Level Up Learning: A Gamified Approach to Boost Student Motivation

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In this research, we'll address the challenge of student disengagement by exploring the effectiveness of gamification to enhance engagement among university students. We'll investigate the application of game design features to increase motivation. Our study is motivated by the pain point of students falling behind in coursework often due to a lack of motivation and engagement with course material. Our proposed solution involves leveraging gamification to create a more interactive and engaging learning environment, ultimately aiming to improve university students' motivation to complete assignments. To achieve these objectives, we'll analyze user needs through surveys with university students. Ultimately, our survey questions will help us gain insights into their learning preferences, study habits, attitudes toward gamified learning, and opinions of gamified examples in learning platforms. This user-centered approach guides the design process to ensure alignment with the interests and needs of the target user base.

Additionally, we'll conduct an in-depth analysis of existing case studies, exploring reported successes and measurable outcomes in terms of increased participation, academic performance, and overall satisfaction. Drawing on related work, prior experiments demonstrate a correlation between gamification and increased motivation. However, existing studies suggest a need for controlled experimental settings to evaluate the impact on mandatory participation within a gamified context. Overall, our research will address the gap in current studies and aims to provide recommendations for the design and implementation of gamified learning tools to enhance student motivation in higher education.

Keywords and Phrases: Gamification, Engagement, Academic performance, Game design features, Motivation, Learning environment

1 INTRODUCTION

In recent years, the challenge of student disengagement has become a prominent concern within higher education. This research aims to tackle this challenge by delving into the potential of gamification as a means to enhance motivation and engagement with course materials among university students. The history and background of this research are rooted in the recognition of a prevalent issue: students frequently falling behind in coursework due to a lack of motivation and engagement with the material. The conventional methods of instruction, often linear and traditional, have struggled to capture the interest and enthusiasm of today's diverse student population. In response to this pain point, our proposed solution involves the strategic application of game design features to create a more interactive and engaging learning environment. To substantiate our research, we draw upon a variety of studies that have explored 2 topics: Gamification in Educational Settings and Student Engagement, and the Implementation and Evaluation of Gamified Learning Environments.

One study that explored the first topic utilized a gamified app to test participants on topics ranging from exam regulations to social events [1]. The study replicated findings that gamification of learning increased engagement, particularly when employing an anti-binge feature to regulate study sessions. This experiment not only emphasizes

the effectiveness of gamification in engaging participants but also highlights the importance of well-designed gaming features to enhance the learning experience. Another study delved into the specific game design features that contribute to psychological need satisfaction, such as points, badges, leaderboards, and more [3]. This highlighted the unique impacts of each element on participants' perceived relevance and competence needs. This nuanced understanding underscores the need for tailored approaches in the application of gamification to address diverse psychological needs.

Moving onto exploring the second topic, one study introduces Gamify-IT, a web-based gaming platform designed for software engineering education [6]. This platform integrates immersive gaming features and evaluates positively for enhancing student engagement, motivation, and learning outcomes. The study's evaluation results suggest the potential of gamification to create a structured and engaging learning environment, catering to different learners. Another study explored the gamification of Massive Open Online Courses (MOOCs), utilizing the website Quizlet [7]. The study revealed that gamification not only increased participant interest in completing the course, but also improved examination outcomes, leading to decreased drop-out rates. This highlights the broader applicability of gamification in diverse educational settings.

Motivated by the desire to improve university students' motivation to complete assignments, our study explores the effectiveness of incorporating game design features to increase motivation within educational contexts. The rationale behind this approach lies in the understanding that game design features, such as pathways, rewards, and a point system, can potentially foster a more compelling learning experience. To achieve our research objectives, we will adopt a user-centered approach, initially analyzing user needs through surveys administered to UCSD students. These surveys will seek insights into students' learning preferences, study habits, attitudes toward gamified learning, and opinions of gamified examples in learning platforms. By aligning our design process with the interests and needs of the target user base, we aim to ensure the practicality and relevance of our proposed gamification strategy. While prior experiments have demonstrated a positive correlation between gamification and motivation, there is a room for improvement. Therefore, we aim to provide nuanced insights and recommendations for the design and implementation of gamified learning tools, thereby contributing to the enhancement of student motivation in higher education.

