Gamification: Does it improve student engagement and academic achievement?

Erika Schutt
St. Mary's College of Maryland

Abstract: Gamification is the use of educational games in the classroom to promote student engagement. This possibility has caught the attention of many researchers and educators. However, research on the benefits of gamification has been mixed, leading to questions about the effectiveness of the practice. The purpose of the study was to evaluate the effects of a 3-week gamification intervention in a high school social studies class. I found no statistically significant changes in students' achievement, off-task behaviors, or affective engagement following the intervention. In addition, students were less likely to demonstrate on-task behaviors. These findings call into question the effectiveness of using games to improve students' engagement and achievement in social studies.

Introduction

Social studies is often taught in a lecture-based format. This can be unexciting and unmotivating for students, the majority of whom do not list social studies as their favorite subject (Alazzi & Chiodo, 2004). By using gamification as a new teaching method, social studies can shift into a subject students enjoy and look forward to each day. Empirical research on gamification is limited, and evidence of its effectiveness is mixed. Whereas some researchers have reported negative effects of including gamification in the classroom(e.g., Kwon & Özpolat, 2021), others have reported positive effects (e.g., Seixas et al., 2015). However, there seems to be some consensus that gamification can support classroom engagement if used correctly (Kennette & Beechler, 2019). The purpose of this study was to examine the influence of a research-based gamification intervention on high school students' cognitive, behavioral, and affective engagement.

Gamification involves the use of game-like elements in non-game situations (Faiella & Ricciardi, 2015). As the term was not introduced until 2002, understandings of the benefits of gamification, particularly in education, are still emerging. Research on the use of games in education has increased dramatically since 2019 (Manzano-León et al., 2021). One of the goals of gamification in educational settings is to improve students' motivation. Indeed, some studies have shown that gamification, when used correctly, does work to improve students' engagement (Kennette & Beechler, 2019; Faiella & Ricciardi, 2015; Manzano-León et al., 2021; Wiggins, 2016). But the effectiveness of gamification is dependent on how it is executed.

Research on Gamification in Education

Gamification has been associated with many benefits for students. Seixas et al. (2016) found a positive relationship between student engagement and gamification. Their sample consisted of two groups of public school geometry students (N = 61) between the

ages of 13 and 14. After identifying content objectives and defining communication tools, Seixas et al. (2016) incorporated elements of gamification into the objectives. Namely, they used ClassDojo and ClassBadges to reward attitudinal, instrument, cognitive, and conceptual objectives. Cluster analyses revealed that students with more badges presented the highest levels of engagement. Conversely, Kennette and Beechler (2019) found that games that include badges, leaderboards, and personality characteristics can make gamification hard to use and reduce students' intrinsic motivation and class satisfaction. Hamari et al. (2014) reviewed 24 empirical studies and positive outcomes of gamification. They found that these games allowed students to have autonomy, make mistakes, witness their progress, understand their responsibility for outcomes, and receive immediate feedback (Hamari et al., 2014).

However, more recent research suggests that gamification is not universally effective. Kwon and Özpolat (2021) tested how assessments that involved gamification influenced students' content knowledge, learning, and course experience. Their study took place at a university and consisted of 62 undergraduate students, 33 in the experimental gamified group and the remaining 29 in the control non-gamified group. They administered quizzes at the beginning of the class, totaling 24 quizzes, and exams to measure the content knowledge of students and performance. They found that assessment gamification increased student's motivation and expressed interest. However, it also reduced students' accumulation of content knowledge. These findings suggest that when gamification is only used to assess coursework, it may have some undesirable consequences. In another review, Manzano-León et al. (2021) examined the relationship between gamification and student motivation across 14 experimental or quasi-experimental studies. Most of the studies they examined at did not specify why they used a specific aesthetic. In the end, they concluded educational gamification can have many benefits, but if only one or two elements of gamification can have a negative impact or no impact on student motivation.

Present Study

In this study, students participated in review games that did not involve rewards (e.g., matching key terms to their definitions). I hoped to improve student engagement in the classroom by using the elements of gamification identified as beneficial in past research. The research questions that guided this study were:

1. How does the use of games in the classroom affect students' content knowledge?
2. How does the use of games affect students' behavioral engagement?
3. How does the use of games in the classroom affect students' affective engagement?
4. What do students report liking/not liking about gamification?

