



Creative Pathology Teaching With Word Puzzles Until Students Learn: A Study in a Medical University

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Authors' contributions

This work was carried out in collaboration between both authors. Author AA designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Author SAMR helped in the analyses of the study, in literature searches and final editing of the manuscript. Both authors read and approved the final manuscript.

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ABSTRACT

The Under graduate students of Medicine under Health Sciences University are exposed to various new concepts, facts and terminology in a limited time. This resulted in problem to ensure abundant revision and to strengthen key ideas amongst them. Majority of the pupils find it difficult to be good to reason out disease problem solving or being expressive in system-specific vocabulary. Many dynamic teaching techniques have been endorsed into these courses in an attempt to improve skill, training, and possession of knowledge. Our study provided an understanding regarding the use of crossword puzzles to the students of medical education to strengthen their ideas and words in a communicative study atmosphere. This research intends to highlight our experience of an innovative teaching-learning (T-L) method, 'crossword puzzle' in the subject of Pathology. In the academic years 2013-2016, we incorporated the crossword puzzle to second year Nursing, Dental, and Medical undergraduates. The aim is to estimate the capacity of interest among students in a

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crossword puzzle and to assess the knowledge of the relevant learning outcomes in pathology. There are not many published reports with regards to the usage of these puzzles in crossword as a teaching and learning method for pathology. Crossword was built and after finishing training the relevant printed crossword puzzle, consisting of about items across and down, was given to all the students within the class. After finishing the crossword puzzles the feedbacks were taken from the students by delivering the questionnaire. The questionnaire was designed to evaluate 5 wide areas of students' understanding through the intervention for its utility in identification of key concepts of vocabulary, utility in teaching, participation aspects, competitiveness, and students' achievement. Some sedentary students commented that it was not up to the mark to assess the intellectual ability of the students. They also showed some queries regarding the standard of the crossword puzzles. Most of them (95%) exclaimed, crosswords were of great help in recognition of important ideas and words and they became willing to take part to the additional activities much more. [91%] agreed and 4 % strongly agreed that they will like to pass on this scheme to their juniors and will like to seek other teachers also to make it as a supplementary teaching tool. [85%] of them agreed that they have a chance to debate and remember essential ideas and think critically while solving crosswords rather few of them felt that more time is needed to solve these kind of puzzles. 96% agreed that the crosswords were helpful in relation to other small group activities specially because it helped them to know correct spellings and improved their vocabulary, solving puzzles together lightened the class environment by providing amusement and light mood and also permitted the students to incorporate information and establish their comprehension of various pieces of data.

Keywords: Crossword puzzles; spelling; teaching methodology.

1. INTRODUCTION

The 2nd year under graduates at Medical & Health Sciences Universities are exposed to various new words and ideas in a limited time. This resulted in problem to ensure abundant revision and to strengthen key ideas. Majority of the pupils find it difficult to be good to reason out disease based problem solving or being expressive in system-specific vocabulary. Various active learning methods have been incorporated into these courses in an attempt to increase understanding, learning, and retention. Crossword puzzles are being introduced in many Universities as a ready and efficient way to strengthen important ideas and useful words with the aim that the pupils would be better able to recollect useful concepts. Our study may provide understanding of the usefulness of crossword puzzles in undergraduate medical education to reinforce concepts and vocabulary in an interactive learning atmosphere. Also the idea of 'dynamic learning' is attaining much impetus, notably in the field of graduate medical education. Novel methodologies like Team-based learning (TBL) to name a few are being introduced. Here we would like to share our observations of a innovative teaching-learning method, 'crossword puzzle' in the subject of Pathology. In the academic years 2013-2015, we introduced the crossword puzzle to II-year

Nursing, Dental, and Medical undergraduates. The objectives were: to assess the interest among students in a crossword puzzle and to examine the knowledge of the relevant learning outcomes in pathology. Crossword puzzles in renal system, hematology system, gastrointestinal systems were constructed. After delivery of lectures the corresponding printed crossword puzzle, consisting of items across and down, was given to all the students in the class. After finishing the crossword puzzles the feedback were taken from the students by administering the self-designed pre-validated questionnaire based on earlier studies. There are not many reports in the literature regarding the usage of a crossword puzzle as a teaching and learning method in Pathology. It is a creative tool, especially for collective learning, creating much intrigue and discussion within the group and also between the educators and learners. A well-created crossword puzzle is likely to test higher levels of intuition as compared to many other types of assessments.

2. AIM AND OBJECTIVES

2.1 Aim

To assess student view of the utility of crosswords as a fast and efficient way to strengthen essential ideas and words.

