



EDUCATION IN HEALTH SCIENCES

Crossword puzzles versus Student-Led Objective Tutorials (SLOT) as innovative pedagogies in undergraduate medical education

Palavras cruzadas versus Tutoriais Objetivos Liderados pelo Estudante (SLOT) como pedagogias inovadoras na graduação em medicina: Nossa experiência

Dr. Preethi J Shenoy¹

orcid.org/0000-0002-4722-5974
preethi.pai@manipal.edu

Dr. Rashmi R Rao¹

orcid.org/0000-0003-1540-6188
rashmi.rao@manipal.edu

Received on: Feb. 17th, 2020.

Approved on: Aug. 22nd, 2020.

Published on: Mar. 19th, 2021.

Abstract

AIMS: Small group teaching in Pharmacology offers an effective platform to encourage interaction amongst peers and self-directed learning. The present study is an attempt to assess and compare the effectiveness and perception of students on two different pedagogical methods: Crossword puzzles and Student Led Objective Tutorials (SLOT).

METHODS: Second year undergraduate students who gave their informed consent were divided randomly into two groups: one which received crossword puzzle as a teaching learning method and the other had SLOT during which the students conducted an interactive quiz with multiple choice questions prepared by themselves. The students' perceptions were recorded using a self-administered questionnaire. One week later, a unit test was conducted for both the groups and the performance of the students was compared. Statistical analysis was done using independent Student's T test with SPSS version 15.0.

RESULTS: Analyses revealed a statistical significant difference ($P < 0.001$) between the mean marks obtained in the SLOT group ($n = 74$; 6.5 ± 3.8) and the marks obtained in the crossword group ($n = 87$; 4.2 ± 2.9), with the students in the tutorial group performing better. The students opined that SLOT sessions helped them to understand Pharmacology better whereas crossword sessions enabled them to memorize the names of the drugs.

CONCLUSION: The present study revealed that SLOT sessions fared better compared to the crossword puzzles in terms of improving the students' test scores. It fostered teamwork, self-directed learning skills and critical thinking. Crossword puzzles make the session more student friendly as it is fun and engaging but a careful design is inevitable as it may fail to test in-depth learning in students.

KEY WORDS: Student Led Objective Tutorial, Cross word puzzle; Pedagogical tools; Small group teaching methods

Resumo

OBJETIVOS: O ensino de farmacologia em pequenos grupos oferece uma plataforma eficaz para estimular a interação entre pares e a aprendizagem autodirigida. O presente estudo procurou avaliar e comparar a eficácia e percepção dos alunos em dois métodos pedagógicos diferentes: palavras cruzadas e tutoriais objetivos conduzido pelo aluno (SLOT).

MÉTODOS: Alunos do segundo ano de graduação, que deram seu consentimento informado, foram divididos aleatoriamente em dois grupos: um que recebeu palavras cruzadas como método de ensino-aprendizagem e o outro teve SLOT onde os alunos realizaram um questionário interativo com questões de múltipla escolha elaborado por si mesmos. As percepções dos alunos foram registradas por meio de um questionário autoaplicável. Uma semana depois, um teste foi realizado para ambos os grupos e o desempenho dos alunos foi comparado. A análise estatística foi feita usando o teste T de *student* de amostras independentes.

RESULTADOS: As análises revelaram uma diferença estatisticamente significati-



Artigo está licenciado sob forma de uma licença
[Creative Commons Atribuição 4.0 Internacional](https://creativecommons.org/licenses/by/4.0/).

¹ Kasturba Medical College (KMC), Mangalore, KA, India.

va ($P < 0,001$) entre as notas médias obtidas no grupo SLOT ($n = 74$; $6,5 \pm 3,8$) e as notas obtidas no grupo de palavras cruzadas ($n = 87$; $4,2 \pm 2,9$), com os alunos do grupo tutorial tendo melhor desempenho. Os alunos opinaram que as sessões de tutoria objetiva conduzida pelos alunos os ajudaram a entender melhor a Farmacologia, ao passo que as sessões de palavras cruzadas lhes permitiram memorizar os nomes dos medicamentos.

