

Customized Anagram Puzzle: Accelerate Student Learning Process For Dental Undergraduates.

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ABSTRACT

BACKGROUND

INTRODUCTION: Education can be made more engaging and enjoyable by incorporating various active learning methods, including anagram puzzles. Anagram is a recent concept which focusses on active learning which helps in critical thinking, communication, and co-operative learning skills making learning more effective, efficient, and retentive. The current study is aimed to investigate the feasibility and effectiveness of using anagram puzzles as an active learning tool for students as an alternative method for recalling fundamental concepts and promoting self-directed learning among dental undergraduate students.

PURPOSE OF THE STUDY: To assess the viability of anagram puzzles as an active teaching/ learning method for dental undergraduate students.

METHODOLOGY: Two segments of the “Must know” category of the syllabus were chosen. The class was divided into two groups using computerized random generator and students were divided into 2 groups (I and II) and they were exposed to didactic lectures, but the activity of solving the anagram puzzles was undertaken only by the interventional group. Questionnaire in the form of Multiple-Choice Questions (MCQ) was given at the end of the activity to both the groups, and results were evaluated.

RESULTS: Mann–Whitney *U* test between interventional (Group I) learners revealed an average mean score of 16.71 out of 20 in the post-activity test when compared to 8.65 out of 10 in the control (Group II) students and was statistically significant in both the sessions.

CONCLUSION: The use of anagram puzzles as an active learning tool for dental undergraduates is feasible and effective. The puzzles were able to help students recall fundamental concepts and promote self-directed learning. Additionally, the puzzles were engaging and enjoyable, which made the learning process more efficient and interesting. We promote other dental educators too to consider using anagram puzzles in their classrooms for effective teaching learning.

KEYWORDS: Anagram, questionnaire, puzzles, teaching, learning

INTRODUCTION

Presentation of realistic information through passive teaching methods is the usual mode of disseminating knowledge in most of the medical/dental schools in India. ¹ Conventionally, teaching methods are classified into teacher controller and learner controller methods. In today’s modern era of technology, teaching/ learning modalities have drastically improved due to the incorporation of innovative technology.² To create a healthy

learning environment for students and to make it fascinating & ecstatic, various interactive and innovative teaching/learning methods have been advocated in medical and dental education.³

As present-day students have more diversity in their learning styles, new strategies like engaging the students in active learning should be introduced in education to make learning more interesting at the undergraduate level. ⁴ It is surprising that puzzle-based learning existed over 60 years in education and has the edge of being more interactive and learner centred compared to conservative teaching. Engaging learners to an activity after didactic lecture could be an effective teaching–learning strategy to facilitate learner acquisition of competence, improve their satisfaction in studying, and improve long-term results.^{5,6}

Crossword is a structural, self-learning educational tool that reviews and reinforces knowledge, and concepts acquired during the lecture reach more students, improves vocabulary, stimulate the mind, and help develop healthy scepticism.⁷ Word search games also known as word find games and are popular for helping learners recognize words. In searching for words, the students seem to read and memorize the words in a way that they enjoy, and which helps them learn the words and their spelling. This non-traditional pedagogy, a new paradigm for interactive teaching, has not been explored in dental schools, although attempted by few disciplines of medicine such as pathology and pharmacology. ⁸

Various studies in medical education have shown that self-learning methods should be incorporated into the teaching–learning process to make learning more effective, efficient and meaningful. Self-learning promotes active learning and critical thinking which in turn enhances self-reliance and, in this process, teachers can manage their time effectively to reinforce knowledge and skills.

Moreover, for students, learning on their own can be an enjoyable experience. The purpose of this study was to determine the effectiveness of anagram puzzles as an active learning method for dental undergraduates. The study was conducted in two phases. In the first phase, a didactic lecture was given to the students on a specific topic. In the second phase, the students were divided into two groups. The first group was given crossword puzzles to solve, and the second group was given anagram puzzles to solve. Both groups were then given a post-test to assess their learning.

METHODOLOGY

DESIGN OF THE STUDY

The present study was a randomized controlled, parallel group interventional study with open label and the participants were final year BDS students in People's college of Dental sciences and research centre, Bhopal, Madhya Pradesh. The Institutional Ethics Committee has approved the Research work proposed to be carried out at PEOPLE'S UNIVERSITY, Bhopal, Madhya Pradesh with its ethical approval letter no. PCDS/ACAD/2022-2023/62-95.

