Effects of Gamification in Test Review

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Abstract

Gamification is a test-review method that has many potential benefits, but its efficacy is not well understood. The purpose of this paper is to explore the relationship between gamification in test review and test grades. We analyzed grades from students in grades 9-12 and conducted interviews with teachers. We found no significant difference in grades between classes that used review games and those that did not. However, teachers reported that review games had a positive impact in the classroom. Limitations and directions for future research are discussed.
Keywords: gamification, test review, grades, review games, students

Nearly one hundred million standardized tests are taken by students across the United States every year (Medina et al., 1990). The average US student takes 112 standardized tests by the time they graduate high school, which is an average of 8 standardized tests per year (Hart et al., 2015). In addition, students regularly take non-standardized tests in their classes There are usually at least 4 core subjects, English, math, science, and history. Each of these classes may give multiple tests throughout the school year. In middle school and high school, students can choose electives that potentially administer tests as well. As such, it can be assumed that the total number of standardized and non-standardized tests for students in the United States each year is several hundred million. Therefore, the methods that students use to study, and the review methods used by teachers are extremely important.

Traditional test review has consisted of methods such as re-reading, highlighting, summarization, and mnemonics; however, there is evidence that these traditional review methods are not effective (Dunlosky et al., 2013). There are other more effective review options, such as practice tests and distributed practice. However, these are not as interactive and engaging as review games. Therefore, gamification in test review is a concept that should be considered and widely implemented.

Gamification is defined by the process of integrating and using game design elements in a non-gaming context (Deterding et al., 2011). The term was first coined by Nick Pelling around 2002 and has grown in popularity since. For instance, 50% of companies aimed to incorporate gamification in at least one aspect of the workplace (Anderson, 2012). Gamification continued to grow, integrating and adapting to fields such as business, education, military, and healthcare (Deterding et al., 2011; Lohse et al., 2013).

Current research shows that gamification has many positive effects on education, such as promoting learning, increasing engagement, improving memory retention, and enhancing motivation (Nadi-Ravandi & Batooli, 2022). Alternatively, some research has shown that gamification may have some potential drawbacks in education, such as lower exam scores and decreased intrinsic motivation (Hanus & Fox, 2015). However, this study used gamification as a reward system for students completing activities, rather than a method of reviewing for tests. The current literature recognizes that there is potential for use of gamification in the test review process, which is what this paper will explore.

Despite those drawbacks, gamification still has its many benefits. Some benefits include making boring activities more enjoyable, providing entertainment, improving self-esteem, creating a sense of positive competition, developing positive social relationships, promoting knowledge acquisition, enhancing working memory, visual attention, and processing speed,

improving concentration, and acquiring a sense of goal-orientation (Sardi et al., 2017). This is important because improving learning for children is the ultimate goal of this study, and all of the benefits that come with gamification should be further researched to achieve this goal.

The purpose of this paper is to explore the relationship between gamification in test review and test grades. We hypothesized that classes that used gamified test review would score higher on assessments than the classes that did not.

Methods

Participants

The participants in this experiment are students and staff, in grades 9-12. The study takes place in a private college preparatory school located in Nevada. Students in the study range from age 14 to 18. The classes that data was gathered from included all the classes in the upper school, excluding media arts, ceramics, studio art, musical theater, music classes, and English, due to these classes not having any tests. Unfortunately, some classes were too small and did not have enough data, so those were excluded. Those classes were: AP Calculus AB/BC, AP World History, and Spanish 3, AP Latin, and AP Economy.

Procedure

We conducted interviews with teachers of the classes included in the analysis. The interview questions consisted of questions about a teacher's teaching style, and the types of reviews that they conduct with students. The main purpose of the interview was to gather background information on classes and to see if they play review games or not. The interviews gathered information on the specific types of review games played. For this study, the platforms used for test review that qualified as gamified include but are not limited to: WordBricks, Duolingo, Kahoot, Babble, Jeopardy, ClassDojo, Lifeline, Feelbot, Brainscap, Quizizz (Ekici, 2021; Kalogiannakis et al., 2021).

The IRB form swiftly gained administrative approval upon submission. Subsequently, interviews with teachers ensued to gather class details—exam formats, platforms for reviews, and the classes they taught. Post-interviews, a formal request to the school administration yielded test scores. Upon receipt, a comprehensive statistical analysis of grades was undertaken.

Analysis

We conducted a Mann-Whitney test to compare the test scores between classes that used review games vs classes that did not use review games. Data from interviews with teachers were qualitatively analyzed by the author.

