



2008

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Berry, David C. and Miller, Michael, "Crossword Puzzles as a Tool to Enhance Athletic Training Student Learning: Part 2" (2008).
Human Performance and Health Education Faculty Research. Paper 9.
http://scholarworks.wmich.edu/humanperformance_faculty/9

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Crossword Puzzles as a Tool to Enhance Athletic Training Student Learning: Part 2

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CROSSWORD PUZZLES can be used to reinforce cognitive information presented in class, to introduce new concepts, or to assess student learning and retention. To evaluate the effectiveness of crossword puzzles for facilitation of learning and retention of knowledge and to examine students'

KEY POINTS

Utilizing crossword puzzles allows students to comprehend course materials in less time compared to traditional methods.

Concrete sequential and concrete random learners benefit by using crossword puzzles in their educational preparation.

Using crossword puzzles allows students to increase their confidence and test taking abilities.

Students using crossword puzzles enjoyed their experiences and thought that it positively affected their learning.

perceptions and preferences for learning, a systematic investigation was conducted. The project involved 27 undergraduate athletic training students (males = 18, females = 9, 23.3 ± 2.45 years of age) who were enrolled in two separate therapeutic modality courses that were taught by the same instructor. Prior to the presentation of course content pertaining to the admin-

istration of therapeutic modalities, all 27 of the students were tested to assess knowledge of the subject matter. Following course instruction on the topic, a posttest was administered. To maintain consistency, the same instructor administered both the pretest and posttest. One class of students ($n = 15$) completed a crossword puzzle designed by the class instructor using Eclipse Crossword®, but students in the second class

($n = 12$) were not exposed to it. Twenty-five terms considered important by the instructor were used to construct the crossword puzzle. The key-terms were derived from textbook content. Fifteen students enrolled in the class exposed to the crossword puzzle were given one week to complete the assignment. Otherwise, both classes received identical assignments and were exposed to identical lectures (75 minutes), handouts, and other class activities that were provided by the same instructor.

Following administration of the posttest, students in the class that received the crossword puzzle assignment completed the Crossword Assessment Survey.¹ Students indicated extent of agreement with 11 statements on a 5-level Likert scale (*strongly disagree, disagree, neutral, agree, strongly agree*). Two open-ended questions related to students' perceived benefits of using the crossword puzzle and whether or not they believed they learned anything with their use were also included. Pretest exam score, time required to complete the pretest exam, students' estimates of time spent studying for the posttest, posttest exam score, and time required to complete the posttest were documented for both classes of students (Table 1). Repeated measures analysis of variance demonstrated that posttest exam scores were significantly greater than pretest exam scores for both classes ($p < .05$) but failed to demonstrate a significant between-class difference for exam scores.

TABLE 1. THERAPEUTIC MODALITIES COURSE MEANS (\pm STANDARD DEVIATIONS) FOR STUDENTS UNEXPOSED VERSUS EXPOSED TO CROSSWORD PUZZLE (CP) ASSIGNMENT

Variable	Unexposed to CP (n=12)	Exposed to CP (n=15)
Pre-test score	60.71 \pm 12.7	56.6 \pm 20.1
Pre-test time (minutes)	7.91 \pm 1.3	7.51 \pm 1.1
Post-test score	92.8 \pm 4.4	92.4 \pm 9.2
Post-test time (minutes)	24.4 \pm 3.3	20.20 \pm 7.2
Estimated study time (minutes)	170 \pm 54.7	168.8 \pm 79.1

Of the 15 students who received the crossword puzzle assignment, 100% either agreed or strongly agreed that it fairly represented the course content and that it assisted learning and retention of the course content. Responses to the open-ended questions indicated that students valued the crossword puzzle as a study aid. It forced them to read the textbook chapters in order to identify the correct key words. Some students felt that the crossword puzzle assignment helped to define the instructor's expectations, making studying for the exam easier. The following are specific comments from the students:

It forced me to read the chapters which helped me retain the information and it helped me focus on the definition of terms which helped on the test it was a good study guide.