2 CITING RELATED WORK

Topic 1: Gamification in Educational Settings and Student Engagement

Gamification as a tool for engaging student learning: A field experiment with a gamified app - Kasper Welbers, Elly A Konijn, Christian Burgers, Anna Bij de Vaate, Allison Eden, Britta C Brugman, 2019 [1]

- Description: This study used volunteer participants in collaboration with a multiple-choice quiz-based application to study the engagement of gamification. The app tested participants on topics “ranging from exam regulations to social events.” Prior experiments in the field show that gamification did increase engagement with learning about school resources, but the volunteers of the study and quiz-based game design may differently impact effectiveness in other aspects. This experiment replicated findings that gamification of learning engaged participants (high retention). To promote effective learning, they tested an anti-binge feature to see whether participants would complete the same number as sessions. If so, and as was found, then students will perform the same number of sessions as their non-time-gated peers while their learned material would be retained better. Additionally, they discovered that generic

feedback was (surprisingly) more effective than personalized feedback in the form of weekly progress emails. Overall, feedback did not affect the amount that volunteers played the app.

- Difference: This study does have some problems with the volunteer nature of the sample. Our goals differ from this reference due to the fact that we are probing students about what kinds of gamification they may want to see in the classroom or online academic websites or believe may benefit their engagement (consequently performance) in school, rather than a voluntary "more work" program such as the one in the study. It demonstrates that gamification is correlated with increased engagement. Despite relatively low volunteers compared to the total population, a significant number of participants remained engaged with the study's app. A formal experiment upon parallel classrooms may reveal different effects upon mandatory participation within a gamified context. A controlled experimental study of parallel classes taught with traditional (control) and different gamification practices could reveal the most promising techniques for implementation in real classrooms.

Play hard, study hard? The influence of gamification on students' study engagement [2]

- Description: This study aimed to investigate the psychological outcomes of students based on enjoyment, self-efficacy, and study engagement. The proposed hypotheses suggested that the integration of gamification into educational settings would result in heightened levels of student enjoyment and confidence, consequently leading to improvements in study engagement. They found notable correlations among the variables, indicating significant relationships between enjoyment and productivity, as well as between these psychological outcomes and engagement. This study validated measurements and conducted regression analyses to explore direct and mediating effects, showing that gamification positively correlates with engagement and both enjoyment and productivity. Furthermore, the study collected data from undergraduate students who were enrolling in a Marketing course at a Chinese university, ensuring a comprehensive exploration of the gamification's impact on students in an educational context.
- Difference: This study focuses on examining the psychological outcomes of students, specifically investigating the impact of gamification on enjoyment, self-efficacy, and study engagement. It utilizes survey data from one university in China and employs methods such as confirmatory factor analysis and regression analyses to explore the relationships between gamification, enjoyment, self-efficacy, and study engagement. On the other hand, our study aims to address the challenge of student disengagement by exploring the effectiveness of gamification in enhancing engagement among university students. Our study is more intervention-oriented, proposing the use of gamification as a solution to increase motivation for completing assignments. We plan to analyze user needs through surveys with university students, focusing on learning preferences, study habits, attitudes toward gamified learning, and opinions on gamified examples in learning platforms.

How gamification motivates: An experimental study of the effects of specific game design elements on psychological need satisfaction - ScienceDirect [3]

- Description: This study investigated game design elements and their distinct psychological effects on participants. They examined specific elements like points, badges, leaderboards, performance graphs, meaningful stories, avatars, and teammates, and showed that each of these independent game elements has unique impacts on participants' perceived relevance to their experience. Drawing on the self-determination theory framework, the study showed that certain elements, such as badges, leaderboards, and performance graphs, positively influence the satisfaction of participants' competence needs and enhance the perceived meaningfulness of

tasks. Moreover, the study suggested that the visibility and manipulability of these elements within games play a crucial role in determining their psychological effects. This nuanced understanding sheds light on the intricate relationship between game design elements and participants' motivation, emphasizing the need for tailored approaches in the application of gamification to address diverse psychological needs.

- Difference: This study investigates the psychological effects of various game design elements, employing a randomized controlled study within an online simulation environment. It focuses on understanding how specific game design elements, such as badges, leaderboards, and performance graphs, impact participants' perceived relevance to their experiences, emphasizing on fulfilling basic psychological needs. The study aims to provide insights into the nuanced effects of these elements, highlighting that gamification is not universally effective, but that specific elements have distinct psychological consequences. On the other hand, our study focuses on addressing the challenge of student disengagement in higher education. We'll explore the effectiveness of gamification, focusing on the application of game design features, in regards to increasing engagement among university students. Our research will incorporate an in-depth analysis of existing case studies to explore reported successes and measurable outcomes related to increased participation and overall satisfaction. We aim to provide recommendations for the design and implementation of gamified learning tools to address student engagement and increase motivation.

