The Effect of Games on Student Learning

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Introduction

Our research focuses on the effectiveness of competitive gaming on student learning. Games are a fun way for students to engage with the material in an active way. Students who participate in competitive games can foster critical thinking, collaboration, and engagement with the material. Additionally, games offer a low-stakes environment for students to learn and make mistakes. Previous work has discussed whether gamification of a statistics module improves learning outcomes and student attitudes (Khoshnoodinar et al., 2023). The study did not observe superior learning performance for students who participated in the game, though they did see that students had a positive attitude towards the gamified statistic module compared to students engaged in a traditional e-learning module. The authors suggested that better design emphasizing feedback, challenges, and concentration could strengthen the impact on learning. Additional research has shown how the use of games, specifically Bingo, can help students with key terminology and concepts in a sociobiology class (Coco et al., 2001).

The objective of this research is to add upon previous studies regarding gamification of study material. By applying previously researched concepts to Jeopardy, we can measure the correlation between retaining concepts and the use of competitive, game-based review methods.

Methodology

Sample Group
- Courses: CHEM1B, CHEM 124, CHEM4, STAT50
- Sample size: around 18 students
- All students partook in both the control and jeopardy trial

Control Trial
- First month of semester: Pre-quiz was administered on covered topic. The same quiz was given one month later
- Each class had their respective topic
- Quizzes contained around 5 questions, and all quizzes were graded out of 10
- Changes in grades from pre- and post-quiz were observed

Jeopardy Trial
- Last month of Semester: Jeopardy game played on the topics covered. The same questions were given one month later in quiz format
- Jeopardy contained a varying number of questions having values of 100, 150, 200, 250, and 300
- It was noted whether students got the question right or wrong
- Jeopardy was graded out of 10 depending on how many questions the students got correct, not on Jeopardy points
- Changes in grades from Jeopardy game and post-quiz were observed

Data Analysis
- Statistical analysis of the data was done in excel
- We measured the differences in post-quiz from pre-quiz in the first month vs. the Jeopardy and post-quiz scores in the second month
- The bar graphs were generated by averaging student grades for all quizzes
- The box and whisker plot was generated by noting the changes in grades between the control trial and the Jeopardy trial

Results

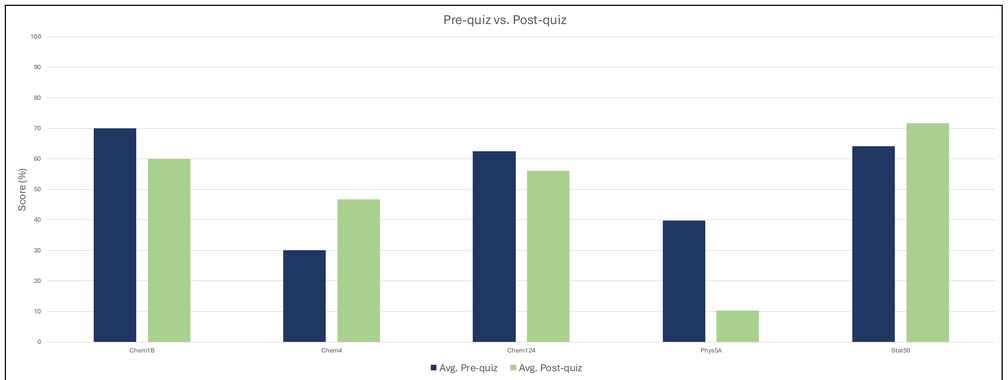

Fig 1. Graph showing difference in pre-quiz and post-quiz scores amongst sections. The x –axis represents class sections and the y-axis represents the pre- and post-quiz scores of students in each respective class.

