The Effectiveness of the Good Behavior Game on Students' Academic Engagement in Online-Based Learning

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Abstract

Online learning has become a popular form of education, particularly accelerated by the COVID-19 pandemic, providing flexibility but posing challenges like reduced collaboration, limited student-faculty interactions, and decreased engagement. Therefore, there is a pressing need to implement effective instructional modalities, designs, and strategies to enhance online engagement. This study investigated the effectiveness of the Good Behavior Game (GBG), rooted in applied behavioral analysis, in promoting academically relevant behavior among nursing students engaged in online learning. Using a quasi-experimental pre-test, post-test design, 95 nursing students from a public university in Jordan were divided into groups exposed to different GBG conditions. Data on participation were collected over 11 weeks, and statistical analyses revealed a significant positive impact of the GBG on student engagement. When the GBG initially targeted the quantity of participation, there was a significant improvement in students' participation quality, but not the quality. On the contrary, when only the quality was targeted, the improvement was significant in the participation quality but not quantity. Combining quality and quantity contingencies in one condition produced the most significant improvement, suggesting the GBG's adaptability and potential as a comprehensive engagement strategy in online learning. The study result suggests that many drawbacks associated with online learning can be addressed through designing effective educational strategy. This research highlights the GBG's potential for enhancing online education, addressing its limitations by fostering students engagement . Further exploration of its applicability in diverse educational settings is recommended, solidifying its place as an effective strategy in the evolving education landscape.

Keywords: Good Behavior Game, academic engagement, nursing students, online learning, COVID-19

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Online teaching is gaining ground in higher education. In 2018 in the United States of America, the National Center for Education Statistics reported that more than half of the students reported enrollment in online learning, with around 73% from private institutions and 34.1% from public institutions as cited by Aldhafeeri & Alotaibi (2022). Since the COVID-19 pandemic, online education has taken unprecedented status in higher education institutions adopting online learning and forced almost all higher educational institutions in developed and developing countries to adopt online learning, including Jordan (Al-Okaily et al., 2024; Salas-Pilco et al., 2022). All higher education institutions adopted online learning to meet the pandemic, regardless of their teaching-learning philosophy (Natarajan & Joseph, 2022). Thus, online learning becomes essential to any educational institution's educational system. This trend continued after the pandemic's end as the institution saw it as a means to deal with similar potential crises. However, one major issue associated with the most commonly used online instructional modalities and designs is student engagement due to poorly designed online courses (Natarajan & Joseph, 2022). Student engagement has been essential in promoting students' performance and satisfaction (Graham et al., 2023). Thus, the research, up to this point, examines ways to promote student engagement in online learning (Aldhafeeri & Alotaibi, 2022). A well designed online course is expected to enhance the learning experience, promote accessibility, and provide a convenient learning modality, while sustaining learning outcomes in a way similar to face-to-face learning (Saiyad et al., 202). Poorly instructional designs have several drawbacks, such as the reduced likelihood of participating in collaborative learning, limited student-faculty interactions, and fewer opportunities for discussions with diverse peers (Dumford & Miller, 2018; Thamri et al., 2022). These drawbacks can lead to decreased exposure to effective teaching practices and a lower quality of interactions, often resulting in student dissatisfaction and frustration (Dumford & Miller, 2018; Thamri et al., 2022). Thus, special attention must be paid to the online instructional modality to ensure it is well-designed and directed toward promoting educational outcomes.

Nursing education has a unique nature that includes practical, problem-based, and project-based learning to promote students' communication skills (Salmani et al., 2022; Wolf & Wolf, 2023). Such skills are considered the core of holistic and comprehensive care for nurses. For example, communication skills and teamwork are essential to the quality of care being received, even from the perspective of the care recipient (Al-Hammouri et al., 2020; Milton et al., 2023). Many studies recommended exploring strategies to foster student engagement across different modes of instruction, primarily when online learning is being used to compensate for skills ordinarily learned through face-to-face learning (Dumford & Miller, 2018; Thamri et al., 2022).