Cyber Range and Cyber Defense Exercises: Gamification Meets University Students [4]

- Description: This study delves into the transformative role of gamification in cybersecurity education, particularly focusing on the implementation of hands-on exercises like Capture The Flag (CTF) competitions and Cyber Defence eXercises (CDX). Acknowledging the pervasive integration of hardware and software in our daily lives, the paper emphasizes the critical need for cybersecurity defenders and heightened awareness among diverse stakeholders. The complexity of cybersecurity training, encompassing various technical domains, needs engaging and practical learning environments. They advocate for the extensive use of gamification techniques, highlighting the success of CTF events and delving into the less explored yet impactful realm of CDXs. Detailing their experience with organizing a CDX using a Cyber Range infrastructure for university students, the study challenges misconceptions about the resource-intensive nature of CDXs, demonstrating their affordability and effectiveness. The paper serves as a valuable resource for educators, showcasing evidence of CDXs as cost-effective tools for cybersecurity training. The study concludes by encouraging the broader adoption of CDXs alongside other hands-on training methods, envisioning benefits for courses targeting cybersecurity defenders and stakeholders.
- Difference: This study centers around enhancing cybersecurity training through gamified hands-on exercises, specifically Capture The Flag (CTF) competitions and Cyber Defence eXercises (CDX). Their primary goal is to share their experience in organizing and managing these exercises with university students, emphasizing the affordability and effectiveness of CDXs, particularly within Cyber Ranges. On the other hand, our study addresses the prevalent issue of student disengagement within higher education. We aim to explore the potential of gamification to enhance motivation and engagement with course materials among university students. The focus is on incorporating game design features to create a more interactive and engaging learning environment, with a particular emphasis on improving student motivation to complete assignments. While both studies involve the application of gamification in an

educational context, the specific domains and objectives differ significantly. This study is centered on cybersecurity education and hands-on exercises, showcasing the practical aspects of gamification within a specialized field. In contrast, our study is more broad, aiming to improve overall student engagement and motivation in higher education through gamification, with a focus on user-centered design and tailored approaches.

Gamification as a driver of motivation in the organizations: A Bibliometric Literature Review [5]

- Description: This study explores the intersection of worker motivation and gamification in organizational settings, aiming to understand the impact of gamified strategies on employee behaviors. Motivation, recognized as pivotal for individual and organizational success, is examined through the lens of gamification, encompassing extrinsic factors like rewards and intrinsic motivations tied to personal and psychological goals. The study embarks on a bibliometric review to identify key themes in existing literature, shedding light on the benefits and challenges of employing gamification in the workplace. Against the backdrop of technology's rapid evolution, organizations seek innovative practices, with gamification gaining prominence as a strategy to maintain and enhance worker motivation. The study unfolds in two main parts: firstly, delving into the concept of gamification, its applications, and potential impacts on organizations; secondly, exploring the intricate topic of worker motivation. The study concludes with insightful discussions, drawing implications, and suggesting avenues for future research in the dynamic realm of gamified strategies and organizational motivation.
- Difference: While both studies address challenges in educational settings, they differ in their specific contexts, objectives, and approaches. This study focuses on the broader theme of worker motivation in organizational settings, utilizing gamification as a strategy to induce desired behaviors. They aim to conduct a bibliometric review to identify key themes in existing literature on gamification in the workplace. They also explore the historical evolution of gamification, its rising popularity, and its application in various sectors beyond traditional workplaces. On the other hand, our study centers around the prevalent concern of student disengagement in higher education, proposing gamification as a solution to enhance motivation and engagement with course materials. Rooted in the acknowledgment of students falling behind due to a lack of motivation, our study aims to strategically apply game design features to create a more interactive and engaging learning environment.

