the learning process. A gamification platform is any system that employs game-related elements in non-game settings to boost motivation and academic outcomes (Zainuddin et al., 2020). Educators can use the renowned assessment tool Quizizz to facilitate stimulating, student-driven formative evaluations for learners across different age groups. Gamification involves integrating game mechanics and design concepts into non-gaming contexts (Zainuddin, 2018). Utilizing gamification in physics lessons offers a dynamic and innovative approach for teachers to captivate students, fostering both imaginative learning and spirited competition (Mohamad et al., 2020) and boosting their educational success and motivation (Rose et al., 2016). While many studies have explored gamification, few have investigated its impact on academic performance but insufficient evidence in terms of covering all lower-order cognitive abilities, i.e., knowledge comprehension and application (Zainuddin et al., 2020; Chen et al., 2021; Ismail et al., 2019); similarly, there were not many studies of gamification in classroom settings (Tolentino, & Roleda, 2019; Rose at al., 2016). The literature needs to identify knowledge deficiency regarding the role of gamification-based formative assessment practices on academic achievement in lower-order thinking abilities. How does gamification-based learning impact academic achievement regarding lower-order thinking abilities? Therefore, this exploratory research study aims to fill the identified literature gap.

Game-based testing may improve student performance and lessen the stress that traditional testing causes. Only traditional assessment methods harm students' learning experiences, such as test anxiety (DeKelerk & Kato, 2017; Mavridis & Tsiaotso, 2017). Technology is a crucial part of life in the twenty-first century, particularly in teaching and learning, since it creates an engaging setting for formative evaluation without putting the

kids under undue pressure. Many teachers feel uneasy and experience tension and anxiety while instructing kids using conventional methods. Prospective teachers are unable to improve their cognitive capacities as a consequence. In this approach, the children's' ability to think critically is repressed, in addition to their ability to grasp the teachings. Children's tendency for innovations and discoveries will not be targeted due to stress and anxiety by traditional based feedback. There needs to be more data to support gamification's claim that it can help prospective teachers with their knowledge, understanding, and application of concepts. There is a gap for gamification, and more studies are required to ascertain how gamification-based learning could enhance the lower-order cognitive abilities of prospective teachers. As a result, the research was created to examine the influence of gamification in developing low-order thinking skills in future teachers.

The study aims to explore the role of gamification-based learning on prospective teachers' lower-order cognitive abilities.

II. METHOD

2.1 Research Design

This study utilized a qualitative exploratory research design with a literature review and the interview method. It also explores the role of gamification-based learning on academic achievement in terms of lower-order cognitive abilities such as knowledge, comprehension, and application. How gamification-based learning may influence academic achievement in terms of lower-order thinking skills. An exploratory study is essential when a researcher wishes to emphasize problems, characterize the issue more accurately, and establish any particular objectives or information requirements that must be addressed via subsequent research (Swaraj, 2019). This exploratory research study attempts to address the gap. Exploratory research establishes initial concepts and insights and guides any necessary follow-up research (Churchill & Iacobucci, 2005). Exploratory research is conducted when a study explores an area about which little is known or assesses the feasibility of a particular research study (Swaraj, 2019). In order to investigate the role of gamification-based formative assessment practices in prospective teachers' academic achievement in encompassing all cognitive abilities, the 12 participants were interviewed via telephone. The purposive sampling technique determined that a sample was employed. The interview data collected from prospective instructors was analyzed using thematic analysis.

2.2 Significance of Study

The present exploratory study aims to contribute to the existing body of research by examining the potential impact of gamification-based learning on academic performance in lower-order cognitive skills, including information acquisition, understanding, and application. It will also guide students by providing an enjoyable, productive, fun-based environment, overcoming students' test anxiety, and also what its role is to improve their lower-order cognitive abilities. The results of this study highlight the importance of gamification-based learning in the teaching-learning process and also provide acknowledgement to teachers, policymakers, and administrators of how gamification-based learning may help improve lower-order cognitive abilities. Besides, this exploratory study may allow the researcher to conduct further studies and ensure the results' authenticity.

Does Kahoot-based gamification learning help to develop the lower level of the cognitive domains? If yes, how? This study investigates the question from the prospective

teachers, and different related research studies were reviewed as secondary sources. In the end, 13 related studies on gamification-based learning and academic achievement were synthesized. However, there needs to be more proof of how gamification may improve all lower-order cognitive abilities in the literature. Hence, it is necessary to use primary sources, such as telephonic interviews performed by 12 trainee teachers who had prior knowledge of Kahoot, to examine the impact of gamification-based learning on academic performance, specifically concerning the acquisition of lower-order cognitive skills.