A comparative study was conducted with sample size of seventy students which was divided into two groups which are group I-Interventional group consisting of thirty-five 4th year BDS undergraduate students and group II- control group consisting of thirty-five 4th year BDS undergraduate students. Two modules of the “must know” category of the curriculum was selected. The class was divided into two groups (interventional and control) using computerized random generator. Learners in both the groups were exposed to didactic lectures, but the activity of solving the puzzles was undertaken only by the interventional group learners. Questionnaire in the form of MCQ was given at the end of the activity to both the groups, and results were evaluated.

The students were requested to complete a 10-word anagram puzzle (an anagram is a word or phrase formed by rearranging the letters of a different word or phrase, typically using all the original letters exactly once. The original word or phrase is known as the subject of the anagram. Any word or phrase that exactly reproduces the letters in another order is an anagram) using the clues related to the lecture material. Control group students did not participate in the activity. The control group were given access to the puzzles once the post-activity questionnaire was collected from the intervention group as fair play to the innovation in teaching learning methods. The Anagram puzzle is copyrighted © 2023 with the registration no L-129342/2023 by the Copyright Office, Government of India.

Each individual was assigned into one group by computerised random generator method (Group I- Interventional group and Group II- control group) and a power analysis was conducted & a minimum sample of 35 in each group is set to ensure that an adequate sample size is collected to show 80% power and 5% level of significance. The Group I and group II were dealt with “Pulp therapy”. First the group I were exposed to a didactic lecture on Pulp therapy following which a puzzle in the form of anagram was given to the students to solve after which a questionnaire was given at the end in the form of MCQ. While the group II was exposed to a didactic lecture following which a questionnaire was given directly in the form of MCQ as the control group did not have the puzzle solving in the form of anagrams.

INTERVENTIONS

The activity included a puzzle in the form of anagram which was prepared by the investigator as shown in figure 3. The clues were verified from the standard Pediatric dentistry books. Group II students attended only the didactic lecture as shown in figure 1, whereas group I students took part in an activity in the form of puzzles in

addition to the lecture as shown in figure 2. After the completion of the activity, both the groups were requested to answer a questionnaire pertaining to the prior lecture. Students in the intervention group (Group I) were sensitized about the anagram puzzles. Printed copies of the puzzles were distributed, and 15 minutes were given to complete the puzzles as shown in figure 3.

QUESTIONNAIRE

The questionnaire consisted of multiple-choice of 10 questions and formats were used as a tool to measure the effectiveness of puzzles as an innovative Teaching Learning method. The questions were distributed, and students were requested to give one best response. These questions were based on the lecture material taken on the same day and prepared by the investigator. Completed questionnaires were collected from the students after 10 minutes.

The keys were verified from standard Pediatric dentistry textbooks. The highest possible test score was 10 with a score of 1 per question. The same questionnaires were used for both the interventional group and the control group. Obtained data was analysed using Mann–Whitney *U* test between interventional (Group I) post-activity test scores and test scores of the control group (Group II). *p* value <0.05 was considered statistically significant.

RESULT

Dental training for undergraduates involves complex concepts and extensive memorization. Traditional learning methods can be tedious and hinder efficient knowledge retention. This study investigated the effectiveness of a customized anagram puzzle approach in accelerating the learning process for dental undergraduates. Participants engaged with anagram puzzles tailored to specific dental topics, encouraging active engagement, critical thinking, and collaborative problem-solving. In this study, mann–Whitney nonparametric test was used to assess for any significance among the groups. Out of two activity sessions, the interventional group students performed well with a mean average score of 16.71 and mean rank of 35 with *p* value <0.05 being significant when compared to the control group students with a mean average score of 8.65 and mean rank of 18.9 who did not participate in the activity as shown in table 1. Overall, the study provided strong evidence that customized anagram puzzles offer a novel and effective approach to enhance dental undergraduate learning, promoting higher knowledge retention, active engagement, and valuable transferable skills.

DISCUSSION

Crossword not only provides fun but also in identifying the learning concepts that have been mastered and has a unique feature of helping students to correct their mistakes instantly. Word search puzzle challenge students to look out for the keyword in the grid that allows them to evaluate their recall and their level of knowledge.

Evidence-based studies reveal that students improve their understanding and learning through active learning, as the students are active players and participants. Keeping in mind the objectives, this study was aimed to evaluate the effectiveness of the puzzle activity as an innovative teaching/ learning method for the dental undergraduates. An activity or a practical exercise to recall and revise the concepts of the didactic lecture was attempted for the first time. ¹⁰ Bailey et al. in the year 1999, developed educational puzzles as a supplement tool to enhance learning that encourages students to be creative and that which reinforces concepts that have been covered in traditional teaching,⁸ that educational games were popular among students, as it provided a nonthreatening environment, where students were challenged in active learning⁹.