One technique that the authors think can overcome some of the drawbacks associated with using online learning is the Good Behavior Game (GBG). The use of gamification in online environments promotes student engagement and motivation that help overcoming drawbacks associated with poorly designed online leaning (Al-Hammouri , 2024; Zakaria et al., 2024). The GBG is an educational strategy that is deeply rooted in the field of applied behavioral analysis (Joslyn et al., 2019). The GBG manages classroom behavior and incentivizes individuals to demonstrate academically appropriate skills and knowledge (Joslyn et al., 2019). With certain behaviors or skills in mind, the class is divided into teams. These teams then compete to meet

certain academic behaviors and skills according to pre-specified rules. The winning team members are rewarded at the end of the time window specified for the game.

Since it was first tested in 1969, the evidence of GBG effectiveness across various populations, age groups, behaviors, and settings has been supported (Joslyn et al., 2019). The seminal work of Barrish and colleagues in this area first developed and introduced GBG as a way to control individual student performance by setting group contingencies (Barrish et al., 1969). In their work, Barrish and colleagues targeted student behavior such as "out of seat" and "talking out" in a fourth-grade class. The class was divided into two teams while the contingencies were based on available privileges on day-to-day school settings. The GBG was an efficient intervention in reducing targeted behaviors (Barrish et al., 1969). Although the behaviors addressed in the seminal work on GBG are not exhibited by adult learners, including nursing students, they show the efficiency of the GBG in making the classroom more conducive to learning.

Since then, GBG has been used to target various academic and classroom behaviors. For example, the GBG was used with children to reduce disruptive behaviors in the classroom (Harris, & Sherman, 1973). It has also been used with schoolchildren to promote student engagement (Hier et al., 2023). However, the use of the GBG with university students was not reported. Thus, to the best of our knowledge, this paper will be the first to address the use of GBG with nursing students. Thus, the study aims to examine the effectiveness of GBG in promoting academically relevant behavior (namely, participation quality and participation quantity as indicators of student engagement) in a sample of nursing students.

Literature Review

Good Behavior Game

In this section, we review the studies that have implemented GBG in classroom settings, noting that the behaviors addressed in these studies are not similar to those faced with adult learner. Limited studies have examined the effectiveness of the GBG with adult learners and show the potential of the GBG in promoting conducive educational environments. The Good Behavior Game was first tested to reduce disruptive behaviors in school-age children (Cooper et al., 2019). Under the GBG, students are ideally divided into teams competing on specific winning criteria associated with targeted behaviors. This approach relies on group-based rewards, where the entire team benefits if members meet the set behavior expectations (Cooper et al., 2019). In other words, each team is required to meet specific criteria associated with the team's performance, which is directly associated with an individual's performance. For example, a team may be asked to collectively score lower than a certain number regarding disruptive behaviors to win (Cooper et al., 2019). Early research in this area showed great potential for the GBG's application in academic settings in controlling student behaviors, including various disruptive behaviors (Barrish et al., 1969).

Since then, the GBG has been applied in various populations, settings, and behaviors. For example, the GBG applications were reviewed and found effective in promoting behavioral vaccines, which refer to behaviors aimed at protecting against health issues (Embry, 2002). The GBG was named as the best practice to promote behavioral vaccines, including antiseptic hand

washing, substance abuse, and violent behavior (Embry, 2002). On the other hand, the GBG has been shown to effectively reduce teacher stress and increase academic engagement in elementary school children (Radley et al., 2023). A strength of the GBG is that it can be adapted to fit various settings and populations. For example, the GBG targeted off-task behaviors in special education classrooms (Groves et al., 2022). The results supported the effectiveness of the GBG in academic settings with different groups of participants in particular settings. However, the applications of the GBG across various settings and populations are still limited. Our literature search showed that the GBG was not examined in the university setting. However, the GBG was recommended as a universal intervention that can be used in different classroom settings and age groups (Kellam et al., 2011).

The mechanism by which the GBG enhances student performance and engagement in any learning setting and context is essentially based on promoting students competition to perform better (Al-Hammouri , 2024; Cooper et al., 2019). Such competition can occur at three levels (Al-Hammouri et al., 2024; Cooper et al., 2019). First, competition can occur within teams where the students must perform better than the other team members to gain the award or reinforcer. Second, competition across teams, where students compete to outperform other teams to gain the award or the reinforcer. Finally, individual learners and teams compete to meet certain criteria to gain the award or the reinforcer (Al-Hammouri et al., 2024; Cooper et al., 2019).