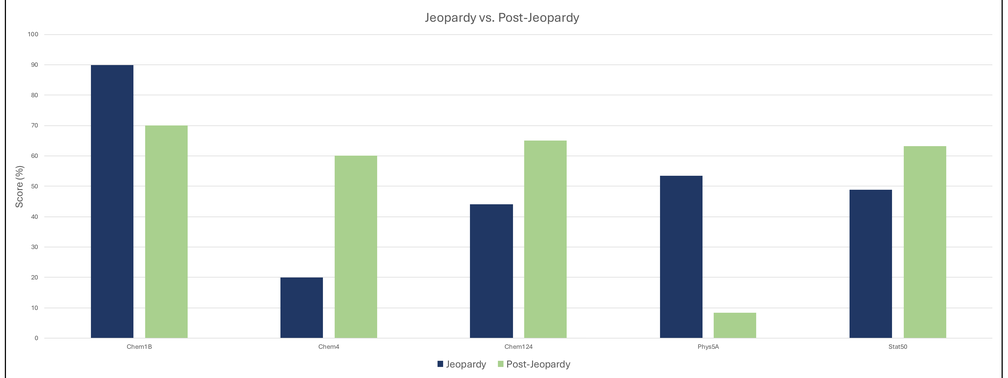

Fig 2. Graph showing difference in jeopardy and post-jeopardy scores amongst sections. The x –axis represents class sections and the y-axis represents the pre- and post-quiz scores of students in each respective class.

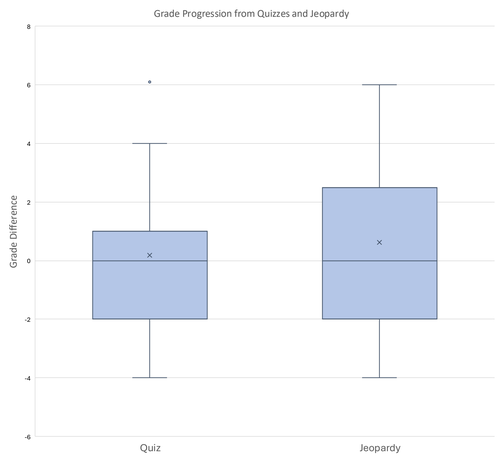

Fig 3. Grade progression from the two quizzes (left) and from the jeopardy and quiz (right). The data produced a p-value of 0.273, which is greater than 0.05, making the data statistically insignificant at the 5% level.

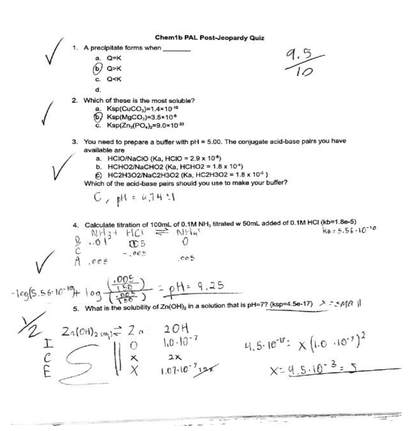

Fig 4: Example of a post-quiz that was given in Chem 1B PAL Students worked on these quizzes individually and timed. The content on this quiz was representative of what students were learning during the week.

Discussion

No definitive conclusion can be made from the data collected on whether competitive games help students learn more.
Figure 1 shows students' scores on quizzes given without a game.
Figure 2 shows the tested group, where a Jeopardy game was played covering course material, then a quiz made from that Jeopardy was given.
These two graphs show that in general:
- If a section improved from pre-quiz to post-quiz, they also improved from Jeopardy to post-Jeopardy.
- If they performed worse on the post-quiz, they performed worse on the post-Jeopardy.

This is inconclusive, since the Jeopardy group did not appear to perform better compared to their change in score with just quizzes.
The box plot depicted by **Figure 3** shows:
- A small overall change in the median grades of the control pre/post-quizzes and the Jeopardy/post-quiz.
- The Jeopardy group has more variability in their scores, with some students improving more than others.

Factors that affected student scores:
- The course content being assessed was different between the pre/post-quiz and the Jeopardy/post-quiz.
- Student absences and external disruptions prevented facilitators from administering the quizzes and Jeopardy sessions at the intended one-month intervals.
- These disruptions impacted the accuracy of retention comparisons.

Future considerations:
- Test whether the type of content material affects whether Jeopardy or a quiz is a better format for students to retain information.
- Communicate with facilitators on when to do each part of the data collection.
- Ensure the same amount of time is given students to participate in the activity so that timing does not skew the data.
- Emphasize to students the importance of attending class so that there is an increased sample size of students included in the study.

References

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- Khoshnoodifar, M., Ashouri, A., & Taheri, M. (2023). *Effectiveness of gamification in enhancing learning and attitudes: A study of statistics education for health school students. Journal of Education and Health Promotion*, 12, Article 385. https://doi.org/10.4103/jehp.jehp_117_23

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