Caused me to look through the chapter to find the answers. This then allowed me to recall what I studied better.

Reading the chapter to find the answers helped to study for the exam.

I was able to get an understanding of the instructor's expectations and also got an overview of the exam content.

Felt it gave me a guide study guide to know how to prepare for the exam.

It made a good study guide for the test. Provided study for topics wouldn't have spent much time on.

Other student comments suggested that the crossword puzzle assignment forced them to read material they would normally have skipped:

The crosswords made me learn some new words and definitions that I most likely would of just read over and not studied.

I was able to learn terms and definitions applicable to the course of study.

Helped a ton with definitions for the specific term throughout the chapter.

Understanding the definitions of the content being studied.

Discussion

There are a couple of advantages that may be realized from use of a crossword puzzle assignment as a learning activity. Because there is apparently no dominant learning style among athletic training students, educators should design learning activities for various learning styles.²⁻⁴ Depending on its design (i.e., use of definitions vs. concepts requiring critical thinking) and mode of delivery (i.e., paper and pen vs. computer-based) a crossword puzzle assignment may be well received by both concrete sequential learners (i.e., preference for workbook activities with detailed instructions and computer-assisted instruction) and concrete random learners (i.e., preference for independent study and computer games and simulations).

Crossword puzzles may facilitate dialogue between athletic training students and their clinical instructors. Athletic training students spend between 7-20% of the educational experience devoted to instructional time, with didactic learning accounting for a majority of this time.⁵⁻⁷ Crossword puzzles can be written to facilitate interaction between students and clinical instructors that facilitate acquisition of cognitive knowledge and psychomotor skills. Not only are learning opportunities created for students, they may also be created for the clinical instructors.⁸

Childer⁹ found that 96% of students enrolled in a sociology course believed using crossword puzzles was helpful when studying sociological concepts. Furthermore, 26% of the students found crossword puzzles useful for identifying areas for further study or for clarification of certain concepts. Research has demonstrated that use of a crossword puzzle in an educational psychology class improved retention, facilitated association of facts, and supported recall of

TABLE 2. STUDENTS' PERCEPTIONS OF CROSSWORD PUZZLE ASSIGNMENT (N = 15)

Questions	Neutral		Agree		Strongly Agree	
	N	%	N	%	N	%
The crossword puzzle fairly represented the course content being studied.			3	20%	12	80
The crossword puzzle assisted me in learning the course content being studied.			5	33.3	10	66.7
The crossword puzzle assisted me in retaining the course content being studied.			6	40	9	60
The crossword puzzle increased my level of confidence regarding my knowledge of the course content.	1	6.7	6	40	8	53.3
The crossword puzzle assisted me in preparing for the course content exam.	1	6.7	2	13.7	12	80
The crossword puzzle was a fun way to reinforce the course content.	2	13.3	6	40	7	46.7
The crossword puzzle assisted with my recall of definitions/terms.			6	40	9	60
The crossword puzzle forced me to read and exam the course content being studied.	3	20	4	26.7	8	53.3
By having to read the associated content chapter(s) I was able to better to understand the course content.	1	6.7	10	66.7	4	26.7
Overall, the use of the crossword puzzle assisted in learning and retention process.			5	33.3	10	66.7

concepts through the creation of a mental picture that linked terms to concepts. Furthermore, the completion of the crossword puzzle increased subjects' confidence levels and improved motivation to study.¹⁰

Conclusion

Crossword puzzles are easily generated and can be used as an alternative to traditional instruction and assessment methods. Students who have completed crossword puzzle assignments find them to be fun, increase their confidence in test-taking, and increase comprehension of course materials. Athletic training educators should consider utilization of alternative instructional methods, such as crossword puzzles, to accommodate various learning styles and to enhance student comprehension of complex concepts. ■

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