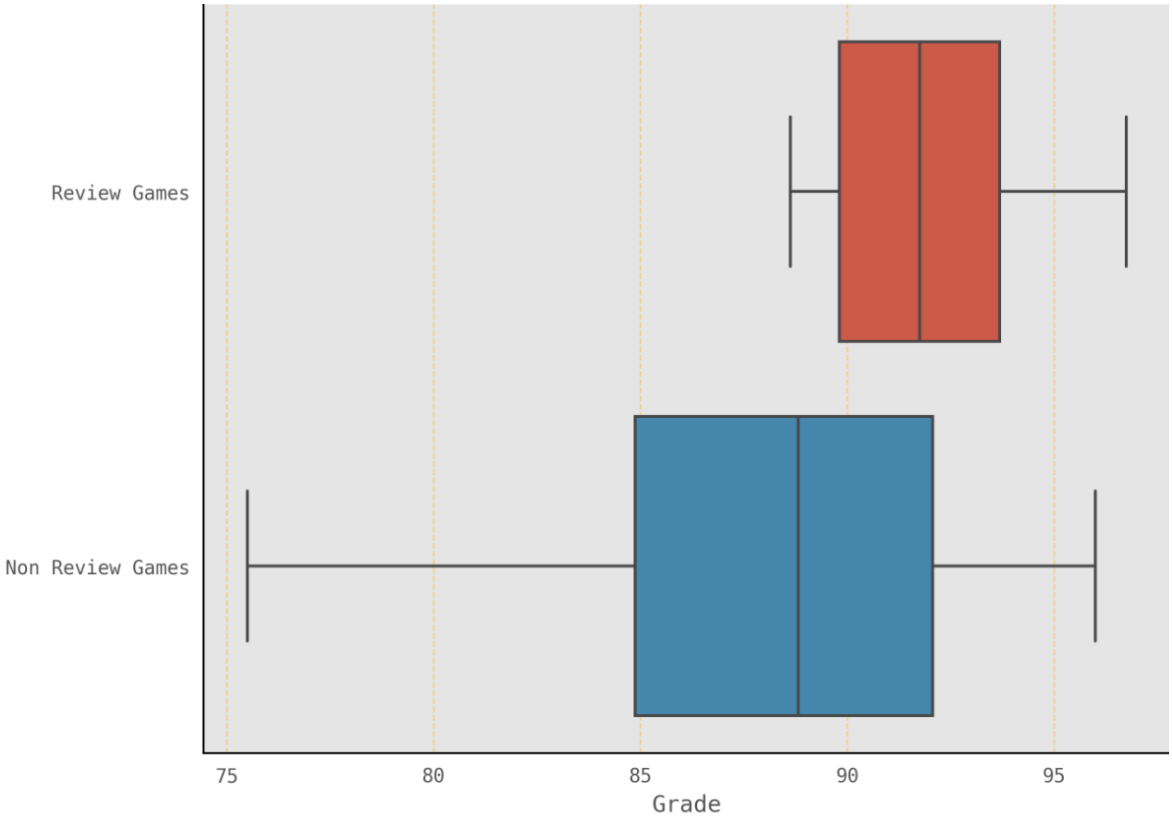
Results

A Mann-Whitney test indicated that average grades over a semester for classes using review games (Mdn = 88.8125, range = 20.5) were not significantly different from average grades of classes not using review games (Mdn = 91.75, range =8.1325), $U = 36$, $p = 0.05548$ (see **Fig. 1**).

Based on interviews with teachers, we found that 7 classes used review games, and 18 did not. Some of the games used included: Jeopardy, Quizlet, and Kahoot. Based on interviews with teachers, we found several common themes: teachers who used review games reported higher class engagement and higher class participation, and perceived their students to do better on assessments. They also believed that their students enjoyed the games and that

students looked forward to playing them. All teachers reported that assessments consisted of multiple-choice and short-answer questions.

Figure 1
Average grades



Note. This figure shows average grades of students in classes that used review games and students in classes that did not use review games.

Discussion

The purpose of this study was to explore the relationship between review games and test scores in high school students. We hypothesized that classes that used test review games would score higher on formal classroom assessments than classes that did not. Overall, students in classes that used review games scored an average of 3.93% higher than students in classes that did not use review games. However, this difference was not statistically significant. In this sample, gamified test review was not significantly correlated to higher grades. This may mean that gamified test review is not associated with higher test scores in high school students. However, gamified test reviews may have other positive effects on high school students. All teachers who used gamified test reviews reported that their students were more engaged in class because of the review games. They also reported that almost all students looked forward

to and had fun playing these games. that students seemed to do better on their tests because of review games. Overall, while using review games may not significantly improve test scores, it may improve other aspects of classroom learning, such as class engagement.

Limitations and Future Directions

There were several limitations to this study. Most notably, we had a small sample size of both teachers and students. In the 25 classes that the study encompasses, there are only 70 students. Future studies should include more students and teachers to increase power and elucidate the relationship between review games and test scores. Several classes were not included in the analysis due to the small sample size, in an interest to protect the anonymity of students in the classes. These classes included: AP Calculus AB/BC, AP World History, Spanish 3, AP Latin, and AP Economy. Excluding these classes may have excluded an important subset of students who are differentially affected by test review games. Future studies should aim to include test grades from a wider variety of classes. Another limitation of this study is the competitive nature of most students attending this high school. This can cause the grades to be not as equally distributed, and lead to a skewing of the data.

The goal of this research project is to explore the efficacy of gamification in test review. There should be more research done in this field, specifically replication of this experiment with a larger and more representative sample size. Whether or not there is a significant impact, there should also be further research done on each element of the test review game, to determine what elements of review are the most helpful and effective.

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