Methods

During my placement, I collected data on student engagement and academic achievement during a three-week period using a behavioral checklist, observations, student surveys, and content tests. The material covered during this time included Black Tuesday, The New Deal, and the rise of dictators. These were ideal for the study as students likely had either little or no prior knowledge of these historical concepts.

Context

I conducted this study at a rural high school in Maryland. The participants are ninth through eleventh grade high school students. The participants include 15 female and 14 male students.

Intervention

My intervention involved the use of gamification in the social studies classroom. The students started the lesson with a pretest to gauge their understanding of the content. I then proceeded to teach the lesson, incorporating a review game for students to participate in towards the end of the lesson. Students were placed in random groups for review games that took the form of game shows, simulations, and interactive quizzes. Students participated in a mini-review game before the assessment.

Data Collection

This mixed-methods study consisted of qualitative data derived from open-ended survey responses and quantitative data drawn from contest tests, behavioral checklists, and engagement survey items. The behavioral and affective engagement scales used in the survey were adapted from Skinner et al.s' (2008) Engagement Versus Disaffection With Learning: Student-Report. Participants responded on a 5-point Likert scale with anchors from "1-strongly disagree" to "5-strongly agree." They were given a test of the content and a survey to complete before and after the intervention. The post-intervention survey was the same as the pre-intervention survey but included an open-ended question. This question was used to capture their perspectives of the lesson and review game; namely, the extent to which they liked it and thoughts as to how it could be improved.

Table 1:

Research Questions and Data Sources

	Data source 1	Data source 2
How does the use of games in the classroom affect students' content knowledge?	Content Pretest/Posttest	
How does the use of games in the classroom affect students' behavioral engagement?	Behavioral Checklist (pre-intervention and post-intervention)	Behavioral Engagement Scale from Skinner's et. al (2008) Engagement Versus Disaffection With Learning: Student-Report (pre-intervention and post-intervention)
How does the use of games in the classroom affect students' affective engagement?	Affective Engagement Scale from Skinner et. al (2008) Engagement Versus Disaffection With Learning: Student-Report (pre-intervention and post-intervention)	
What do students report liking/not liking about gamification?	Open-Ended Item on Student Survey (post-intervention)	

Data Analysis

Changes in students' content knowledge, behavioral engagement, and affective engagement were assessed using two-tailed paired *t*-tests comparing pre- and post-intervention measures. Effect sizes were measured using Cohen's *d*. First and second-level codes were used to explored patterns and themes emerging from students' descriptions of their experiences with gamification.

Validity Concerns

The behavioral checklists were completed by my mentor teacher, removing any biases I might have. In addition, the criteria for the checklist was designed to be objective, leaving little room for subjective judgment in completing the checklist.

Results

How does the use of games in the classroom affect students' content knowledge?

Students took a test before and after learning the content we covered during the intervention. They already had some understanding of the material before the intervention, as demonstrated in their average quiz score of 81.7% (Table 2). They showed no significant growth by the end of the intervention, with an average quiz score more indicative of mastery (*M* = 95.6%).

Table 2

Paired t-test Comparing Pretest and Posttest Content Knowledge

	N	*M*	*SD*	*p*
Pretest	28	81.7	19.2	0.169
Posttest	27	95.6	12.6	

How does the use of games in the classroom affect students' behavioral engagement?

To answer this question, I used a behavioral observation checklist with prompts that relate to behavioral and affective engagement. In observation checklist, my mentor and I observed 29 students before and during my instruction. The categories in the checklist included on-task and off-task prompts. On-task prompts included raising hand to ask questions, following directions, and completing work. Off-task prompts included being on phone, head on desk, and disruptive behavior. Surprisingly, the number of on-task behaviors during gamification (*M* = 1.21) was significantly lower than the number of on-task behaviors before use of gamification (*M* = 1.62; see Table 3) and there was a small effect size. There were no significant changes in students' off-task behaviors (see Table 4).

Table 3

Paired t-test Comparing On-Task Behaviors Pre and Post Observation

	N	*M*	*SD*	*p*	*d*
Pre	29	1.62	0.69	0.006	0.74
Post	29	1.21	0.37		

Table 4

Paired t-test Comparing Off-Task Behaviors Pre and Post Observation

	N	*M*	*SD*	*p*
Pre	29	0.40	0.50	0.062
Post	29	0.18	0.36	

How does the use of games in the classroom affect students' affective engagement?