2.2 Objectives

1. To study the usefulness of crosswords for strengthening of ideas and words and student feedback for assessment of their utility.
2. To survey the duration needed to scheme and implement a content-valid crossword at a average level of difficulty.

3. MATERIALS AND METHODS

Crosswords puzzle with verified subject authenticity created by the faculty was given to

the student's. The puzzle designed had both longitudinal and parallel columns with terms in the longitudinal columns starting from top to bottom and in the parallel columns starting from left to right. There were no terms that ran slant wise or that were reversed. Both small and extended terms were included to keep the puzzle at average level of difficulty as puzzles with only extended words are difficult to solve. The hints ranged from simple to difficult and were designed precisely around important terms denoting useful notions and connections. Subject authenticity was safe guarded by connecting the hints and solutions to exact learning goals.

| S. No | Questions on cross word puzzles on the topic "Glomerulonephritis" |
|-------|--|
| 1. | A 35-year-old man notes passing dark urine following a flu-like illness that has lasted for 10 days. On General physical examination, his blood pressure measures 140/90 mm Hg. Urinalysis shows hematuria. A week later level of serum creatinine is 2.9 mg/dl. A kidney biopsy is done and Histopathological examination and immunofluorescence pattern with antibody against human IgA is shown here. Which one of the following is the most appropriate diagnosis? |
| 2. | A 50-years-old male was detected at age 15 with type 1 diabetes mellitus. His disease has been poorly controlled, as documented by elevated hemoglobin A1C levels. He developed a non-healing ulcer of his foot at age 35. At 45 yrs of age, he had an elevated Blood urea nitrogen [BUN] and a urine examination revealed specific gravity of 1.012, pH 6.5, 1+ protein, ,1+ glucose, negative leukocyte esterase, negative nitrite, no blood and no ketones. Which one of the following Kidney diseases is he most likely to have? |
| 3. | A Male aged 30 yrs developed prominent puffiness around his eyes along with swollen feet for the past 2 weeks. On General physical examination his blood pressure is 155/95 mm Hg. Urine microscopic examination shows oval fat bodies. Which one of the following conditions is he most likely to have? |
| 4. | Kidney biopsy of a patient with light microscopy shows proliferated mesangial cells and subendothelial deposits along with diffuse thickening of capillary walls. There was split "tram-track", appearance of basement membrane. The most likely diagnosis in this patient is: |
| 5. | The commonest cause of nephrotic syndrome in adult is: |
| 6. | The commonest cause of nephrotic syndrome in children is: |
| 7. | A 20-year-old male who was previously healthy has fatigue for the last 5 days. On General physical examination his blood pressure is 155/90 mm Hg. Laboratory investigations are as follows, serum creatinine of 4.4 mg/dL along with 3+ blood, 1+ protein in urine sample. Which of the following pathologic findings on renal biopsy is most likely to be present in this man? |
| 8. | A 5 year-old boy presented with mild periorbital edema, hypertension, and elevated serum urea and creatinine.He had a infection of throat two weeks prior to this complaints. Most probable diagnosis in this case is |
| 9. | Syndrome characterized by mild periorbital edema, hypertension, and elevated serum urea and creatinine is referred as: |
| 10. | Glomerular disease showing abnormality in some of the glomeruli but not all the glomeruli are involved: |

