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# Impact of Gamification on Engagement and Learning in Video-Based Platforms

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**Abstract:** Video-based learning provides flexible and self-paced learning. However, passive video consumption results in shallow learning. To address this, reflective activities such as commenting on videos and reviewing peers' comments are used to increase engagement. Incorporating gamification can further boost engagement. This study investigates the impact of gamification, specifically badges, on student engagement and learning in video-based learning. We conducted a comparative study between a gamified and a non-gamified version of the same platform. Findings show that badges significantly increased learner engagement. Student feedback indicated a positive reception of badges. Also, students who used the gamified platform wrote higher quality reflective comments on videos, leading to increased learning.

**Keywords:** Gamification, Badges, Video-Based Learning, Engagement, Learning

## 1. Introduction

Video-based learning (VBL) offers flexibility and allows learners to control the pace of learning (Sablić et al., 2021). However, passive consumption of videos often results in low knowledge retention (Chatti et al., 2016). Various strategies can increase learner engagement, including annotations (Chatti et al., 2016), quizzes (Koedinger et al., 2015), and interactive note taking (Mitrovic et al., 2016). Learners who take quality notes by capturing and reflecting on key video concepts achieve better knowledge gains than those who do not (Taskin et al. 2019).

Another way to increase engagement is gamification (Lee & Kim, 2025). Gamification leverages principles of game design and integrates game-like elements, such as points, badges, and leaderboards into non-game contexts (Deterding et al., 2011). Gamification motivates university students to achieve certain goals and behaviors, resulting in increased knowledge and performance (Tahir et al., 2022; O'Donovan et al., 2013).

In this paper we use gamification in VBL for presentation skills, one of the most demanded soft skills in industry (Galster et al., 2023). Presentation skills are the "Ability to exchange (send and receive) information in different form orally (e.g., in formal presentations or informal conversations)" (Galster et al., 2023). We address three research questions (RQs):

- **RQ1:** To what extent does gamification influence learner engagement in VBL?
- **RQ2:** To what extent does gamification affect learning outcomes in VBL?
- **RQ3:** What are learners' attitudes towards gamification in VBL?

We make the following contributions:

- We describe how gamification influences engagement based on interaction measures (e.g., platform usage, activity completion rates). We found that gamification enhances engagement in reflective activities and generally increases the use of the VBL platform.
- We explore how gamification influences learning outcomes in a VBL platform. We found that gamification influences learning by motivating students to write more high-quality comments when reflecting on video content.
- Regarding learners' perceptions towards gamification, gamification is well received by students. Also, self-assessed perceptions about the impact of gamification on learning are consistent with the actual learning effectiveness of gamification.

## 2. Background

**Video-based learning:** Videos present knowledge in a consistent and attractive manner (Yousef et al., 2014). By incorporating both audio and visual elements, videos offer a structured and engaging way to present training content for better understanding and knowledge retention (Yousef et al., 2014). VBL also removes physical and time barriers, allowing training in a setting and at a time that best suits learners (Sablić et al., 2021). Video-based training is effective and valued by students (Giannakos et al., 2016).

Despite its popularity, VBL provides limited human interaction and limited interaction with video content (Chatti et al., 2016). To avoid passive learning, active video watching (AVW) utilizes reflective activities such as annotations, writing comments, and rating comments (Correia & Chambel, 1999; Lau et al., 2016). Galster et al. (2018) conclude that AVW is promising for teaching presentation skills. Since then, there have been multiple developments in AVW to increase engagement and learning. For example, Mohammadhassan et al. (2022) enhanced AVW-Space (an AVW platform) with nudges, leading to a notable increase in conceptual knowledge. These improvements highlight that increasing engagement in learning activities increases learning in AVW platforms.