The Good Behavior Game and Student Engagement in Online Courses

The evidence concerning the GBG's effect on student engagement in online courses is minimal. Our search returned no results for studies that examined the effect of the GBG on student engagement in online courses among university students. Although there were no studies that have examined GBG in online courses among university students, we found a single study that examined the effect of the GBG on student engagement in three third- through fifth-grade classrooms in online courses (Hier et al., 2023). The authors of this study reported that the GBG was not previously implemented in the online learning context (Hier et al., 2023). This study showed that applying the GBG was associated with moderate to strong improvement in student engagement. In addition, the study supported the GBG usability and acceptability by teachers and students, respectively (Hier et al., 2023). Since learner engagement in online education needs more attention, even in higher education (Al Okla et al., 2023), studying the impact of the GBG on student engagement can provide valuable insights. While there is strong evidence supporting the benefits of the GBG, its use in higher education remains limited. This study addresses one research question:

Does the use of the GBG affect student engagement (quantity and quality) in a sample of nursing students in a university setting?

Method

Research Design

This study employed a quasi-experimental pre-test, post-test research design conducted at a major public university in Jordan. Under this design, the authors first assigned different

interventions to already existing groups of students. After collecting baseline data, each group was exposed to different conditions to examine the effect of the GBG on different dimensions of student engagement behaviors. For example, Group 1 followed a sequence of baseline phase, quality improvement phase, and quality and quantity improvement phase. For Group 2, the sequences were the baseline phase, followed by the quantity improvement phase, followed by the quality and quantity improvement phase.

Participants

A total of 105 students were registered for the Communication and Health Education course, where the GBG activity was applied. Among the students, 95 participated in the GBG as a class bonus activity. The grades students were awarded—based on the GBG activity— were not a part of the course's final score; instead, they were added as bonus grades to the final grade at the end of the course. The minimum required sample size was calculated using G*Power. To perform a repeated measure, Multivariate Analysis of Variance (MANOVA) on two groups with a power of 0.8, a large effect size, three measurement time points, and an alpha level of 0.05, a minimum sample of 82 was required. The participants were nursing students from the Communication and Health Education class. The class consisted of two groups; each was assigned to different conditions (as described below) to achieve the study goal. The sole inclusion criterion was that they must be nursing students currently enrolled in an online Communication and Health Education course.

GBG and Measures

The GBG activity was applied to two groups of the above-mentioned online course. Students in each group were randomly divided into teams of 10-11 students. Each group participated in a game concerning specific dimensions of students' academic engagement (participation quantity and participation quality, see below). Each group had a separate online discussion forum. The lecture was a 2-hour weekly lecture. Thus, a weekly analytical question was posted in the forum at the end of the lecture. Students were given three days to answer the question and respond to each other's responses. After the end of the three days, the discussion was closed, and students' participation quantity and quality were evaluated. The time was selected based on practical reasons. The evaluators of the students' responses needed enough time to review scores of the students' participation quality and quantity before posting next week's question. Students' participation quality and quantity were measured for both groups at all times to compare students' performance under different GBG activity conditions (i.e., Quality Condition, Quantity Condition, Quality-Quantity Condition; see below).

Participation Quantity

In the GBG activity planned in the course, the participation quantity referred to the team's average number of posts. To calculate participation quantity, the total number of posts by each member was counted. Then, the number of posts made by all team members was added and divided by the number of students in the team. The average scores and the individual student's performance were then used to determine the winning team.

Participation Quality

The quality was determined using a rubric designed to assess the quality of student participation. The rubric evaluated students participating in four domains: reflective, originality,

clarity, and provocative. The reflective domain focused on student ability to analyze and synthesize course ideas in answering the question. Originality focused on the student ability to generate new ideas and perspectives while answering the question and avoiding paraphrasing others' ideas. Clarity focused on the student ability to express ideas clearly, understandably, and logically. Finally, the provocative domain focused on the students' responses' ability to initiate a discussion concerning the topics of the questions. These domains were scored for each comment using a scale from 1 to 5. The scores were averaged for each student, then the team scores were calculated by averaging the team members' scores. Thus, individual and team scores ranged between 1 and 5. The team and individual students' scores were then used to determine the winner among the competing teams.