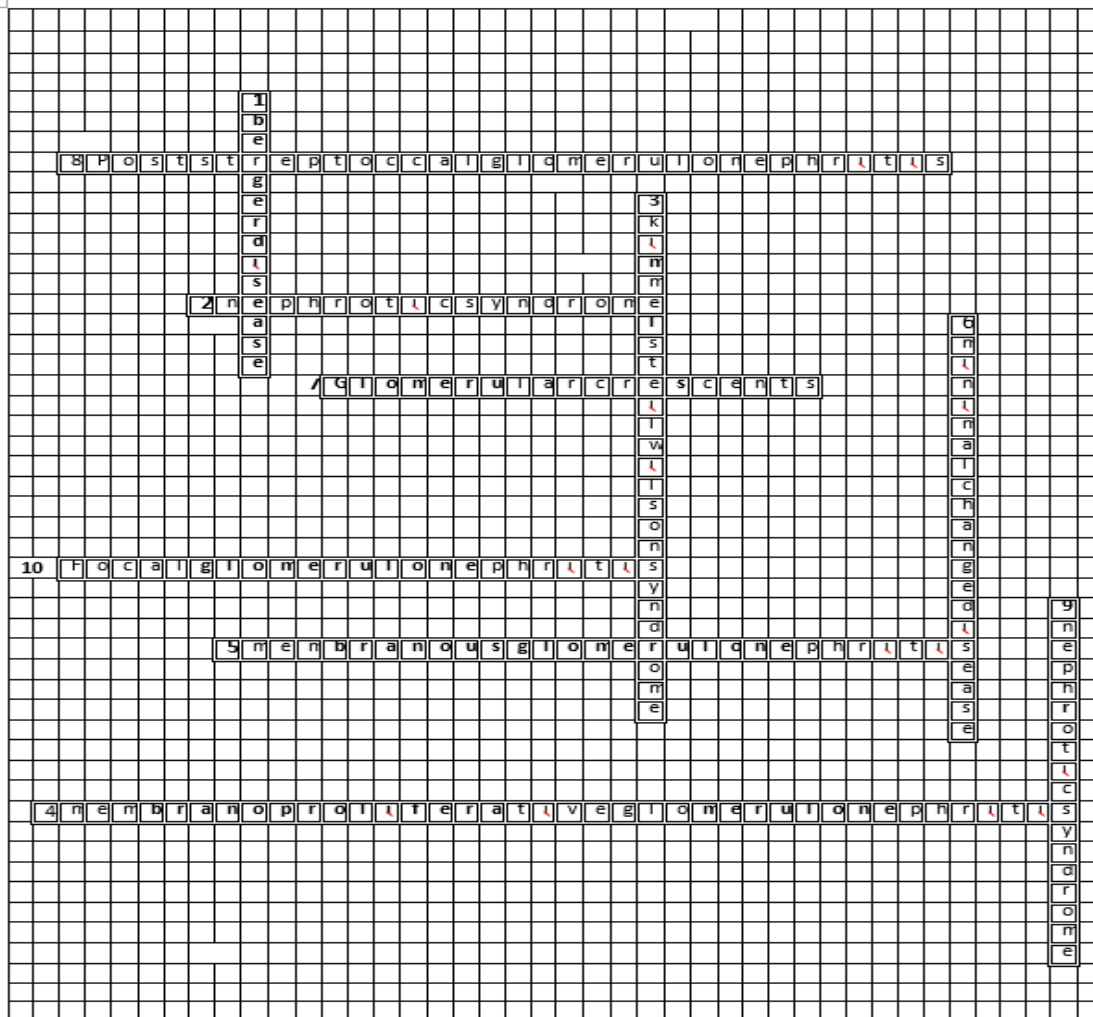


Fig. 1. Cross Word puzzles on the topic Glomerulonephritis

The extent of difficulty is indicated by mention of extent of understanding:

- Simple rote learning and recall were considered easy and
- Problem answering and knowledge application were considered hard and more applicable to the ultimate goals of the courses.
- There were common clues given in the questions with half hour allotted for the exercise.
- Pupils were asked to complete this task in class time in a joint and collective process in groups of 6 or 7.
- If the group that finished first had any false answer, then the group that finished next was considered.

3.1 Evaluation

Facts was collected from 3 different background of students (Medical, Dental, BSc & MSc Nursing who are undertaking pathology courses) through questionnaire that included specific queries dealing with crossword puzzles. The research was developed based on the overall educational objective of assessing the usefulness of this learning intervention. The questions were developed to assess 5 broad areas of students' perceptions of crosswords for usefulness in establishing important ideas and terms, usefulness in learning, collaborative aspects, competitive aspects, and student satisfaction. Informal student comments were also noted.

4. RESULTS

A cross word problem was constructed to explain glomerulonephritis in pathology course. 95% pupils with pathology course said that the crosswords were very helpful and had significant contribution in their learning. To majority of them (95%), crosswords were useful for identifying key concepts and vocabulary and they strongly agreed that they will like to participate in more of these exercises. 91% agreed and 4% strongly agreed that they will like to transfer this strategy to their juniors and will like to request other faculty also to make it as an adjunct teaching tool. 85% of them agreed that they have an opportunity to discuss and recall essential concepts and think critically while solving crosswords while few of them felt that more time is needed to solve these kind of puzzles. 96% agreed that the crosswords were useful in relation to other small group activities specially because it helped them to know correct spellings and improved their vocabulary, solving puzzles together lightened the class atmosphere by providing fun and humor and also permitted the students to integrate information and establish their understanding of various pieces of data. 94% strongly agreed that the crosswords offered avenues for ready teambuilding and that the task provided them an atmosphere of challenge, and performing and relying on team members in demanding conditions; which helped them in building more confidence. 98.5% strongly agreed that the crossword tool helped them in identifying the important areas of the topic .