Chiang's (2020) research sought to understand how Chinese students in an EFL class in Taiwan felt about using the mobile game-based learning app Kahoot. Regarding utilizing the app to study English as a foreign language, male and female students had no differences in opinions. Despite the fact that many people had unfavorable opinions regarding Kahoot's usage as a testing tool, most participants expressed support for its use in EFL reading classes. The results indicate that the students were open to game-based learning since they thought it would help them in English language classes, especially when studying English as a second language.

Hasram et al., (2020) researched online games' use for teaching and acquiring vocabulary in primary schools: A literature review. Based on much earlier research, this study reviews the literature on the components, appeal, and difficulties of online games for ESL learners. Online games have been shown in the literature to increase learners' learning pleasure and promote learners' autonomy in comprehending, making those ideal aids for vocabulary acquisition. It has been described in different research studies that online gaming supports the development of 21st-century abilities. However, before using online games as classroom activities, educators must be aware of the difficulties in their desire to use online games.

Zainuddin, et al., (2020) comprehensively analyzed empirical data to investigate gamification's impact on educational outcomes. This research aims to consolidate the empirical data from current literature on the issue of gamification in the educational context of learning and teaching. This study provides an up-to-date analysis of the current scientific data about the advancements in learning technologies and gamification plugins. The findings of this research provide valuable insights into the prospective avenues for future investigations in the realm of gamified learning and teaching. A comprehensive examination of the themes and substance of 46 empirical research publications published in the Web of Science database from 2016 to 2019 was undertaken. The review conducted a comprehensive analysis and assessment of the inconsistencies present in the existing literature. It also established a foundation for future research endeavors to reexamine the fundamental principles of gamification, including its theoretical foundations, methodological strategies, theoretical frameworks, gaming platforms and applications, game mechanics, and educational outcomes. Furthermore, this study aimed to examine the unique characteristics of gamified learning, which is widely regarded as a transformative approach and a crucial catalyst for enhancing motivation, engagement, and user experience—additionally, the research aimed to identify the notable obstacles and limitations related to the implementation of gamification.

The study by Chen et al., (2021) focused on using formative assessment as an intervention in online education. The researchers examined many aspects, including student involvement, results, and perceptions. The present study investigated student

involvement, learning outcomes, and perceptions of an online course that used frequent exercises, quizzes, and examinations as formative evaluations. The data was gathered for five weeks during the first transition from blended learning to entirely online teaching in a course, coinciding with the institution's closure. The identification of students who demonstrated active participation in all online learning activities and attained high scores on exercises, quizzes, and tests was conducted via a study of their learning records and test results. To engage students and enhance learning results, formative assessment that includes regular activities, quizzes, and exams is being used in the current study. However, in this study, the lower-order thinking abilities of prospective teachers were not considered.

Tolentino and Roleda's research on gamified physics training in a reformatory classroom environment was published in 2019. This research investigated how high school Physics students' motivation and performance were affected by a gamified setting. This study aimed to determine whether using a gamified approach to teaching Physics will increase students' interest in the subject and their performance in the eighth grade. One hundred seventy-eight students enrolled in four science courses for Grade 8 at a standard public high school in Manila's 2nd district participated in the research from 2017 to 2018. According to the findings, gamified education significantly raises students' performance in physics but not their motivation. However, the input from pupils, the instructor who used the strategy, and outside observers support the impact of gamification on pupil motivation. The implementation must be done correctly to prevent unhealthy rivalry, prevent students from being so grade-conscious that they turn to cheat and preserve a learning-friendly classroom climate. The effective strategy for raising student success in Physics is to gamify the teaching of Physics. Positive influences are also made on student motivation. While a teacher demands planning and implementation, the benefits of student progress, attitude toward learning, Physics, and evaluation make it all worthwhile. It is recommended that more in-depth studies be undertaken to support or dispute the effects of gamification in learning Physics that are presented in this study.

The study by Mohamad et al., (2020) about the online game-based formative assessment: Distant learners' postgraduate students' challenges towards Quizizz. This research is a quantitative analysis done to investigate how 91 remote postgraduate students feel about "Quizizz." Most postgraduate students are primary, secondary, and higher English instructors. Despite most students' opinions of "Quizizz" being favourable in this article, difficulties with learning are also highlighted. There are 20 items in the survey. Using SPSS version 25, a descriptive analysis of the data was done. Most respondents agreed that "Quizizz" might provide a platform that encourages supportive comments, incentives, and quick feedback when students' scores are shown on the leaderboard. The results would help instructors use "Quizizz" as a formative assessment tool.

