Reviewing for Exams:
Do Crossword Puzzles Help in the Success of Student Learning?

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Abstract

The goal of this project was to further our understanding of how students learn. Does reviewing for exams using certain teaching methods actually enhance students' learning of course material? Through a comparative analysis of two sections of the same class we tested to see if using crossword puzzles as a 'fun' review technique actually affects students' exam scores as evidence of successful learning.

Review of the Literature

•Crossword puzzles have not been largely examined to evaluate success for students learning.

•Crossword puzzles are shown to increase retention among students (Crossman & Crossman 1983) and clarify concepts (Childers 1996). But do they help when used as an exam review aid?

•Many types of games are used as test review including: board games (Clark & Farland 1992), simulations games (Dorn 1989), jeopardy (Rotter 2004), bingo (Klepper 2003), and crossword puzzles (Childers 1996; Crossman & Crossman 1983).

Research Questions

•Does using crossword puzzles as an exam review aid affect student exam scores?

Methodology

Participants

Eighty-seven students in two sections of an introductory sociology class participated in this study (Class A, N=43; Class B, N=44). The majority of students were freshmen (Class A, 86%; Class B, 59.1%); the remainder were sophomores (Class A, 11.6%; Class B, 36.4%) and juniors (Class A, 2.3%; Class B, 4.5%).

Procedure

Key terms were chosen to give the students to review for the exams. Using a crossword creator software program the review terms, along with their clues, were generated into a crossword puzzle. The crossword puzzles review aid was given to one group and a review of just the key terms used on the crossword were given to the other group. The group given the crossword puzzle was alternated throughout the semester with the four tests:

Test Number	Class A	Class B
1	Crossword puzzle review	No crossword puzzle review
2	No crossword puzzle review	Crossword puzzle review
3	Crossword puzzle review	No crossword puzzle review
4	No crossword puzzle review	Crossword puzzle review

Results

Repeated Measure ANOVAs

Results found that there was a significant effect over time in student scores on their exams for both class periods (Class A: $F = 5.617$, $p = .001$; Class B: $F = 8.850$, $p = .000$). Specifically, it was found that students exam scores in Class A were better when they were given the crossword puzzle as exam review (Exam 1 $M = 73.30$; Exam 3 $M = 76.075$) than when they were given a list of terms for exam review (Exam 2 $M = 71.463$; Exam 4 $M = 68.575$). However, in Class B students scores on exams were lower when they were given the crossword puzzle as the exam review (Exam 2 $M = 73.605$ and Exam 4 $M = 70.744$) than when they were just given a list of terms for exam review (Exam 1 $M = 77.512$ and Exam 3 $M = 75.860$); this indicates that there is a possible difference between the classes on the exams.

Independent t-tests

In order to examine the possible difference in scores between the two classes, an independent t-test was conducted on all four exams. Results found that the means for each of the four exams did not differ significantly between the two classes ($p = .310$; $p = .321$; $p = .933$; $p = .456$, respectively). Levene's test for equality of variances also indicates that the variances for Class A and Class B for each of the four exam times did not differ significantly from each other ($p = .230$; $p = .208$; $p = .427$; $p = .712$, respectively). Thus, there is no significant difference between the two classes in terms of their scores for each of the exams.

Pair-sample t-tests

Pair-sample t-tests were conducted to compare both non-crossword puzzle review times, and the cross-word puzzle review times within both class periods to see if there were significant differences between the same conditions for exam review. In both class periods, the results for the non-crossword puzzle exam review times found that the mean scores were not significantly different from one another (Class A, $p = .095$; Class B, $p = .474$). For the crossword puzzle reviews, the results also found in both class periods that the mean scores were not significantly different from one another (Class A, $p = .316$; Class B, $p = .060$). Thus, there was no difference between the scores on the students' exams under the same test condition.

Pair-sample t-tests were then conducted to compare the exams scores between the crossword puzzle reviews and the non-crossword puzzle reviews within each of the classes separately. For Class A, the results were mixed. When comparing the first pair (Exam 1 & Exam 2) it was found that the mean score on the exam with the crossword puzzle review ($M = 73.000$) was not significantly different ($p = .125$) from the mean score on the exam with the non-crossword puzzle review ($M = 71.463$). However, when analyzing the second pair of exams (Exam 3 & Exam 4) the mean score for the crossword puzzle review ($M = 76.075$) was significantly different ($p = .000$) from the mean scores on the exam with the non-crossword puzzle review ($M = 68.575$). Thus, having an exam review using crossword puzzles as a review technique did affect students' exam scores in Class A, but only for one of the exam pairs. For the pair that was significant, students did better on the exam when they were given the crossword puzzle as review. The results also found that a significant correlation exists between each of the exam pairs ($r = .573$, $p = .000$; $r = .623$, $p = .000$), indicating that those who scored high on one exam tended to score high on the other.

For Class B, the results for both tested pairs found that the mean score on the exams with the non-crossword puzzle review were significantly different from mean scores on the exams with the crossword puzzle review (respectively, $M = 77.512$ to $M = 73.605$, $p = .017$; and respectively, $M = 75.860$ to $M = 70.744$, $p = .001$). Thus, having an exam review using crossword puzzles as a review technique did affect students' exam scores in Class B, but in the opposite direction; the mean scores show that students did worse on the exams when they were given the crossword puzzle as review. The results also found a significant correlation exists between each of the test pairs ($r = .711$, $p = .000$; $r = .671$, $p = .000$), indicating that those who scored high on one exam tended to score high on the other.

Conclusions

The results were mixed when looking at the use of crossword puzzles as tools for the increase of student success of learning. One class had improvement in student exam scores when using the crossword puzzle, but only one pair was found significant. On the other hand, the second class' results were significant in both exam pairs, but the crossword puzzle as a review tool negatively affected student's exam scores.

What does this mean? The fact that one class did do better on exams when given the crossword puzzle indicates that further research on this topic needs to be done. Why did students' scores decrease when using the crossword puzzle as review? Learning theory suggests that if students only used the crossword puzzle as their study technique, they are less able to retain information than if they used multiple techniques (Krätzig & Arbuthnott 2006). Perhaps when given the crossword puzzle, rather than just the key terms, the students in the second class did not take the initiative to go beyond the crossword puzzle and explore the terms more thoroughly; whereas when they were only given the key terms, they were 'forced' to look things up. As Gurung & Daniel (2006) point out, "many students spend too much time on some aids…at the expense of studying important material or working on elaboration and understanding of material" (p. 53). This supports the fact that the students did worse on exams when given the crossword puzzle as a test review and study aid.

This study provides a glimpse at the use of a review technique in helping students learn material for exams. Future research should be focused upon the use of such review aids, how the instructor informs students about using the aid, as well as how exactly students utilize the aid for studying for exams.

Bibliography: Available upon request from authors.