5. DISCUSSION

Crossword puzzles fall within the wide realm of short class training and constitute a more of student-constituted rather than teacher specific approach requiring student involvement and reciprocation [1]. The outcome of Small group activities include deeper understanding and encouragement of problem solving, participation, and personal responsibility for learning; along with development of interpersonal and social team working skills [2]. Demonstration of greater academic achievement, more favorable inclination toward learning, and more general positiveness were noted in students who learned in small groups [3]. Crossword puzzles readily assess the present state of understanding in a casual way that provides immediate response to students about mistakes or misinterpretations. This corresponds with the findings of other researchers on active learning [4] and activities

and riddles [5-9]. The solutions to the hints are important terms focused on ideas and help to strengthen the vocabulary, however, the following are likely to be comparatively relevant for crosswords. Although crosswords have been used in classroom teaching [10-12]. It is amazing that this method is not reported to be extensively utilized and tested. This may be partly because some individuals find the use of games inadequately evaluated [13] and the comparatively huge amount of time required to develop topic-specified appropriate crosswords. Some other might be linked to an aversion of crosswords, realizing it to be non instructive because it doesn't resemble customary learning and may be thought of as improper of class time. We think that some of the causes for student adoption and favorability of this unconventional method may be that riddles take the pressure off from study environment by provision of entertainment and amusement, cognitive impetus, fulfilment after successful completion, and applicability of method to overall learning.

There are many recognized interests to incorporate crosswords in the medical education system. Crosswords, which are made easily, and solved fast are also self-correcting; if the term fits into given space it is true, if it doesn't fit it is incorrect. The problem for us has been to keep these riddles at a level of complexity where the pupils find these to be just a little beyond their comprehension allowing them to adapt. Specific letters in specific positions as hints are discovered as a riddle is partially filled in. Finding a horizontal (or vertical) target word, for example, typically reveals a letter in a specific position of each of several vertical (or horizontal) target words. Kirkpatrick's model assesses the effectiveness of teaching programs and learning interventions, learning, behavior, and results, at different levels-reactions [14]. Although we have not related crossword items specifically to exam questions, other researchers have noted a positive correlation between exam questions and ideas reviewed in riddles and games. Studies reveal the use of an extended matching crossword puzzle to assess students' diagnostic thinking and clinical reasoning [15]. Future research in this area may be directed at determining the effect of crossword riddles on absorption of words and ideas in undergraduate medical education, building of teams and critical-thinking skills, and a controlled experiment to recognize the key contributory aspects of this intervention.

Table 1. Questionnaire on cross word puzzles on the topic “Glomerulonephritis”

| Question | Study groups [Total N=200] | | | | Results/Feedback | | | | |
|--|----------------------------|----------------|-----------------------|-----------------------|-----------------------|-----------|-------------------------------|-------|-------------------|
| | Medi-cal N=50 | Dental N=50 | [U.G] nursing N=50 | [P.G] nursing N=50 | Strongly dis-agree | Disagree | Neither agree nor disagree | Agree | Strongly agree |
| Has it permitted the students to integrate information and establish their under-standing of various pieces of data | 50 100% | 49 98% | 46 92% | 47 94% | 3 1.5% | 3 1.5% | 2 1% | 96% | 192 |
| Have the crosswords offered oppor- tunities for immediate team building? | 49 98% | 48 98% | 45 90% | 46 92% | 5 2.5% | 4 2% | 3 1.5% | 94% | 188 |
| Has this exercise provided you an atmosphere of challenge, and performing and relying on team members in demanding conditions; which helped them in building confidence? | 49 98% | 48 96% | 45 90% | 46 92% | 3 1.5% | 4 2% | 5 2.5% | 94% | 188 |
| The puzzles lightened the class atmosphere by providing fun and humor? | 50 100% | 49 98% | 46 92% | 47 94% | 4 2% | 2 1% | 2 1% | 96% | 192 |
| Did the crossword tool help you identify what are important areas? | 50 100% | 49 98% | 49 98% | 49 98% | 1 0.5% | 1 0.5% | 1 0.5% | 98.5% | 197 |

6. CONCLUSIONS

The sensible use of crossword riddles in a joint/cordial competitive environment is a useful addition to the reserve of active learning strategies. This study gives awareness into (1) the usefulness of crossword riddles in undergraduate medical education to strengthen ideas and set of words in collective educational environment, (2) the feedback of students to the incorporation of crosswords, and (3) verification of its achievability in a bigger group setting. Crosswords provided students with an occasion for, analytical thinking, to work jointly, participate, and remember and exchange views on important ideas by using necessary words associated with these ideas.

CONSENT

It is not applicable.

ETHICAL APPROVAL

As per or university protocol the written ethical approval has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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