**Gamification:** Gamification is the use of game design elements in non-game contexts (Deterding et al., 2011). Example game elements include points, badges, leaderboards, challenges, and levels (Klock et al., 2020). Gamification aims to increase the intrinsic and extrinsic motivation of the user and get them involved in tasks by combining playful activities (Buckley & Doyle, 2014). Intrinsic motivation is the satisfaction from undertaking a task for its implicit satisfaction (for example, employees performing their tasks out of enjoyment), while extrinsic motivation is the satisfaction from achieving explicit rewards (for example, certificates) (Manzano-León et al., 2021; Fischer et al., 2019).

Gamification is beneficial for different educational levels, from primary to tertiary (Manzano-León et al., 2021). For example, Tahir et al. (2022) integrated gamification into an Intelligent Tutoring System (ITS) for a database course. Challenges, goals, and badges motivated students to perform more complex tasks. O'Donovan et al. (2013) gamified a course on computer game development using storyline, points, progress bars, badges, and leaderboards in an online learning tool. Student engagement and performance improved as a result of gamification, compared to the previous non-gamified course.

## 3. Research Method

### *3.1 Study Design*

We utilized purposive sampling (Baltes & Ralph, 2022) to recruit participants from students enrolled in ENGR101, a mandatory first-year course for all engineering students at the University of Canterbury, New Zealand in the years of 2023 and 2024. The study was conducted in the context of AVW-Space (Lau et al., 2016), a VBL platform which facilitates engagement through three learning activities: watching instructional videos, commenting to reflect on and interacting with the content, and reviewing peers' comments to encourage further reflection. The study received approval from the institution's human ethics board.

The study was conducted in two phases: In the first phase, students completed a pre-survey (Survey 1) to provide demographic data and answers to conceptual knowledge questions on presentation skills (see Section 3.3). Then, the students watched and commented on the eight videos. At the end of this phase, the instructor selected relevant student comments and anonymously published them in AVW-Space. In the second phase, the students reviewed their peers' comments. Finally, the students completed a post-survey (Survey 2), which included the same conceptual knowledge questions. In 2024 we added a treatment to AVW-Space to gamify the learning through badges to further enhance the engagement. Consequently, in 2024 we also surveyed students on their perception towards badges and the gamified AVW-Space. Students in both years received 1% of course credit for undertaking the exercise.

## 3.2 Game Elements and Implementation

We selected badges as the game element. Prior work showed that badges have the potential to support learning (Denny et al., 2018; Hakulinen et al., 2015; Tahir et al., 2022). Other elements, such as points and leaderboards which foster competitiveness (Amo et al., 2020) were discarded due to their potential negative impact on certain user demographics, such as extroverts (Codish & Ravid, 2014) and their drawbacks in educational contexts (Toda et al., 2017). Also, competition and social comparison have detrimental effects on motivation, behavior and peer relationships (Verheijen et al., 2019; Hanus & Fox, 2015). To mitigate these risks, we implemented badges using task-based awarding conditions, promoting individual progress without fostering competition. We designed 10 badges reflecting the three main learning activities in AVW-Space. We implemented three badges for watching videos, five badges for commenting on videos, one badge for reviewing peers' comments, and one badge to reflect the achievement of all other badges, see Figure 1. Table 1 presents the awarding conditions.