To answer this question, I surveyed students before and after gamification. In this survey, students were asked to respond to questions relating to affective engagement (Skinner et al., 2008). In total, 27 students completed the pre and post student surveys. Changes in students' affective engagement were not statistically significant (see Table 5).

Table 5

Paired t-test Comparing Affective Engagement Before and After Intervention

	N	*M*	*SD*	*p*
Presurvey	27	3.30	0.31	0.496
Postsurvey	27	3.34	0.32	

What do students report liking/not liking about gamification?

In the post-gamification survey, students were asked to answer an open-ended question asking "Did you enjoy using games in the social studies classroom? Why or why not?" I categorized four topics that presented themselves in their responses. These four categories were instructional method (*N*=22), engagement (*N*=24), environment (*N*=7), and learning content (*N*=6). Out of the 27 students, 24 students reported positive reviews and 4 students reported negative reviews of the use of games in the classroom. However, 3 out of the 4 negative reports start off saying they do like using games in the classroom. For example, one student wrote:

> Yes, I enjoyed using games in the social studies classroom. However, personally, I retain information by writing notes down a bit more, because I am able to look over them later. The games make the lesson more interactive and fun, though.

Another student wrote "Yes, it's less boring than everything else. I like videos better though." Other students reported that using games to review the material aided with the

assessment and the environment of the classroom. Examples include "Yes because with the quiz today it really helped" and "Yes, it makes the class even more fun and less stressful."

Discussion of Results

The results of the content tests suggest that using review games in the classroom had no impact on students' knowledge of the materials. I also found that students were less likely to be on-task during gamification. There were no significant changes in students' self-reported affective or behavioral engagement. These findings could reflect that students had become accustomed to the teaching approach used since the beginning of the school year and not gamification. Students also did not appear to be more affectively engaged after participating in social studies games. However, in their responses to the open-ended prompt, students expressed a sense of enjoyment, less stressful, and described the material as easier to remember. These apparently conflicting findings could reflect response bias in open-ended responses; students may have responded in ways they believed would please me. However, it is also possible that there were real changes in students' affective responses to gamification that were statistically undetectable due to the small sample size (i.e., Type II error).

Conclusions and Implications

Despite some students reporting that they felt less stressed and enjoyed using games in the classroom, the evidence as a whole indicates that review games had little impact on students' engagement or understanding of the material. In future works, scholars might conduct such studies over the course of the whole school year to evaluate if the non-significant findings in this study were an artifact of the short period for the intervention. This would help eliminate the main questions left lingering: is this form of gamification a great use of class time? Moreover, are there other factors that can improve gamification to promote better student motivation and behaviors? If and when gamification is put to the test in a more robust study (i.e., one with a larger sample, and conducted over a longer time period), these questions can be answered. However, at present, the most logical inference is that review games in social studies do not help students learn the content or encourage them to engage with the material. Teachers who wish to review content with their students may instead use focus on other approaches.

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Appendix

Appendix A: Student Survey

Please circle the number that best describes how you feel.

- In class, I work as hard as I can:

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
(1)	(2)	(3)	(4)	(5)

- When I am in class, I listen very carefully:

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
(1)	(2)	(3)	(4)	(5)

- When I am in class, I just act like I am learning:

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
(1)	(2)	(3)	(4)	(5)

- When we work on something in class, I feel interested:

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
(1)	(2)	(3)	(4)	(5)

- In class, I do enough to get by:

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
(1)	(2)	(3)	(4)	(5)

- When my teacher first explains new materials, I feel bored:

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
(1)	(2)	(3)	(4)	(5)

- Class is fun:

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
(1)	(2)	(3)	(4)	(5)

Open ended question:
Did you enjoy using games in the social studies classroom? Why or why not? (JUST POST)

Appendix B: Behavioral Observations from Skinner's et. al (2008) Engagement Versus Disaffection With Learning: Student-Report

Student	Raising hand to ask questions	Following directions	Completing work	On phone	Head on desk	Disruptive behavior
Student 1						
Student 2						

Student 3						
Student 4						
Student 5						
Student 6						
Student 7						
Student 8						
Student 9						
Student 10						
Student 11						
Student 12						
Student 13						
Student 14						
Student 15						
Student 16						
Student 17						
Student 18						
Student 19						