In a study by Saxena et al. in the year 2009, investigated the effectiveness of crossword puzzles as an active learning tool in pathology education for undergraduate medical students. The students who participated in solving crossword puzzles designed to reinforce key concepts and terminology.¹³ The researchers likely employed a pre-test, post-test design, where students' knowledge of pathology was assessed before and after engaging with the crossword puzzles. This allowed them to evaluate the impact of the intervention on student learning. The positive findings of the study, with students reporting enjoyment and improved knowledge retention, suggest that incorporating crossword puzzles into medical education curriculum could be a beneficial strategy to enhance student engagement and knowledge acquisition. Similar attempt was made by our study in training students by using beyond conventional design to improve knowledge, learning and retention.

Similarly, Bergman et al. in the year 2008 investigating the effectiveness of different medical school curriculum on anatomy knowledge, researchers examined students from eight Dutch medical schools. Fascinatingly, the study design did not involve manipulating the curriculum itself. Instead, they compared schools with traditional and problem-based learning (PBL) approaches to see if this impacted anatomy knowledge. The researchers likely assessed student knowledge through exams or other evaluations to determine if curriculum style had a significant effect. Their findings revealed that regardless of the teaching method (traditional vs. PBL), students entering clinical training often felt they lacked sufficient anatomical knowledge. This suggests that factors beyond curriculum design, such as total instructional time and emphasis on clinical application, might be more critical for building strong anatomy knowledge. ¹¹ This study is in parallel to ours wherein we compared conventional method of teaching with anagrams. Logan et al in the year 2011 explored that word search puzzle challenges students to look out for the keyword in the grid that allows them to evaluate their

recall and their level of knowledge.¹² Since we had significant results in interventional and control group, we too claim that the intervention consisting of word search and crossword activity helped students perform better and puzzles used as an active teaching learning tool supplementing traditional teaching for dental undergraduates.

The irrefutable significance of the study revealed that learners from the interventional group scored better than the control group in the puzzle and questionnaire being conducted. Activity-based learning in the form of anagram puzzles, educational online games, quiz, debates, etc., in a class room set up, provide learners with good opportunities to apply theoretical concepts to perfection. This will break the monotonous system of passive listening in a large group gathering.

LIMITATIONS OF THE STUDY

- 1. Sample Size:** The study being a pilot program involved a small sample size, raising concerns about the generalizability of the findings to a wider population of dental students. A larger sample could provide more robust evidence for the effectiveness of the intervention.
- 2. Sustainability and Scalability:** The study did not assess the long-term impact of using anagram puzzles or their feasibility for integrating them into the regular curriculum beyond the specific tested topics. Further research is needed to explore the practicalities of implementing such methods in larger-scale settings though we regularly used anagrams, MCQs, etc as a supplemental tool in making learning more effective.

CONCLUSION

Activity constructed learning in the form of puzzles in a classroom setup offer learners with good prospects to put on theory understanding to perfection. This will pause tedious previous system of passive listening in a larger group. Our study exposed that in changing trends in dental schooling, interventional methods in the form of puzzles are successful in better retention. Use of puzzles and anagrams in a classroom setting should be stimulated to augment active learning as they are simple and creative. This could be hailed as an innovative teaching Learning method and could be implemented in the dental curriculum.

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FIG 1: Image of students attending the didactic lecture



FIG 2: Image of students solving the anagram puzzle

TABLE 1: MEAN AVERAGE SCORE OF INTERVENTIONAL AND CONTROL GROUP AFTER THE ANAGAM PUZZLE WAS DONE.

Groups	n	Mean rank	Mean average scores	P value
Intervention group MCQs + puzzle	35	52.1	16.71	0.00*
Control group MCQs only	35	18.9	8.65	

PULP THERAPY ANAGRAM PUZZLE

1. The material of choice for direct pulp capping in permanent molars is _____

MUCLIA RXOYDDEIH

2. The material of choice for pulpotomy in primary molars is _____

CRERMFO SLOO

3. _____ is the common cause of failure of pulpotomy, that employs Ca (OH)₂ in primary molars.

ANINTREL ERPISTONOR

4. The treatment of choice for vital, wide apex tooth which shows pulp exposure is _____

OAXEPNSGIEES

5. The initial pulpal response to any insult is _____

IFMAINMNOTAL

6. The most common cause of pulp pathology is _____

IORCSEBM

7. The treatment of acute pulpitis is _____

PEPTMUCYOL

8. Cholesterol crystals are occasionally present in the zone of _____

TITROIRANI

9. Condition in which a stimulus provokes pain easily is _____

EATRIHPHAPY

10. _____ fibres are responsible for conduction of pain impulse.

LDTAE

FIG 3: PULP THERAPY ANAGRAM PUZZLE & QUESTIONNAIRE