The GBG activity in the class consisted of three conditions for each group. Group 1 was exposed to the baseline condition, Quality Condition, and Quality-Quantity Condition, while Group 2 was exposed to the baseline condition, Quantity Condition, and Quality-Quantity Condition. The order of implementing different conditions for the different groups was planned to help make multiple comparisons between groups across different conditions. For example, when Quality Condition targeted participation quality for Group 1, Group 2 had Quantity Condition, which targeted participation quantity but not quality. Thus, this assembly enabled the authors to compare the impact of different conditions on different aspects of students' engagement. Finally, superimposing the contingencies applied to the other group over the existing one in Quality-Quantity Condition, helped the authors examine the effect of the rule change on the targeted aspect of student engagement. Such assembly is usually used in single-subject research design and is called multiple baseline design (Cooper et al., 2019). In what follows, we will explain all of these conditions.

Baseline

Both groups were initially exposed to this condition. As the name suggests, the goal of this condition was to establish baseline data to compare student engagement indicators (participation quality and quantity) to subsequent conditions. Under this condition, the instructor posted a weekly analytical question into the discussion forum, with no specific contingencies applied. The only instruction was that "weekly discussion questions will be posted about the course material on the discussion board. You can post your answers to the discussion and respond to others' answers." This condition was applied for three weeks, during which the student could participate in three analytical questions.

Quality Condition

Under this condition, the teams in Group 1 competed to win over other teams based on the quality of participation. Although the students' participation quantity was not targeted under this condition, it was measured and assessed for analysis purposes to compare both groups under different conditions. After the end of the baseline condition, the students were given recorded instructional material describing the rules and contingencies of the GBG. Two types of contingencies were applied. The first contingency was applied to the teams meeting the GBG minimal criteria: achieving a team average participation quality score of 2.5 out of 5, with the lowest team member participation quality score of 2 or above (Table 1). If the team met these conditions, each student was awarded a +1 (for that week) grade toward the course final grade.

The second contingency applied was the winner team contingency (Table 1). Based on this contingency, each team member with the highest average participation quality score among all teams was awarded a +1 grade toward the course's final grade. Thus, if the winning team met the minimal criteria, each student would be awarded +2 grades toward their final course grade. However, one last contingency was added to ensure minimal team performance deterioration. This contingency was called response cost. If the team scored 0.5 lower on average teams' participation quality score compared to the previous week, a -1 grade would be implemented on the bonus grades the teams awarded to their course bonus grades (Table 1).

Table 1

Quality Condition Contingencies

Performance criteria	Description	Status	Contingency
Minimal criteria	• The team scored at least 2.5 in the average participation quality score. • The lowest participating student achieved a 2 or more in participation quality score.	Met NOT Met	+1 0
Winner	• The team with the highest average participation quality score.	Met	+1
Response cost	• The team scored .5 lower in average participation quality score compared to the previous week score	Met	-1

Quantity Condition

Under this condition, the teams in Group 2 competed to win over other teams based on the participation quantity. Although the students' participation quality was not targeted under this condition, it was measured and assessed for analysis purposes to compare both groups under different conditions. After the students had completed the baseline condition, the students were provided with recorded instructional material describing the rules and contingencies of the GBG under this condition. Similar to Quality Condition, two types of contingencies were applied. The first contingency was applied upon the teams meeting the GBG minimal criteria, which were achieving an average team's participation quantity equal to or above 50% of the highest participating team, with the lowest participating team member achieving at least 5% of the team's total participations (Table 2). If the team met these conditions, each student was awarded a +1 grade (for that week) toward the course's final grade.

The second contingency applied was the winner team contingency (Table 2). Based on this contingency, each team member in the winning team, which had the highest average participation quantity score, was awarded a +1 grade toward the course's final grade. Thus, if the winning team met the minimal criteria, each student would be awarded +2 grades toward their final course grade. Similar to Quality Condition, one last contingency was added to ensure minimal team performance deterioration. This contingency was called response cost. If the team scored 10% lower on the total number of participations than the previous week's score, a -1 grade would be implemented on the bonus grades the teams awarded to their course bonus grades (Table 2).