Topic 2: Implementation and Evaluation of Gamified Learning Environments

Gamify-IT – A Web-Based Gaming Platform for Software Engineering Education [6]

- Description: This study proposes a web-based gaming platform for software engineering education called Gamify-IT, which aims to enhance student engagement and learning outcomes through gamification. The platform integrates immersive gaming elements, including role-playing, exploration, and various minigames tailored for both programming and generic content. The domain model and game mechanics establish a structured framework, with courses consisting of themed worlds, dungeons, and minigame tasks, allowing students to progress by achieving a score of at least 50%. Gamify-IT supports different player types, including socializers, explorers, and achievers. The platform's architecture utilizes a microservice approach with Docker Containers, enabling independent development and easy integration of new minigames. The evaluation results indicate positive feedback from 20 students, with high ratings for the learning experience, motivation, and exploration aspects.

Chickenshock emerged as the most favored minigame, while Finitequiz received lower ratings, suggesting a need for more advanced gamification in certain areas.

- Difference: This study focuses on the implementation and evaluation of a specific gamified learning environment, Gamify-IT, which is designed for software engineering education. The platform incorporates immersive gaming elements, minigames, and a structured framework with a particular emphasis on software engineering concepts. The evaluation involves assessing student engagement, motivation, and learning outcomes within this specialized context. On the other hand, our study focuses on a broader research initiative addressing the challenge of student disengagement in higher education. We aim to explore the effectiveness of gamification as a general strategy to enhance engagement among university students. We propose a user-centered approach involving surveys with university students to understand their learning preferences, study habits, attitudes toward gamified learning, and opinions of gamified examples. We'll also explore reported successes and measurable outcomes related to increased participation and overall satisfaction in gamified learning contexts from other studies. Overall, we want to figure out recommendations for the design and implementation of gamified learning tools in university learning environments, focusing on enhancing student engagement and motivation more broadly.

Gamification of MOOCs for increasing user engagement | IEEE Conference Publication [7]

- Description: This study explores the gamification of "Massive Open Online Courses" (MOOCs) from "Massive Open Online Education Platforms" (MOOEPs). These courses are similar to traditional college courses but differ in their purely online nature and thus disjointed location and time. Gamification involved the website Quizlet, a resource for web-based index cards to learn and memorize information. This contrasted with the traditional group in a standard word learning course. Of 50 candidates in each group, 30% declined to take the final exam in the traditional group while only 16% declined in the Quizlet group. Furthermore, the Quizlet group had higher passing rates (72% compared to ~63%) despite a higher requirement to pass (70% compared to 65%). The researchers concluded that gamification not only increased participant interest in completing the course, but also improved examination outcomes. In other words, both engagement and success in the MOOC increased and drop-outs decreased.
- Difference: This study focuses on the gamification of purely online classroom contexts while we are interested in the results of gamification in a standard university context (thus with mixed in-person and remote courses). This study is promising in its straightforward findings about the success of gamification strategies in remote contexts, however we are searching for gamification to improve results in both in-person and online contexts that are present at a standard university environment. Furthermore, the remote aspects of the study are not directly translatable to in-person contexts that we seek to gain insight into; for example, Quizlet's index card features are a metaphor for physical flashcards, but it is to be seen if physical constraints diminish results or if completely different alternative methods are required to reach similar success.

Effects of a gamified learning environment on students' achievement, motivations, and satisfaction [8]

- Description: The primary focus of the paper was to study the effect of a gamified e-learning environment on middle school students' motivation, satisfaction, and achievement in learning computer science. Through designing a gamified platform for 8th-grade students, the study analyzes how these features influenced their learning experience. The findings showed that the incorporation of gamification elements could increase students' motivation and satisfaction levels significantly in their learning of computer science. However, the study did not observe

any significant impact on students' academic achievements. Furthermore, the overall results support implementing more gamification elements into e-learning platforms.

- Difference: This study focuses on computer science education for middle schoolers, which is different from ours in examining the broader application of gamification across diverse majors and age ranges. While acknowledging the potential attractiveness of gamified elements to younger students, our study remains cautious about generalizing its effectiveness to older students or across diverse majors due to inherent biases. Moreover, our study occurs after the pandemic, showing an advantage as our participants have experienced both online and offline learning environments. In contrast, this study was conducted during the COVID-19 lockdowns, where students were exclusively confined to online learning, potentially impacting the evaluation of gamification's efficacy.