Research examining pharmacy students' perceptions of learning in an undergraduate medicinal chemistry course were undertaken by (Rahim et al., 2020). This study investigates how students in a medicinal chemistry course perceive the impact of gamified online quizzes on their knowledge retention. This research uses a mixed method to collect the data, including descriptive analysis, content analysis from informal discussions, and researchers' observations. Three gamified online quizzes utilizing Quizizz were used instead of conventional quizzes outside class. Within a certain amount of time, several tries were permitted. Post-quiz conversations were placed in class as interventions.

During the course, students filled out a survey. Results show that. Out of 63 responders, more than 96% said they learned more from the gamified online quizzes because of the rapid feedback, errors they made, and post-quiz conversations. Overall, student performance increased with time as measured by the proportion and precision of their quiz answers. The results from the descriptive data analysis of the research were supported by the student-submitted qualitative comments on the survey, the course social media, and casual conversations. In an undergraduate course in medicinal chemistry, active peer learning outside class was shown to be enhanced by the students' view of the gamified online quizzes as pleasant and effective. The online quiz is an effective formative evaluation tool for educators in large classrooms and might replace conventional classroom quizzes.

In the research Kahoot as a formative assessment tool in foreign language acquisition, Kapsalis, et al., (2020) found the usefulness of Kahoot as a formative assessment tool in reinforcing grammatical concepts in adult foreign language acquisition is examined in the study. Using Kahoot, Greek at the A1 level was the focus language in a multilingual, multicultural learning environment. To compare the advancement of pupils utilizing Kahoot (Experimental group) to those using conventional techniques like paper and pencil assessments, an experimental quantitative approach was used (control group). Both groups took pre-and post-tests to see whether the students had absorbed the grammatical concepts they had been taught more effectively. The research was done at the University of Ioannina's Center for the Study of the Hellenic Language and Culture (Greece). Overall, both groups' post-test performance improved significantly. However, there was not a noticeable performance gap between the two groups.

The study by Huang et al., (2019) examined undergraduate students' behavioral and cognitive engagement levels in gamification-enhanced flipped learning. This study aims to ascertain if incorporating gaming features into flipped courses may enhance student engagement. A comparison research was conducted involving two cohorts of undergraduate students enrolled in an information management course. The results indicated that participants in the gamification-enhanced flipped learning cohort (n = 48) had a higher likelihood of timely completion for pre- and post-class assignments than their counterparts in the non-gamified flipped learning cohort (n = 48). The results of the pre-class thinking tasks indicate that students in the gamification-enhanced flipped learning group produced more excellent artefacts than those in the non-gamified flipped learning group. Furthermore, the group that experienced gamification-enhanced flipped learning demonstrated superior performance compared to the students who did not receive gamification on the examination administered after the course. Further studies could use an identical design framework to examine other student cohorts and courses, substantiating the methodology's effectiveness.

To determine how well the Kahoot game enhances students' vocabulary learning, Putri (2019) performed quasi-experimental research utilizing a quantitative methodology. This study's participants included fifteen seventh-graders. The experimental group's pre-test means score was 74.45, while the control group's was 72.11; both groups' mean scores increased after treatment. On the post-test, the experimental group scored 86.81, whereas the control group got an average of 81.05. The scores of students taught using the Kahoot Game, and those taught using the traditional technique clearly show differences. Thus, the Kahoot game enhances pupils' vocabulary learning more than the conventional approach.

This research article aimed to examine the potential effects of a gamified multimodal learning environment on university student's final grades in a topic taught in a faculty of education at a Spanish university (Arufe-Giráldez et al., 2022). One hundred thirty-three university students from Spain participated in the study. The post-test design was quasi-experimental and included a control group. The control and intervention groups had 66 and 67 pupils, respectively. For the intervention group, a multimodal gamified learning environment was created in place of the conventional teaching strategies used for the control group. Every single one was used all through the school year. The findings showed statistically significant variations in the end average grade (p 0.001), with intervention group students receiving better overall rates. Similarly, students from the intervention group performed better on the voluntary learning activities, earning more Health Points (p = 0.006), Experience Points (p = 0.005), Total Scores (p = 0.002), and Level Achieved (p = 0.003). These results suggest that gamified multimodal learning environments might affect students' academic achievement. A more scientific study, however, is required to back up these conclusions. We saw how many students participated in the gamification process in the GLE and obtained plenty of experience points, health points, and excellent final scores. Other pupils lacked the drive or propensity to rack up the points. A more empirical study is required to evaluate the various teaching methodologies and examine how GLEs impact students' final grades and motivation levels.