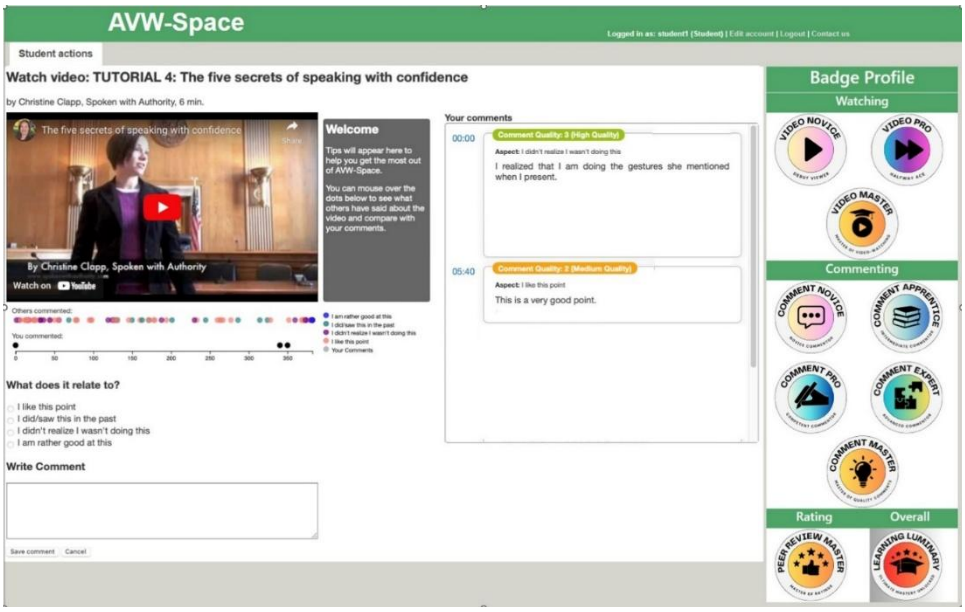


*Figure 1.* Gamified AVW-Space

## 3.3 Data Analysis

To measure engagement **(RQ1),** we analyzed AVW-Space logs: data on the number of distinct days users logged in, the number of user sessions, the number of videos watched, the number of comments posted, the number of nudges (personalized prompts) received, the number of high-quality comments written, and the number of peer comments reviewed.

Since assessing learning **(RQ2)** of students during live presentations was impractical due to the large cohort, we used an alternative approach. We asked students to complete timed pre- and post-surveys, listing terms related to delivery, structure, and visual aids. We automatically scored their responses using ontology developed in prior research (Dimitrova & Mitrovic, 2022) and used the resulting Conceptual Knowledge scores (CK1 and CK2) as a proxy for learning. We utilized descriptive statistics and statistical tests to compare the gamified (2024 group) and non-gamified (2023) groups. Perception surveys **(RQ3)** included closed and open-ended questions. For closed questions, we used descriptive statistics and quantitative methods. For open-ended questions, we analyzed responses using content analysis (Seidel, 1998). We started by extracting key phrases relevant to each question. Then, we identified recurring themes and organized them into distinct categories (Seidel, 1998).

Table 1. *Badges and Awarding Conditions*

| Badge | Task-based awarding conditions |
|---|---|
| Video Novice | Watch your first video |
| Video Pro | Watch 4 videos |
| Video Master | Watch all 8 videos |
| Comment Novice | Write your first high-quality comment |
| Comment Apprentice | Write two high-quality comments for the first video |
| Comment Pro | Write two high-quality comments for the next video |
| Comment Expert | Write three high-quality comments each for the next 3 videos |
| Comment Master | Write five high-quality comments each for the next 3 videos |
| Peer Review Master | Rate 15 peer comments |
| Learning Luminary | Accumulate all other badges |

Furthermore, we used structural equation modelling (SEM) to examine the impact of gamification on learning outcomes **(RQ2)** in the gamified group (Figure 2). We defined four hypotheses to test as part of answering RQ2. Prior research indicates that badges moderate the effect of prior knowledge on time-on-task (Tahir et al., 2022). From that we infer our first hypothesis (H1) that students with higher prior knowledge are more likely to earn more badges. Our second hypothesis (H2) suggests that the number of badges earned has a positive effect on the number of high-quality comments written by students. This is because badges are designed to prompt users to write more high-quality comments. Our third hypothesis (H3) suggests that high quality comments influence the post-test knowledge. Previous research has established that high-quality comments are positively correlated with post-test knowledge (CK2) (Mohammadhassan et al., 2022). Our fourth hypothesis (H4) suggests that pre-existing knowledge positively influences the posttest knowledge. Studies in video-based training have shown a positive relationship between CK1 and CK2 (Mitrovic et al., 2019). Based on these established correlations and our hypotheses, we propose that high-quality comments mediate the relationship between badges and CK2.