CONCLUSÃO: O presente estudo revelou que as sessões do SLOT se saíram melhor comparativamente àquelas com as palavras cruzadas em termos de melhorar as pontuações dos alunos nos testes, assim como promoveu o trabalho em equipe, habilidades de aprendizagem autodirigida e pensamento crítico. As palavras cruzadas tornam a sessão mais amigável ao aluno, pois é divertida e envolvente, mas um design cuidadoso é inevitável, pois pode falhar em testar o aprendizado em profundidade nos alunos.

PALAVRAS-CHAVE: Tutorial objetivo conduzido pelo aluno; palavras cruzadas; ferramentas pedagógicas; métodos de ensino para pequenos grupos.

ABBREVIATIONS: CP, Crossword puzzle; MCQ, multiple choice questions; NSAID, Nonsteroidal anti-inflammatory agents; SLOT, Student Led Objective Tutorial.

INTRODUCTION

Pedagogical techniques in Pharmacology require an essential skill in incorporating methods to promote deep learning in students as this discipline entails a correlation between the basic concepts and its application in clinical science while dealing with varied clinical circumstances. In addition, development of self-directed learning skills, art of communication and peer-to-peer interactions should also remain in focus to facilitate an all-encompassing academic development of the student (1).

The main modes of teaching Pharmacology comprise of didactic lectures, small group discussions and practical classes. Didactic lectures comprising of larger groups, though a common instructional design to highlight pharmacological aspects of drugs are often teacher-centric where students become passive recipients of instruction. They are also less effective in skill development. Small group discussions aim at increasing student participation (2). Tutorial as a small group teaching learning method revolves around the central tenet of student involvement and group discussion (3). During the tutorial session the facilitator aims at providing in-depth directives to a small group (4). These sessions are designed to develop and test student

ideas, clarify muddy areas of understanding and correlate the basic concepts to solving specific problems. They improvise skills like analyses, decision-making, team building, communication and promote a culture of life-long self-directed learning. Active involvement in learning enables the students to learn better rather than being a passive receiver of knowledge. Learner-centred education emphasizes that the responsibility of learning should rest on the students. The role of instructors is transformed to a facilitator and not merely a lecturer (4). Although tutorials are designed to enhance active student participation and research signifies it as an effective teaching learning strategy (3, 5), it is observed that often it may end up being small lectures by the instructor. This passive approach does not provide students with enough knowledge and experience to deal with real world clinical situations.

Realising these lacunae the Medical Council of India has emphasized utilizing small group teaching, which encourages peer interaction and self-directed learning. These sessions foster qualities of communication, teamwork and professionalism in students and make learning effective (6). Peer tutors offer an engaging and positive environment for student learning and help them to utilize their time constructively. Conventional pedagogical tools have long been out-dated as they fail to facilitate the required qualities in a medical graduate and neither promote life-long learning (2). Constant review of the existing curriculum is required to improvise and meet the growing demands of medical education in the present era of globalisation. Introduction of innovative teaching learning strategies could provide to be the key to this. Student Led Objective Tutorial (SLOT) is an innovative teaching method employed in small group teaching to inculcate interest in the subject. It provides opportunities for students to learn in groups and facilitates self-directed learning. Previous studies have judged SLOT superior as compared to conventional tutorials and appreciated as the method of active learning by the students. Students also expressed that the mechanics of SLOT were a key to effective learning and mastering the techniques of answering the multiple-choice

questions (MCQ) in the examination (4).