This research investigated by Alzaid (2018) whether vocabulary learning using technology would be more effective than using PBFA. Additionally, this research elicited ESL students' perceptions of the learning ideals, motivation, and competency of GBFA and PBFA. Additionally, this research was interested in determining if motivation among students and vocabulary learning are related. In the present study, two upper intermediate ESL classes participated in GBFA and PBFA sessions for two weeks. Except for the assessment tasks, each group used different materials. The experimental group used mobile phones to complete the assessment tasks, while the control group relied on traditional worksheets. The respondents completed a questionnaire on their encounters with GBFA (Group-Based et al.) and PBFA (Peer-Based Formative Assessment) after three instances of formative assessment. The subsequent analysis examined the correlation between motivation and learning by juxtaposing the post-test outcomes of the students with their responses to motivating inquiries in the survey. The results indicate that gamified formative assessment has more potential for augmenting vocabulary learning than traditional paper-based assessment methods.

Additionally, it was shown that the experimental group exhibited higher levels of perceived competence and motivation than the control group. The study's results also indicated a correlation between motivation and language acquisition. However, students across the field in the sample believed that both methods benefited their vocabulary development. This research demonstrates that technology and gamification in the classroom enhance motivation, vocabulary learning, and competency compared to conventional paper-based formative assessment.

The Washback impact of Quizizz on students' learning in higher education was the focus of Pitoyo and Asib (2020) gamification-based assessment research. This research examined how the Quizizz assessment platform affected students' learning. The researcher conducted in-depth interviews, observational studies, and questionnaires to investigate the

problem. A qualitative analysis of the collected data will be done. The study's findings indicate that after taking many gamified Quizizz tests, students were inspired and eager to learn more. They were intrigued by game features, including the leaderboard, meme, time limit, and test report.

Different research studies have been conducted, and it has been reviewed and synthesized that gamification is effective in achieving educational success and is also considered a new educational technique. However, the in-depth analysis did not find how gamification-based learning affects students' academic achievement regarding all lower-order cognitive abilities. The existing research provides little data about the impact of gamification-based learning on students' academic accomplishment in lower-order cognitive abilities. In order to examine the impact of gamification-based learning on students' academic accomplishment in low-order thinking skills, exploratory research was conducted using the interview approach.

III. RESULTS AND DISCUSSION

3.1 Results

Braun and Clarke (2006) provide a comprehensive six-phase approach that offers a valuable foundation for the implementation of theme analysis. The technique discussed is often regarded as very successful within the field of social sciences due to its provision of a well-defined and practical framework for conducting theme analysis (Maguire & Delahunt, 2017). Braun and Clarke (2006) provide a framework consisting of six steps for theme analysis.

These phases are outlined as follows.

(a) Become familiar with the data, (b) Generate initial codes, (c) Search for themes, (d) Review themes, (e) Define themes, (f) Write-up.

An inductive approach was applied to the data where the participant's statements were openly coded through a thematic step-by-step analyzing method (Braun & Clarke, 2006).

3.2 Discussion

The research question is "Does Kahoot-based gamification learning help to develop lower-order thinking abilities of the cognitive domain (knowledge, comprehension, and application)"? If yes, how?

Three themes were made from the fifteen sub-themes: immediate constructive feedback, motivation, and cognitive development. It is described in Table 1.

Table 1 Themes and Sub-themes

Themes	Immediate Constructive feedback	Cognitive Development	Motivation
Sub-themes	Quick response, correcting errors, real-time feedback, revision	comfortable environment, learn to play, challenging tasks, reduce anxiety and stress, puzzles game, competitive environment, time management skills	Fun-based environment, entertainment, active learning, encouragement Points

Theme 1: Immediate Constructive Feedback

Most participants described that the Kahoot-based gamification provided immediate constructive feedback and helped them acquire knowledge and skills. It also offers quick and real-time feedback during instruction that may overcome errors and mistakes by revision. Real-time feedback improves students' abilities and also overcomes confusion about the questions. Kahoot game-based tests offered practical chances to review material discussed during interactive sessions. It also made it easier to identify knowledge gaps, which helped guide the development of effective corrective measures.