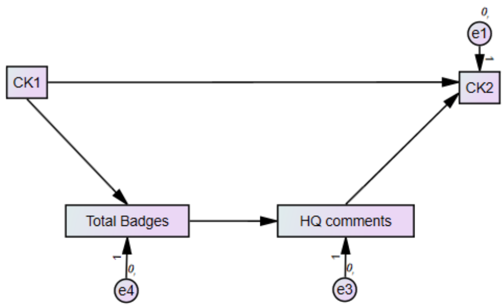


*Figure 2.* Hypothesized path analytic model

## 4. Results

We analyzed the data from students who completed Survey 1 and watched at least one video. The non-gamified group included 645 students (Year 2023), while the gamified group had 223 students (Year 2024).

### *4.1 Engagement (RQ1)*

Engagement data were not normally distributed (Shapiro-Wilk test), so we employed the Mann-Whitney U test to compare the gamified and non-gamified groups. We found significant differences in all engagement metrics except the number of videos watched (Table 2). This may be because students were told to watch all eight videos. Overall, the analysis indicates that the gamified group engaged significantly more than the non-gamified group.

Table 2. *Measures for Engagement (* indicates significant difference)*

| | Gamified [2024] (N=223) | Non-gamified [2023] (N=645) | Significance |
|---|---|---|---|
| | Mean (sd), Median | Mean (sd), Median | |
| Distinct Days* | 4.46 (3.63), 3 | 3.09 (2.24), 3 | U=57864, p<.001 |
| User sessions* | 5.74 (5.11), 4 | 3.83 (3.25), 3 | U=55713.5, p<.001 |
| Videos watched | 7.27 (1.95), 8 | 7.35 (1.86), 8 | U=72705, p=.67 |
| Comments posted* | 25.15 (15.21), 31 | 12.39 (9.73), 9 | U=38933.5, p<.001 |
| Nudges received* | 32.33 (16.45), 34 | 23.08 (13.40), 21 | U=45326, p<.001 |
| High quality comments written* | 19.20 (12.59), 28 | 6.70 (6.44), 6 | U=38152, p<.001 |
| Comments reviewed* | 19.09 (20.93), 15 | 16.54 (21.15), 10 | U=59498, p<.001 |

### *4.2 Learning (RQ2)*

We compared the learning outcomes of students who completed both Survey 1 and Survey 2 (Table 3). 149 students from the gamified group and 493 students from the non-gamified group completed both surveys. Data were not normally distributed, so we used the Mann-Whitney U test. Results showed no significant difference in learning gains (CK2-CK1) between the two groups. However, there was a significant difference between the two groups on the CK1 scores, indicating that students did not start with similar levels of prior knowledge. This suggests that although both groups improved similarly, the initial disparity in prior knowledge may have influenced how each group engaged. Therefore, interpreting learning gains without considering baseline differences could be misleading. As a result, we cannot conclusively explain the impact of gamification using CK1 and CK2 when comparing the two groups directly. However, a Wilcoxon Signed-Rank Test conducted separately for the gamified group (Z=2.73, p=.006) and the non-gamified group (Z=2.608, p=.009) indicated significant within-group improvement from pre-test (CK1) to post-test (CK2). This shows that both groups improved their post-test scores compared to their pre-test scores.

Table 3. *Learning (* indicates significant difference)*

| | Gamified (N=149) | Non-gamified (N=493) | Significance |
|---|---|---|---|
| | Mean (sd), Median | Mean (sd), Median | |
| CK1* | 11.60 (5.14), 11 | 14.04 (5.82), 14 | U=45955.5, p=<.001 |
| CK2* | 13.06 (6.44), 13 | 14.14 (6.75), 14 | U=41832, p=.001 |
| CK2 – CK1 | 1.46 (6.43), 1 | 0.70 (6.58), 1 | U=34377, p=.24 |

We evaluated the path diagram using IBM SPSS Amos version 28.0.0, analyzing data from 149 participants with complete data (Figure 3). Based on the inputs and number of variables, the model includes 12 parameters. A sample size of at least 10 participants per parameter is recommended (Raykov & Widaman, 1995), making our dataset appropriate. All variables in the model are observed. The chi-square test ($\chi^2 = 2.915$, df = 2, p = .23) indicates that the model's predictions are not significantly different from the observed data. The model fit indices further support this: the Comparative Fit Index (CFI) is .998 and the Root Mean Square Error of Approximation (RMSEA) is .027. These values meet accepted thresholds (CFI > .90, RMSEA < .06) for a good model fit (Hu & Bentler, 1999; Teo et al, 2013).