Introduction of crossword puzzles to the armamentarium of innovative pedagogical tools focusses on strengthening knowledge acquirement (7). This method adds a friendly ambience to teaching, making learning fun and a constructively competitive arena enabling students to apply their knowledge and critical thinking skills (8). Studies have proved that crossword puzzle provides lexicon expansion, invigorates the intelligence, uplifts conviction, and hastens the capacity to learn mainly decreasing the excessive thrust heaped on rote learning (9). According to Dee Fink, providing an enabling learning environment is a significant cue for effective learning to take place (10). Integrating a variety of pedagogical tools rather than employing a single isolated classroom design definitely results in an intensifying and enriched learning experience (10). Hence, with this view, we designed the present study to assess and compare the effectiveness and perception of students on two different pedagogical methods: Crossword puzzles (CP) and SLOT as a teaching learning method in Pharmacology.

METHODS

After obtaining approval from the institutional ethics committee all the second year medical students of the institution were approached for the study. The students were briefed about the objectives and a brief outline of SLOT and crossword as pedagogical tools for small group teaching were elaborated. The students who consented to participate in the study were randomly divided into two groups i.e. SLOT group and the Crossword puzzle group. Nonsteroidal anti-inflammatory agents (NSAID), drugs for rheumatoid arthritis and gout were the study topics for both the sessions. These topics were already introduced to the students during their didactic lectures.

The students in the SLOT group were further divided into smaller batches consisting of twenty members each appropriate for small group tutorials. Further sub-groups of five each were created. A leader was selected in each sub-group who was in-charge of co-ordinating the framing and presentation of MCQs. A topic was

given to each of the sub-group with instructions to frame three to five MCQs and present in the tutorial session. One week duration was provided as preparation time during which they could approach the assigned faculty to clarify any doubts regarding the subject content, MCQ preparation, creation of distractors or creation of an ideal stem for the MCQ questions.

On the day of the tutorial, students of a particular batch assembled in the demonstration room equipped with audio-visual aids. Each tutorial session lasted for 60 minutes. Each group then presented the questions in a power point presentation posing questions to the subsequent group while the remaining groups were active observers. Following this the next slide was projected with the correct answer and an explanation for the objective in setting-up of the question. The faculty coordinated the quiz-based sessions and wherever required, provided explanations for the MCQs. At the end of the session, a pre- validated questionnaire including both open-ended questions and a Likert scale (Score of 0 for strongly disagree to score of 4 for strongly agree) incorporated statements was administered to the students to elicit their perceptions and experience with the new method.

A crossword puzzle on NSAIDS and drugs used in rheumatoid arthritis/gout was prepared by the faculty and the clues (across and down) were created using standard reference textbooks of Pharmacology. The crossword puzzle administered were print-copies. The students were allotted a time of one-hour.

Following this, one week later to assess the overall performance of students a written test on the same topics including MCQs and short answers was conducted for both the groups. The answer sheets were evaluated and the scores obtained by the students in the two methods were compared.

Statistical analysis:

To analyse the data, the methods of descriptive statistics (mean) and analytical statistics (independent t-tests) were used employing IBM SPSS Statistics 25. An independent t test was conducted to determine if a difference existed

between the mean of the marks obtained by the students in the SLOT versus the CP.

RESULTS

Out of a total 244 students who were approached for the study, 203 students agreed to participate in the study and provided their informed consents. However, only 161 students appeared for the assessment test carried out after one week of conducting the SLOT/Crossword. Hence the scores obtained by only these students were analysed.

The SLOT group (n=74) scored 6.51±3.79, whereas the crossword group (n=87) scored 4.22±2.91. A descriptive analysis of the scores revealed a statistical significant difference ($P < 0.001$) between the mean marks obtained in the SLOT group and the marks obtained in the crossword group. The effect size $\eta^2 = 0.1$ was large (95%CI: 1.22; 3.36).

Analysis of the perceptions of the students obtained using questionnaires revealed an average score as depicted in **Tables 1 and 2** for the SLOT and CP, respectively.

TABLE 1 – Perception of students as reflected in the questionnaire of the SLOT group.