Table 2

Quantity Condition Contingencies

Performance criteria	Description	Status	Contingency
Minimal criteria	• The team scored at least 50% of the highest participating group in the teams' average participation score. • The lowest participating student achieved 5% of his team's total participation	Met	+1
		NOT Met	0
Winner	• The team with the highest average participation quantity score	Met	+1
Response cost	• The team had 10% or more reduction in the average team participation quantity score compared to the previous score	Met	-1

Quality-Quantity Condition

This condition is technically a combination of the conditions 1 and 2 in that Quality-Quantity Condition targeted participation quality and quantity (Table 3). Again, two types of contingencies were applied under this condition. First contingency was applied upon the teams meeting the GBG minimal criteria, which were achieving 50% of the highest participation quantity team, the lowest participating student achieving at least 5% of the teams' participation, the team meet at a score of 2.5 on the average participation quality, and the lowest team member score of 2 or above in participation quality. If the team met these conditions, each student was awarded a +1 grade toward the course final grade (Table 3).

The second contingency applied was the winner team contingency (Table 3). We took one step further to determine the winning team beyond conditions 1 and 2. Under Quality-Quantity Condition, we calculated another number by multiplying the average participation quality score for the teams by the average number of teams' participation quantity. The team that achieved the highest number is considered the winning team. Similarly, based on this contingency, each team member was awarded a +1 grade toward the course's final grade. Thus, all winning team members were awarded +2 grades toward their final course grade, achieving both contingencies. Finally, two additional contingencies were added to ensure minimal team performance deterioration. This contingency was called response cost contingencies. If the team scored 10% lower on the total number of participations than the previous week's score, a -0.5 grade would be implemented on the bonus grades the teams awarded to their course bonus grades (Table 3). Additionally, if the team scored 0.5 lower on average teams' participation quality score than the previous week's score, a -0.5 grade would be implemented on the bonus grades the teams awarded to their course bonus grades (Table 3).

Table 3

Quality-Quantity Condition Contingencies

Performance criteria	Description	Status	Contingency
Minimal criteria	• The team scored at least 50% of the highest participating group in the teams' average participation score. • The team scored at least 2.5 in the average participation quality score. • The lowest participating student achieved 5% of his team's total participation	Met	+1
	• The lowest participating student achieved a 2 or more in participation quality score.	NOT Met	0
Winner	• The group scored the highest number of multiplying the team's average participation quality score by the team's average participation quantity score.	Met	+1
Response cost	• The team had 10% or more reduction in the average team participation quantity score compared to the previous score	Met	-.5
Response cost	• The team scored .5 lower in average participation quality score compared to the previous score	Met	-.5

Procedure

To achieve the study goal, Group 1 has received baseline condition, followed by Quality Condition, and then Quality-Quantity Condition. Group 2 received baseline condition, Quantity Condition, and finally, Quality-Quantity Condition. Under all conditions for both groups, the participation quality and quantity data were collected on a weekly basis to compare and contrast to achieve the study goal.

After the online class time, an analytical question was posted on the discussion forum. The students were given three days to answer the discussion forum question, starting from the time of posting the question, beyond which no further participation was accepted. The time left between ending the participation and the next class was reserved for scoring the participation quality and quantity and announcing the results for the groups to provide feedback concerning their performance in the previous week.

At the beginning of the class, the first three questions were posted without providing any specific instructions, except that these questions will be part of a bonus activity later in the class. The participation quality and quantity were scored to form the baseline for subsequent conditions. After the first three weeks, Group 1 was provided with the condition details and how the contingencies would work. Group 2 simultaneously received the same type of information about Quantity Condition. After five weeks of implementing Quality Condition and Quantity Condition, Quality-Quantity Condition was implemented for both groups simultaneously. The initial plan was to implement conditions 1 and 2 for five weeks, followed by Quality-Quantity Condition for five weeks. Due to technical issues with the discussion forum platform, the data

collection was stopped after three weeks of implementing Quality-Quantity Condition. Thus, the entire GBG activity, including the baseline, and the three conditions continued for 11 weeks.

Inter-rater Reliability

Two raters evaluated the participation quality and quantity. Although the evaluation for the participation quantity was straightforward, counting the number of participations done by each student and then combining them into teams' averages and totals, the case was more complicated for participation quality. First, two research assistants were recruited for this purpose, and they have nothing to do with other class- or grading-related activities. The two research assistants were only responsible for scoring the GBG activities (i.e., participation quality and quantity). The research assistants received training on using the participation quality rubric using data from previous semesters.