The model indicated that higher CK1 scores directly cause higher CK2 scores (beta = .45, p<.001), confirming Hypothesis H4. Therefore, the effect of the number of high-quality comments on CK2 is adjusted for and above and beyond this influence (.1, p = 006) which confirms Hypothesis H3. The number of badges affects the number of high-quality comments (.96, p<.001). Therefore, hypothesis H2 is confirmed. However, pre-exiting knowledge (CK1) does not affect the total number of badges (.04, p = 382). Therefore, hypothesis H1 is rejected.

This suggests that gamification via badges enhances post-test knowledge (CK2) by encouraging students to produce high-quality comments. Interestingly, the number of badges earned appears to be independent of pre-existing knowledge (CK1) and instead exerts its own direct influence on learning outcomes. One explanation is that even students with strong prior knowledge may not necessarily know how to write high-quality comments. Additionally, those who already feel knowledgeable might be less motivated to engage fully.

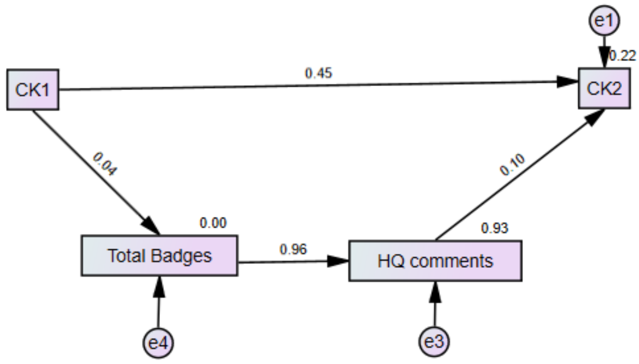


*Figure 3.* Path Diagram for the Gamified Group

### *4.3 Student Perception on Gamification (RQ3)*

Figure 4 illustrates the participant perceptions on the badges implemented in the AVW-Space. A majority of respondents (43%) liked the badges and 2% indicated they did not see any badges. In the following, we excluded those who did not see any badges. Over half liked the visual appearance of the badges (53%) and felt that the badge names and descriptions accurately represented levels of achievement (64%). Most participants found the process of earning badges to be neither too easy nor too difficult (53%) and reported checking their badges frequently (57%). Additionally, many felt that badges motivated them (54%), increased their engagement (51%), and expressed overall satisfaction with the badge system (51%). Notably, the perception of increased engagement was consistent with the quantitative measures, which showed higher levels of engagement for the gamified group.