Nº	Questionnaire item	Average scores obtained
1	The new type of tutorial was relevant to the topic.	4.3
2	The new type of tutorial stimulated interest in the topic.	4.1
3	The new type of tutorial assisted me in understanding of the content of the lectures.	4
4	The new type of tutorial provided guidance on how to learn effectively for this topic.	3.9
5	I learned more than I would have by participating in a traditional (old type) tutorial.	3.9
6	I received adequate feedback on my tutorial work.	4.2
7	The tutors were interested in helping me learn.	4.3
8	I enjoyed working with a team.	3.8
9	The group work increased my ability to learn independently.	3.6
10	My group succeeded working as a team.	3.8
11	The supervision by the lecturer was useful.	4.2
12	I am looking forward to more of this kind of innovative tutorial.	4

SLOT, Student Led Objective Tutorial.

TABLE 2 – Perception of students as reflected in the questionnaire of the Crossword puzzle group.

Nº	Statement	Average score obtained
1	The crossword puzzle enhanced by knowledge on NSAIDs	4
2	The crossword puzzle stimulated interest in the topic.	4.1
3	The crossword puzzle assisted me in understanding of the content of the lectures.	3.7
4	The crossword puzzle made learning more fun	4.3
5	I learned more than I would have by participating in a traditional tutorial.	3.8
6	It helped me to remember names of drugs and their facts.	4.7
7	Length of time provided was sufficient.	3.7
8	I enjoyed working with a team.	4.1
9	The supervision by the lecturer was useful.	3.8
10	I am looking forward to more of this kind of innovative tutorial.	4.2
11	Crossword puzzles promote active learning.	4.2
12	The material on the puzzles were pertinent to the topic.	4.3

NSAID, Nonsteroidal anti-inflammatory agents.

Feedback obtained through open-ended questions revealed that the students enjoyed the SLOT sessions as it was conducted with a competitive streak. They opined that it improved their in-depth understanding of the topic and made learning more active. They felt that framing MCQ enhances critical thinking which also led to a concept of ownership in learning. The students also appreciated that it improved teamwork, self-directed learning skills and improved peer-to-peer communication. According to the students the SLOT sessions were innovative, creative, interesting, and motivated them to study Pharmacology providing them with a healthy environment to learn from their peers.

On the other hand, the pitfalls of the session as opined by the students included a necessity for active engagement of the students within the team deemed to be a requirement for successful learning. Non-involvement of individuals was a strong deterrent for effective learning. They also felt that it was more time-consuming and prior allotment of subtopics within a group resulted in segmental learning.

The students in the crossword group appreciated the session as innovative, interactive and engaging, which made learning fun and non-monotonous. It facilitated active participation in the tutorial and improved their creativity. It helped them to memorize the names of the drugs and motivated them towards active learning. However, they also felt that the time given was a limiting factor. Moreover, the questions did not facilitate in-depth understanding and explanation of the pharmacology of the drugs. They accepted that prior learning could have helped them better but did not offer any special advantages over the conventional tutorials held.

DISCUSSION

The present study was an attempt to compare the effectiveness of two innovative teaching modalities employed as small group pedagogies in Pharmacology. The results of the scores obtained by the students in the SLOT group showed a significant increase when compared to the scores

obtained by the students in the Crossword group. The questionnaire also revealed that the students appreciated the SLOT sessions better in improving an in-depth understanding of the subject as suggested in earlier studies (11) whereas the crossword merely facilitated memorization of the names of the drugs and failed to increase critical thinking and problem-solving skills.

SLOT has been deemed to be an innovative pedagogical tool to inculcate increased interest amongst learners providing ample opportunities for peer learning and self-directed learning (4). Literature survey revealed earlier studies which have proved its supremacy over the conventional tutorials and a method to propagate active learning. The students have also opined that the design of the tutorial helps the students to score better in MCQ examinations (4). The results of the present study are in concordance with a previous study that found peer tutoring engaging and encouraging to stimulate the students' academic development (12).