During research assistants training, the goal was to achieve a 100% interrater agreement. Both research assistants were required to score the participation quality separately during the course. After they finished scoring, the research assistant met to discuss the scoring results. In case of any discrepancy in the scoring results, the research assistants discussed the scoring until they reached a 100% inter-rater agreement. Then, the research assistants calculated the required parameters to award the bonus for meeting minimal criteria, award the winning team a bonus, and implement a response cost when applied. Then, they prepared the final announcement for the feedback to be posted before the next class. The announcement involved the teams' names, the number of grades awarded, and the reason for the grades awarded (i.e., their performance according to the contingencies/conditions in effect). To promote confidentiality, individual students' names and the rubrics were not shared. The announcement was made available 24 hours before the next class, to allow the students to ask any questions concerning the results so they can improve their performance in the subsequent week.

Data Analysis

The data collected during the GBG activity included participants' gender, participation quality, and participation quantity. A repeated measures MANOVA was used to analyze data from three-time points, comparing Groups 1 and 2 on participation quality and quantity. The analysis used the final data points recorded under each condition: week 3 (final baseline data), week 8 (final data for the Quality and Quantity Conditions), and week 11 (final data for the Quality-Quantity Condition).

In addition, to provide additional information regarding the data trend concerning the condition in effect, the individual week data points were depicted in two different graphs. One graph was for participation quality, and one was for participation quantity. Separate lines were used to depict different groups (Group 1 and Group 2) (See results section below).

Ethical Consideration

During the course, no identifiable data were collected. Only the gender of the students was collected. The participation of the GBG as a bonus activity was totally voluntary, while the students could withdraw from the study without any consequences. Each participating student signed a written informed consent before starting the study. The confidentiality of the students

was maintained by ensuring that students' answers and comments were made only available to the research assistants for scoring purposes.

Results

A total of 95 students participated in this study, with 71.6% of them being females. The number of students in Group 1 and Group 2 was 55 and 40, respectively.

MANOVA: Repeated measures

The results of repeated measures MANOVA showed that there was a statistically significant effect of the GBG activity on the linear combination of the dependent variables (i.e., the quantity and quality of participation at weeks 3, 8, and 11): Pillai's Trace (V) = .85, $F(2, 92) = 249.8$, $p < .001$. Likewise, there was a statistically significant effect of the time factor (V = .98, $F(4, 90) = 1323.4$, $p < .001$) and time X GBG activity (V = .92, $F(4, 90) = 252.9$, $p < .001$). Table 4 presents the results of repeated measures MANOVA.

Table 4

Results of Repeated Measures MANOVA

Factor	V	F	H. DF	E. DF	P	ES[†]	Power
Group	.85	249.8	2	92	<.001	2.29	1.0
Time	.98	1323.4	4	90	<.001	7.0	1.0
Group X Time	.92	252.9	4	90	<.001	3.39	1.0

V: Pillai's Trace; F: F statistic; H. DF: hypothesis degrees of freedom; E. DF: error degrees of freedom; ES: effect size.

[‡] Values of the effect size were calculated using post-hoc function in G*Power 3.1

Univariate and Follow-Up Analyses

The ANOVA output showed that the GBG activity's effect on the quality of students' participation was statistically significant: $F(1, 93) = 481.69$, $p < .001$. The effect on students quantity of participation was also significant $F(1, 93) = 25.53$, $p < .001$. The effects of time on participation quantity $F(1, 93) = 1974.87$, $p < .001$ and participation quality $F(1, 93) = 3058..90$, $p < .001$ were statistically significant. Similarly, significant effects of time by group on participation quantity $F(1, 93) = 54.39$, $p < .001$ and participation quality $F(1, 93) = 38.13$, $p < .001$were found.

A follow-up analysis, using Bonferroni adjustment, revealed that the mean difference in the quantity and quality of participation was insignificant at the end of week 3 (i.e., at baseline). By the end of week 8, students in Group 2 had a statistically significant higher mean score of participation quantity. However, the mean score of participation quantity was significantly lower in Group 2 by the end of week 11. Regarding participation quality, the pairwise comparison showed that the mean difference was significantly lower in gGroup 2 compared toGgroup 1 at the end of weeks 8 and 11 (Table 5).