Gamification for Education: Using LexiPal to Foster Intrinsic and Extrinsic Learning Motivation of Students with Dyslexia [9]

- Description: This study focused on the improvement of motivation in nine young students in Indonesia with dyslexia, a learning disability that makes it difficult for the students to recognize words in reading and writing. Children with dyslexia are often demotivated to learn due to negative environmental and social aspects such as a perceived lack of intelligence which may lead to further negative outcomes like bullying. As a result, there is reason to explore methods to improve motivation to engage with academic work in such children. Separately, motivation has intrinsic and extrinsic factors that are different between people depending on interest, action, or goal. In a gamification setting, these factors can be influenced by overt progression and mastery of topics, scoreboards, appeal of the gamified system as a whole, digital and physical rewards, and praise to name a few. The students used the LexiPal software in hopes of increasing their motivation to learn. After students interacted with the software over a week, surveys with the students and interviews with the teachers were conducted. Student outcomes included “fine motor skills, time perception, emotional intelligence, cognitive flexibility, and the ability to form complete sentences.” These were all results of increased motivation to learn given the students’ enthusiasm to complete all levels available.
- Difference: This study focuses on a younger age group than we are targeting and further targets a specific minority of students with dyslexia. Results from the study may not be generalizable to the same extent in an older college student population as a whole, but the results should not be disregarded either due to the displayed ranging benefits of gamification outcomes on students that are demotivated to learn (perhaps even in similar emotional contexts to older students). Furthermore, our participants are from a college in the USA and not grade schools in Indonesia, which may have vastly different social and environmental effects on the replicability of the study. Regardless, it would be a great discovery if we could reveal similar benefits of gamification on a college student population.

The impact of gamification on students’ learning, engagement and behavior based on their personality traits [10]

- Description: This study explored the different outcomes of gamification on college students based upon their personality traits. It acknowledged that gamification does not always have a positive effect on students, especially due to certain competitive methods of increasing motivation such as leaderboards. In previous studies, extroverts and introverts had varying success with gamified elements, sometimes opposite to each other as in the case of ranking. This study discovered that gamified elements the class’ web-based environment for giving

assignments and programming exercises showed a higher average of markers in engagement compared to the non-gamified group although no statistical difference was evident. Personality traits measured included openness, conscientiousness, extroversion, agreeableness, and neuroticism. Accuracy on assignments statistically improved in the gamified scenario, and introverted participants displayed higher points and logins than extroverted peers. People with higher neurotic personality traits displayed a higher number of logins overall in both groups. Gamification benefited those with a lower agreeableness trait and those with a lower conscientiousness trait the most. As shown, a student's personality traits may affect how they perceive and benefit from gamification. Therefore, gamified elements with such visibly mixed outcomes should be considered cautiously when comparing methods for increasing motivation.

- Difference: Our study does not focus on the personality traits of our participants and their performance in a gamified environment but rather their preferences in learning and whether they perceive gamification to be beneficial. However, this study is very insightful by illustrating that not all people—as is particularly seen between extroverted and introverted students—will benefit from a gamified design that incorporates game design elements regardless of their potential influences on student performance. As such, methods that increase competition and ranking should be considered cautiously, which aligns with our survey's results of mixed perception of the leaderboard on motivation.

3 METHOD

Our project aims to enhance the learning experience by implementing gamified elements within some learning websites. To comprehensively understand the diverse student needs, studying preferences, and the potential impact of gamification on student engagement and motivation, we are using an approach centered around the creation and analysis of surveys. These surveys will delve into students' learning preferences and habits, gauge their inclination toward gamified learning, and investigate their expectations regarding this method. Furthermore, the surveys will present specific learning scenarios within the platform to evaluate target users' feedback on the implementation of gamified features.
The survey will be created in Google Forms and spread out by group members. Here are the survey questions:
Asking students' learning preferences and habits:

- How frequently do you use Canvas per week?
- How do you best learn?
- Do you like learning visually, auditorily, or kinesthetically?
- Which learning style do you think is the most beneficial? And why?
- Do you like hands-on activities, lectures, or group discussions?
- Why do you think that dynamic is the most beneficial? And why?
- Is there a different dynamic and learning style that works better for you? If yes, what's the best way you like to learn and why?

Asking students' attitudes to gamified learning platform:

- Do you think the gamification of learning environments is beneficial?
- How helpful do you think gamified features (confetti, mastery paths, digital badges and leaderboards, point system, module level unlocking) are in increasing your motivation in finishing assignments on Canvas? (Scale 1 to 5)
- What is your experience with gamified features in learning environments? Positive/Negative? Did they help with your motivation?