SLOT could prove to be a welcome addition to innovative pedagogical tools as it relies on student involvement and promotes a sense of ownership in learning amongst them. The students have to develop an in-depth understanding of the subjects to help them frame the MCQs thereby improving their analytical skills and promotes critical thinking. It improves their reasoning skills as they discuss with their peers on framing the wrong alternatives for the MCQ. Presenting the MCQ also helps them to improvise on their communication skills and instils confidence in them (4). This further on helps them to apply the pharmacological concepts taught to real-life scenarios, which they might face during their clinical sojourn (4).

One of the pitfalls as mentioned by the students was non-involvement of all the students, which could reflect on their performance as a group. This has also been reported in an earlier study in which 39% of the students felt that there was a lack of co-operation amongst some of the members of the team who failed to actively contribute in framing MCQ (13). Factors like differing personalities, lack of peer-to-peer interaction can minimize the success of groups (14). It has been proved that utilizing group

dynamics principles and concepts of reflection enables the groups to inspect and introspect (15).

A previous study incorporating crossword puzzles in Pharmacology has elaborated that it increased the learning abilities of the students by improving their ability to recall the names of the drug and diseases (16). It has also been deemed to improve the cognitive skills of the students and inculcate interest in learning. The results of our study is also consistent with earlier reports reporting such sessions as fun and efficient means of review for examinations (16). Saxena et al. in an earlier study has reported that crossword puzzles were instrumental to the overall learning of 61 out of 80 students while implementing it in the subject of undergraduate Pathology (16). Yet another study by Crossman and Crossman has reported that higher test scores were obtained by students in the subject of History of Psychology after incorporating crossword puzzles as a pedagogical study tool (17). The utility of crossword puzzle lies in the fact that it stimulates the learner to recall previous contents learned and enjoys the act of learning. However, in our study the scores obtained by the students were less when compared to the SLOT session and the student acceptability also leaned more towards the SLOT sessions when compared to the CP.

SLOT and crossword puzzles could prove to be novel tutorial methods that can counterbalance shortage in teaching faculty with increased utility in inculcating interest amongst both students and facilitators, uniformity in dissemination of content, provide an arena for group learning, and optimum usage of audio- visual aids in teaching and learning. SLOT might also elucidate the students' prospects of peer tutoring in and out the classroom. However, a crucial design of crosswords is essential to increase its utility as a pedagogical tool in enhancing higher order reasoning abilities and improve learning in students.

Notes

Part of this work was presented at 11th National conference on Health Professions Education 2019 held during November 21-23, 2019 organized

by Department of Medical Education, JNMC, Belagavi, Karnataka, India in collaboration with FAIMER and Academy of Health Professions Educators (AHPE), India

Funding

This study did not receive financial support from external sources

Conflicts of interest disclosure

The authors declare no competing interests relevant to the content of this study.

Authors' contributions.

All the authors declare to have made substantial contributions to the conception, or design, or acquisition, or analysis, or interpretation of data; and drafting the work or revising it critically for important intellectual content; and to approve the version to be published.

Availability of data and responsibility for the results

All the authors declare to have had full access to the available data and they assume full responsibility for the integrity of these results.

REFERENCES

1. Arora K, Hashilkar NK. Effectiveness of student-led objective tutorials in pharmacology teaching to medical students. *Indian J Pharmacol.* 2016;48(1):S78-S82. <https://doi.org/10.4103/0253-7613.193321>
2. Hashilkar NK, Gelula MH, Angadi NB. Effectiveness and student perspective of a pilot effort in team based learning in pharmacology for medical undergraduate. *International Journal of Basic & Clinical Pharmacology.* 2016;5(4):1413-16. <https://doi.org/10.18203/2319-2003.ijbcp20162444>
3. Kumar RP, Kandhasamy K, Chauhan RC, Bazroy J, Purty AJ, Singh Z. Tutorials: an effective and interactive method of teaching undergraduate medical students. *Int J Community Med Public Health.* 2016;3(9):2593-5. <https://doi.org/10.18203/2394-6040.ijcmph20163079>
4. Sivagnanam G, Saraswathi S, Rajasekaran A. Student-Led Objective Tutorial (SLOT) in Medical Education. *Med Educ Online.* 2006;11(1):4610. <https://doi.org/10.3402/meo.v11i.4610>