Table 5

Pairwise Comparison of the Quality and Quantity of Participation Mean Scores

	Quantity			Quality		
Data point	3ed	8th	11th	3ed	8th	11th
Group 2	.23	5.88	4.40	1.24	1.32	2.85
Group 1	.40	2.20	6.24	1.21	3.30	3.23
Difference	-.17	3.68**	-1.84**	.03	-1.97**	-.38**
95% CI	-.38, .03	3.18, 4.17	-2.21, -1.46	-.05, .11	-2.11, -1.8	-.48, -.28

** the mean difference is statistically significant at p value of <.001

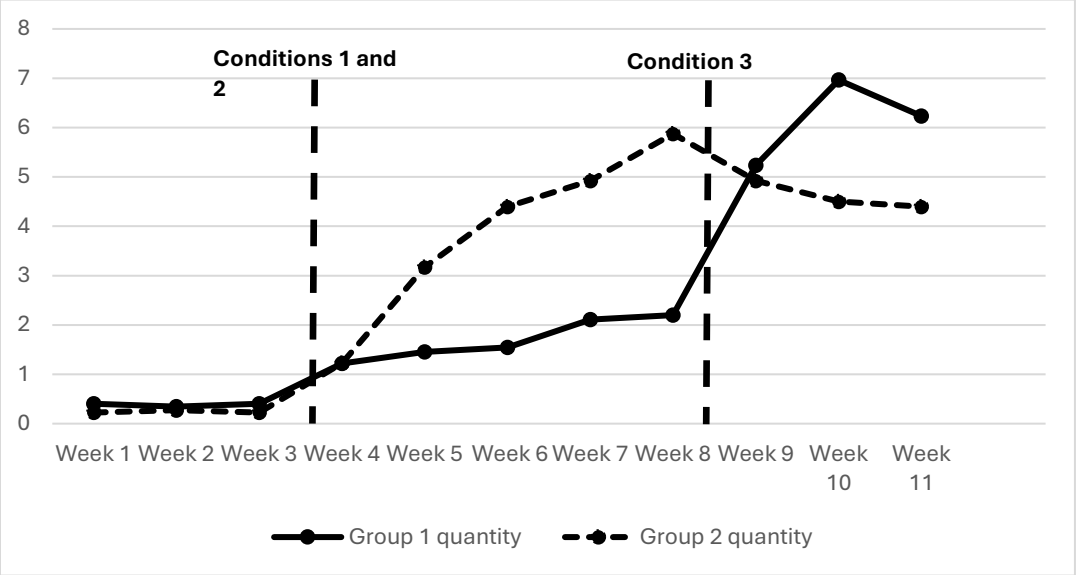
Figure 1 shows teams' weekly participation quality data points. As seen in the figure when applying conditions 1 and 2, Group 1 showed a steady increase in participation quality (Figure 1), contrary to Group 2. This seemed logical as the Quality Condition contingencies targeted participation quality. Looking at Figure 2, Group 2 showed a steady increase in participation quantity compared to Group 1 (Figure 2). Again, this seemed logical since Quantity Condition targeted participation quantity.

Figure 1

Teams' Participation Quality Weekly Data Points

Figure 2

Teams' Participation Quantity Weekly Data Points



Looking at Figures 1 and 2, we can see that after the application of Quality-Quantity Condition in Groups 1 and 2, there was a steady increase in the engagement indicator that was not targeted earlier. For example, in Group 1 which was initially targeted by participation quality contingencies, the participation quantity steadily increased after implementing Quality-Quantity Condition, which represented superimposing participation quantity contingencies over the already existing participation quality contingencies. For Group 2, which was initially targeted by participation quantity contingencies, the participation quality steadily increased after implementing Quality-Quantity Condition. This represented superimposing participation quality contingencies over the already existing participation quantity contingencies.

Discussion

In an era marked by the profound transformation of education, accelerated by the COVID-19 pandemic, the importance of online learning is paramount. This study has explored the potential of the GBG as a novel strategy to enhance online learning, specifically focusing on nursing students—a group with unique learning needs and a curriculum demanding practical skills and effective communication. The current study aligns with the calls in the literature to provide empirical evidence on the use of gamification in educational settings in general, and in online learning in specific (Antonaci et al., 2019). This is considered of utmost importance for an online learning environment where the students' engagement is problematic with limited interaction of the students with institution, teachers, and peers, compared to in-person learning (Vermeulen &Volman, 2024)