- What other gamified features do you think can improve students' motivation in completing their assignments?

This task might involve presenting learning scenarios within the existing learning platform. They will be designed to have potential gamified features such as earning points for completing tasks, or unlocking levels. Students will then provide feedback on their feelings of engagement and preferences concerning these simulated gamified elements.
To ensure a diverse sample, the participant recruitment process is a challenge for us. Our group members will send out Google surveys on our social media platforms to reach students across various academic levels and disciplines. Our survey will have varied conditions to make sure the participants' reactions are recorded accurately under different situations. For example, using different levels of rewards and different challenge complexity within the gamified elements. These are important because we can better understand how participants respond to diverse gamified setups and let us know which elements are most effective.

4 ALTERNATIVE METHOD

One of the alternative methods is to do interviews. The interview is a more personal way to get the information we want, and it could be more targeted to get the specific data we want. This method will explore in-depth participants' perceptions, opinions, and attitudes regarding gamified learning within the specific website. The reason we are not pursuing this is the limitations of getting data. Also, coordinating schedules for interviews could be challenging and time-consuming.

Another alternative method is to do usability testing. Usability testing for our project will involve observing students when they interact with the learning website designed with gamified elements. While usability testing could provide valuable insights into how students engage with the gamified learning platform, it mainly focuses on the functionality instead of user preferences, and attitudes. Also, it is difficult to have a sample gamified learning platform.

5 RESULTS

The survey conducted at UCSD aimed to examine learning preferences and attitudes toward gamification. We gathered 31 responses from UCSD students. Notably, all respondents were familiar with Canvas, with 83.9% using it extensively. The findings highlighted a strong inclination (96.8%) towards visual learning, although a substantial portion (77.4%) also favored auditory and kinesthetic modes. A majority (61.3%) perceived visual learning as the most beneficial, citing its efficacy in understanding intricate concepts via visual representations and its clear, reliable nature in reducing ambiguity compared to other modes. Regarding classroom dynamics, the preferences varied: 38.7% preferred hands-on practice, 35.5% favored lectures for precise information delivery, and 25.8% valued group discussions for diverse viewpoints. There are reasons behind it. Hands-on practice offered real-time application of knowledge; lectures were favored for their direct access to instructors for focused questioning; and group discussions were valued for the exchange of diverse perspectives among students. Additionally, when asked about alternative dynamics and learning styles, respondents highlighted a remarkable ability to retain essential information by associating each crucial part with a different form of learning, enabling them to recall the entirety of the material effectively.

Exploring gamification on Canvas revealed that 90.3% of participants were familiar with its features. While Canvas confetti was deemed less motivating, mastery paths and point systems received positive feedback for enhancing assignment completion motivation. However, digital badges and leaderboards evoked mixed reactions, with an equal number expressing strong positivity and negativity towards them. The study generated insightful suggestions to enhance gamified features. Respondents proposed daily check-ins, profile customizations linked to achievement points, skill trees offering diverse learning paths, and customizable avatars as incentives for completion. Additionally, they recommended integrating encouragement messages and cooperative gaming elements to further boost motivation.

In conclusion, through this survey, we find the importance of accommodating diverse learning preferences and leveraging various teaching methods to create inclusive and effective educational environments. Also, respondents' attitudes towards gamification features on Canvas and suggestions for enhanced gamified elements present opportunities for designers to use gamified features to improve people's learning motivation.

6 DISCUSSION

There are limitations of the results. First, we only have 31 responses and they are all from UCSD which are too narrow to get the conclusion of people's learning preferences and their positive attitude to gamification. Second, our questions should contain more perspectives and because there are not only three styles of learning mode. Third, we should employ longitudinal approaches to capture a more comprehensive understanding of the long-term impact of gamified e-learning environments.

The study's limitations are obvious and should be considered when interpreting the findings. Primarily, our sample size of 31 respondents solely from UCSD are biased of the conclusions regarding learning preferences and attitudes towards gamification. This narrow scope may not adequately represent the diverse range of learning styles and preferences across broader demographics or majors. Future study should aim for a more diverse participant pool. Furthermore, the survey only focuses on three primary learning styles—visual, auditory, and kinesthetic, which might not fully capture the complexity of individuals' learning preferences. We should incorporate a more comprehensive range of learning styles and preferences in future surveys.

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DISCUSSION FEEDBACK

See feedback file.

JOURNAL

See journal file.