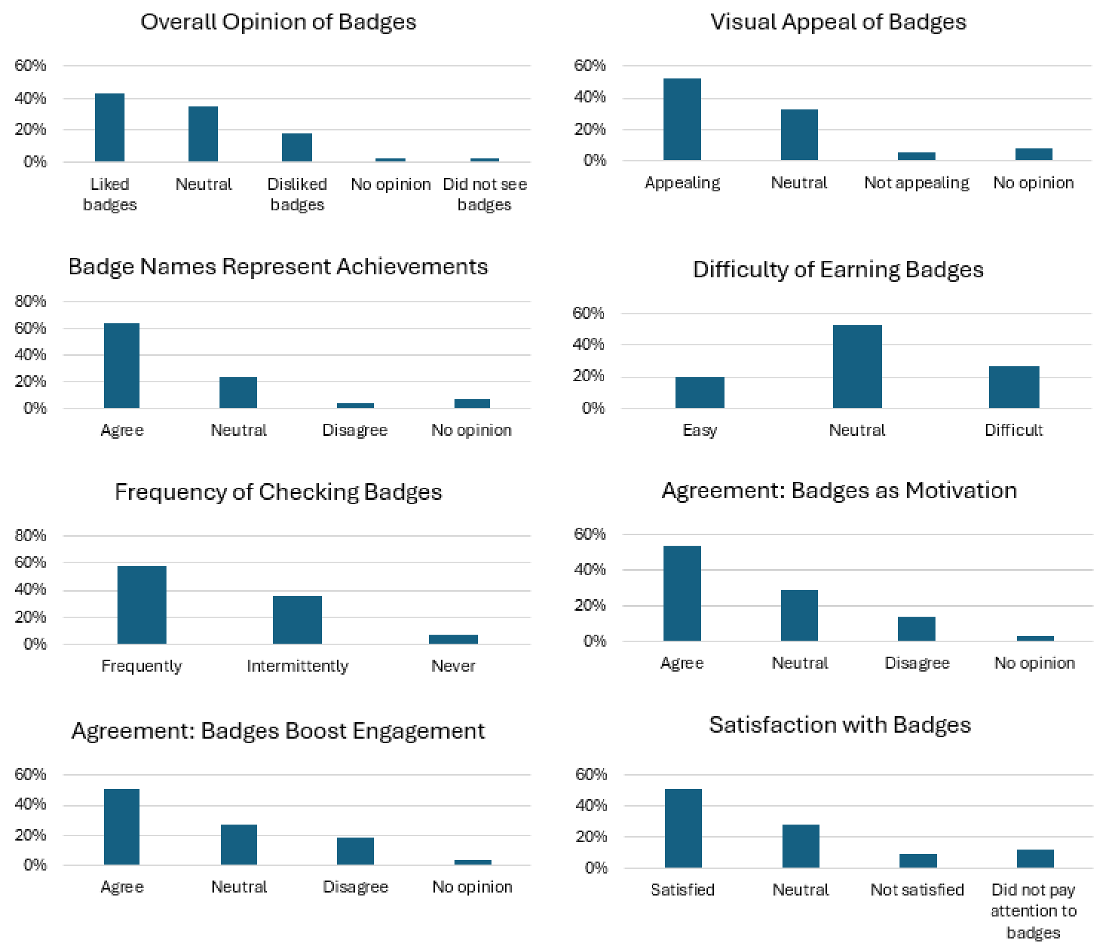


*Figure 4.* Perception of Badges

In addition to the above, we also asked open questions to participants who used the gamified platform to describe their experience with the badges in terms of their impact on motivation and engagement with the learning activities. The majority of the responses (n=80) reported a positive experience. Many participants (n=39) noted that the badges increased their motivation and engagement (which confirms the responses to the closed question discussed in the previous paragraph), often stating that they felt more encouraged to actively participate in the activities. For example, one participant wrote "*The badges motivated me to complete each task they gave, so in turn I believe they were effective*". Others went further to describe specific reasons for their positive experience. A frequently mentioned benefit was the sense of clear goals and direction provided by the badges (n=17). Participants appreciated that the badges helped break down larger tasks into smaller, more manageable steps. One participant commented "*The badges broke the overall large task into smaller tasks making it more manageable and easier to complete*". Six participants highlighted the usefulness of badges in making their progress visible. As one put it, "*The badges were a good way to tick off parts of the training, to see your progress*". In contrast, 27 responses were neutral. These participants typically indicated that, although they understood the purpose of the badges, they sometimes struggled to determine how to write high-quality comments. This may suggest the need for further interventions, such as providing clearer explanations for what constitutes a high-quality comment. Lastly, 27 reported a negative experience. The main issues were that earning the badges required too much effort and that the process felt tedious. This suggests that, for these participants, the badges did not support intrinsic motivation.

Furthermore, we asked participants how earning badges influenced their learning experience on the platform. The majority of participants (n=64) reported a positive impact, which was consistent with the results of the SEM analysis, indicating that badges had a significant influence on post-test knowledge. The key reasons for this were consistent with those mentioned earlier, such as increased motivation to learn, clear goals, and visible progress. In addition, nine participants indicated that the badges helped them improve their learning and reflection. One participant noted, "*It made me think more deeply to get high quality comments*". However, ten participants reported a negative impact. Of these, five described the experience as frustrating, with one stating, "*It made the learning experience feel like a chore*". Another three participants mentioned that the focus on earning badges led to superficial learning and distraction, as one explained, "*It made me less focused on the task and more focused on getting the checkpoints* […]".