The repeated measure MANOVA analysis showed that implementing the GBG activity and associated contingencies significantly promotes the targeted academic behavior. Although

no previous studies have examined the effectiveness of GBG in university students in general or nursing students specifically, the current study's results align with similar previous studies. For example, GBG was implemented with school-age children whose outcome behaviors were writing speed and accuracy (Klaft & Codding, 2022). Another study with school-aged children showed the positive impact of the GBG on students' engagement during online classes (Hier et al., 2023). However, these results are consistent with the few available studies on the use of gamification in online environments to promote student engagement and motivation (Zakaria et al., 2024). The study revealed intriguing trends in the data. Students initially exposed to participation quality contingencies demonstrated a steady improvement in this aspect, while those exposed to participation quantity contingencies demonstrated an increase in their quantity of participation. However, the most significant finding emerged when both contingencies were combined under Quality-Quantity Condition, resulting in a synergistic effect. In this phase, students from both groups exhibited improved engagement in areas that were not initially targeted. This suggests that the GBG has the potential to enhance holistic engagement by addressing multiple aspects of student participation simultaneously. Thus, generally, the current study supports the previous studies' results, suggesting that the implementation of active learning modalities in online education has had a favorable impact on students' attitudes toward learning, leading to a reduction in their reluctance to engage in the learning process (Al-Hammouri , 2024).

Contrary to what the authors were expecting, there is a significant difference between groups at week 11 regarding participation quality and quantity. We expected these differences to disappear as the same contingencies were in effect for both groups. One explanation for this finding is that more sessions/weeks were needed under similar research conditions before the data stabilized (Carneiro et al., 2021; Costa & Cançado, 2012). If the study had been completed as planned, the participation quality and quantity differences might have disappeared. Another explanation would be fluctuation in student performance as other course requirements near the end of the semester started to interfere and resulted in some noise in the data. Although these might be valid explanations, further future replication is required to support which one could be the valid explanation. This contradiction with some of the authors' expectations does not discount the noticeable impact of GBG on student engagement as indicated by their participation quality and quantity, especially when we look at the large values of post hoc effect sizes (Table 4).

Results from this study demonstrate that the GBG can be a valuable tool for promoting engagement in online learning environments. Through a systematic approach combining contingencies for participation quality and quantity, the GBG was able to bridge the gaps created by the limitations of online education. Notably, the GBG succeeded in fostering higher levels of student participation and improved the quality and quantity of their engagement, especially when used in conjunction with traditional online discussion forums. One explanation regarding the effectiveness of the GBG could be that GBG has impacted students' motivation to learn, which in turn impacted student engagement (Akram & Li, 2024).

The implications of this research extend beyond nursing education. The GBG's adaptability to various disciplines and its potential as a holistic engagement strategy in online learning environments open new avenues for educators and institutions seeking effective ways to

design activities in online educational courses. Specifically, the GBG offers a promising approach to address the challenges posed by the reduced collaborative learning opportunities and limited student-faculty interactions.

Limitations and Recommendations

This study has several limitations that warrant consideration. First, the generalizability of the results may be restricted due to the study's specific context—a major public university in Jordan—and the participant pool consisting of nursing students in a Communication and Health Education course. Second, a larger and more diverse sample would enhance the generalizability of the results. Third, technical issues with the online discussion forum platform led to the premature termination of data collection, impacting data completeness and the ability to draw more conclusions. It has been suggested that there are usually several sessions before the trend in any changing behavior stabilizes (Carneiro et al., 2021; Costa & Cançado, 2012). Thus, having more time to complete the data collection would have given us a complete picture of when and how the targeted behaviors would stabilize and stop the increasing trend. These limitations should be considered when interpreting the study's results and designing future research endeavors in online education.

Conclusion

In conclusion, this study underscores the importance of innovative approaches in adapting to the changing education landscape. The GBG, initially implemented in different contexts, has proven its efficacy in enhancing student engagement in online learning, particularly in fields like nursing, where practical skills and communication are essential. Further research can explore the nuances of the GBG's application in diverse educational settings, assess its long-term impact on student outcomes, and investigate its potential as a comprehensive engagement strategy. Integrating such strategies can help ensure that online learning remains a robust and effective platform for education in the years to come.

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Ethical approval

The institutional review board committee at Jordan University of Science and Technology approved this study.

Conflicts of interest

The authors have no conflicts of interest.

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