5. Singh K, Katyal R, Singh A, Joshi HS, Chandra S. Assessment of effectiveness of small group teaching among medical students. *J Contemporary Med Edu*. 2016;4(4):145-8. <https://doi.org/10.5455/jcme.20161016115304>

6. Medical Council of India. Salient features of regulation on graduate medical education in Part III, Section 4 of the Gazette of India dated 17th May 1997 [Internet]. c2020 [Amended Up to 2028 May; cited 2020]. Available at: <https://www.nmc.org.in/rules-regulations/graduate-medical-education-regulations-1997>.

7. Bartley PD. Crossword puzzles. *J Emerg Nurs* 1997;23:64-7. [https://doi.org/10.1016/S0099-1767\(97\)90067-2](https://doi.org/10.1016/S0099-1767(97)90067-2)

8. Kumar LR, B Angera S, Thalenjeri P. Introducing innovative crossword puzzles in undergraduate physiology teaching-learning process. *Arch Med Health Scis* 2015;3(1):127-130. <https://doi.org/10.4103/2321-4848.154964>

9. Saxena A, Nesbitt R, Pahwa P, Mills S. Crossword puzzles: active learning in undergraduate pathology and medical education. *Arch Pathol Lab Med*. 2009; 133(9): 1457-62.

10. Dee Fink L. *Creating Significant Learning Experience: An integrated approach to designing college courses*. San Francisco, California: John Wiley & Sons, Inc.; 2003.

11. Towle A, Cottrell D. Self directed learning. *Arch Dis Child*. 1996;74:357-9. <https://doi.org/10.1136/adc.74.4.357>

12. Sobral DT. Cross-year peer tutoring experience in a medical school: Conditions and outcomes for student tutors. *Med Educ*. 2002;36:1064-70. <https://doi.org/10.1046/j.1365-2923.2002.01308.x>

13. Sukhlecha A, Jadav SP, Gosai TR, Baluswamy D. Student-led objective tutorials in Pharmacology: An interventional study. *Indian J Pharmacol* 2016;48(1):S83-S88. <https://doi.org/10.4103/0253-7613.193310>

14. De Grave WS, Dolmans DH, Van Der Vleuten CP. Student perspectives on critical incidents in the tutorial group. *Adv Health Sci Educ Theory Pract*. 2002;7:201. <https://doi.org/10.1023/A:1021104201303>

15. Tipping J, Freeman RF, Rachlis AR. Using faculty and student perceptions of group dynamics to develop recommendations for PBL training. *Acad Med*. 1995;70:1050. <https://doi.org/10.1097/00001888-199511000-00028>

16. Saxena A, Nesbitt R, Pahwa P, Mills S. Crossword puzzles: active learning in undergraduate pathology and medical education. *Arch Pathol Lab Med*. 2009;133(9):1457-62.

17. Crossman EK, Crossman SM. The crossword puzzle as a teaching tool. *Teaching Psychol*. 1983;10(2):98-9. https://doi.org/10.1207/s15328023top1002_10

Preethi J Shenoy

Associate Professor, Department of Pharmacology, Kasturba Medical College, Mangalore Manipal Academy of Higher Education

Rashmi R Rao

Associate Professor, Department of Pharmacology, Kasturba Medical College, Mangalore Manipal Academy of Higher Education

Mailing address:

Dr. Preethi J Shenoy

Department: Pharmacology, Kasturba Medical College, IV Floor,

Light house Hill Road, 575001

Mangalore, KA, India