## 5. Discussion and Conclusion

We implemented badges associated with task-based awarding conditions to investigate their impact on students' perception, engagement, and learning within video-based learning. Our findings indicate that gamification significantly enhances engagement across various measures. In particular, gamification was effective in promoting constructive learning behaviors, such as writing high-quality comments and rating peers' comments. These findings align with the findings of previous research (Manzano-León et al., 2021; Tahir et al., 2022).

However, due to significant differences in pre-existing knowledge (CK1) between the gamified and non-gamified groups, we were unable to directly compare learning outcomes across groups. Despite this limitation, structural equation modelling within the gamified group revealed the influence of gamification on learning-related variables (e.g., high-quality comments, CK2). The analysis demonstrated that badges exert an indirect effect on post-test knowledge (CK2), mediated by the high-quality comments. These results suggest that badges contribute meaningfully to learning outcomes. These results align with previous research which state gamification contributes to the performance of students (O'Donovan et al., 2013). Future research could further explore different mediated pathways of gamification via different attributes associated with learning. Furthermore, we observed that pre-existing knowledge about presentation skills did not significantly influence the number of badges a student received. For future research, it would be valuable to explore other variables that may affect a student's level of immersion in gamification. Additionally, researchers could investigate whether a latent variable such as the ability to write constructive comments may be contributing to this level of immersion (note that in both groups, over 87% of participants who completed both surveys reported English as their first language, i.e., writing constructive comments was most likely not due to a lack of language skills).

In addition to performance measures, we also gathered participants' perceptions of the badges. The feedback was largely positive, particularly regarding aspects such as visual design, award criteria, motivation, engagement, learning experience and overall satisfaction. Our research empirically demonstrated that self-assessed perception data were also consistent with the observed quantitative improvements in engagement and learning, reinforcing the conclusion that badges are both a well-received and an effective intervention.

We acknowledge several threats to validity. In terms of construct validity, we used conceptual knowledge scores (CK1 and CK2) as a proxy for learning. While this approach provided an objective, scalable measure, it is an indirect indicator that may not fully capture actual competency in presentational skills that include performative dimensions (e.g., body language). Regarding internal validity and confounding factors, the students may have had different schedules impacting the time they spent on AVW-Space in different years. More critically, the two groups showed significant differences in pre-learning scores, limiting our ability to attribute learning gains specifically to badges. In terms of external validity, the study was conducted in a video-based learning environment (AVW-Space) for presentation skills and employed badges as the gamification intervention, which may limit the generalizability of findings to other platforms with different game elements or for training different skills. In terms of conclusion validity, comment quality as an engagement measure was determined using a machine learning model trained on prior data. However, superficial, keyword-rich comments may have been misclassified as high quality. There is also a risk that students gamed the system by deliberately including relevant terms without fully understanding them, potentially weakening the validity of conclusions about badges promoting genuine cognitive engagement. Additionally, some students may not have been motivated to meaningfully complete the pre- and post-tests, which could compromise the accuracy of the CK1 and CK2 measures and threaten the validity of conclusions drawn from these variables. In addition, the reliability of the study's findings may be impacted by sample-related factors. Specifically, the 2024 cohort (gamified group) had a notably smaller size (n = 223) compared to the 2023 (non-gamified) group (n = 645), due to partial participation of eligible students. This imbalance could affect reliability, as the smaller sample size in the gamified group may have reduced the statistical power.

Overall, our findings offer empirical support for the use of badges as a gamification intervention to enhance engagement and learning VBL. They also indicate that badges are well received by students. Our findings offer practical guidance for researchers and designers of gamified learning, highlighting the value of integrating badges with clearly defined goals and pathways to encourage desired behaviors in educational settings.

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