Most participants mentioned that they could refer to their results and elaborate on their answers because the real-time feedback was shown on the screen. "*The availability of real-time feedback allowed us to evaluate our responses critically, thereby promoting the learning of the presented content.*"

The majority of participants also believed that "*When we play the Kahoot-based game, we get knowledge and reduce the confusion about the lesson due to real-time corrective feedback display on our screen and also do revision which may develop the low order thinking abilities.*"

Besides, one participant said, "*It is a good interactive assessment platform that provides opportunities to get knowledge with immediate corrective feedback and also correct the mistakes that happen while playing game and revise the lesson*".

Theme 2 Cognitive Development

The participants also believed that using Kahoot gives them valuable chances to consider their learning and reduce test anxiety and stress. It also provides a comfortable environment, like learning to play. The Kahoot-based game provides puzzles and quizzes with time-bounds that provide a competitive and challenging environment among classmates, and they can use their lower-order abilities. Challenges and competition while attempting the task with fixed time intervals can increase time management skills and also be able to improve lower-order abilities. "*We can recognize conceptual and comprehensive ideas that need more focus due to using Kahoot. Challenges and complications may be handled in a group setting to achieve meaningful Kahoot game-based. We are kept interested in the lesson and given a chance to apply principles of the material via Kahoot.*"

The participants of Kahoot as a platform for game-based learning suggested that time management may be improved with continued active participation. Most participants said, "*If more chances are provided to utilize Kahoot as a learning tool, time management skills can be improved. Extensive use of Kahoot-based game practice may improve learning*".

Theme 3 Motivation

Real-time delivery of Kahoot-based game tests improved students' participation and motivation during teaching. Most participants said that Kahoot-based games provide a fun environment that may give opportunities for active learning with enjoyment. When they play with a Kahoot-based game, their earn scores are displayed on the scoreboard. Those who attempt the quiz, puzzles, etc., with minimum time, get high scores, or points are displayed on the scoreboard. This makes them a simulative and enthusiastic environment in the classroom.

The majority of the participants believed that *The Kahoot-based game is one of the most promising strategies for getting children interested in learning. Kahoot games-based learning reinforces knowledge and critical abilities like teamwork and applications. Kahoot-based games develop a more active and enjoyable learning environment. We can solve complicated and challenging tasks without pressure, anxiety, and stress.*

A few participants described that "*Kahoot based game also discourages when we do not attempt the quiz, puzzle, etc. in minimum time our scores are not displayed in scoreboard. However, major participants believe we learn more when playing the Kahoot game and feel easy and comfortable*". Students who feel comfortable and efficient may utilize their abilities to perform more. Kahoot-based games may increase student engagement and participation levels and help develop particular lower-order cognitive abilities.

IV. CONCLUSION

Gamification-based learning plays a significant role in teaching. It is an innovative method to assess students' performance with immediate feedback through a gamification-based environment. Gamification is considered a new educational strategy that successfully obtains academic performance in several research papers examined and summarized. Gamification plays a positive role in enhancing students' overall success. However, thorough research has yet to explore how gamification-based learning impacts students' academic performance in all lower-order cognitive domains. In terms of lower-order cognitive domains, it is found that there needs to be more evidence in the literature on the effectiveness of gamification-based learning on student academic attainment. Exploratory research using the interview approach was used to determine how gamification-based learning affects students' academic success in low-order cognitive domains. It is concluded that when prospective teachers play the Kahoot-based game, they get knowledge and reduce the confusion about the lesson due to real-time corrective feedback displayed on their screen and also do revision, which may develop the low order thinking abilities. Kahoot-based games provide prospective teachers with real-time constructive feedback, ensuring active participation and improving their time management skills through the fun-based environment. The Kahoot-based game offers time-limited puzzles and quizzes that foster competition among prospective teachers and use their lower-order cognitive abilities. While performing the Kahoot game with set time limits, challenges, and competition might develop lower-order and time-management skills.

Recommendations

Gamification-based formative assessment plays a vital role in stimulating prospective teachers by providing real-time corrective feedback during instruction in the classroom. The thematic analysis shows that Kahoot-based gamification develops prospective teachers' cognitive abilities. It is recommended that Kahoot-based formative assessment practices be implemented while delivering instruction in the classroom.

The Kahoot-based formative assessment may provide opportunities for prospective teachers to overcome the confusion about lessons delivered by the instructors. The thematic analysis of the study showed that prospective teachers easily understand the topic taught by the instructor when they provide gamification-based formative assessment via Kahoot, which also overcomes the ethical pressure among their classmates.

The study was conducted with an explorative design with a qualitative approach. For results, authenticity, and to ensure validity, experimental studies on different school-level students should be performed in future studies.

This study was performed on the role gamification-based formative assessment of prospective teachers' lower-order thinking abilities; future studies may also be conducted on higher-order thinking abilities.

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