Graduate Research in Engineering and Technology (GRET)

Volume 1
Issue 8 *Pedagogies for Higher Education.*

Article 7

September 2022

Innovative Teaching-Learning using Crossword Puzzles

Mrudul Dixit
MKSSS's Cummins College of Engineering for Women, Karvenagar, Pune,
mrudul.dixit@cumminscollege.in

Vidya Sisale
MKSSS's Cummins College of Engineering for Women, Karvenagar, Pune,
vidya.sisale@cumminscollege.in

Recommended Citation

Dixit, Mrudul and Sisale, Vidya (2022) "Innovative Teaching-Learning using Crossword Puzzles," *Graduate Research in Engineering and Technology (GRET)*: Vol. 1: Iss. 8, Article 7.
DOI: 10.47893/GRET.2022.1147
Available at: https://www.interscience.in/gret/vol1/iss8/7

Innovative Teaching-Learning using Crossword Puzzles

Mrudul Dixit[1], Vidya Sisale[2]
[1,2] Cummins College of Engineering for Women, Pune, India
mrudul.dixit@cumminscollege.in, vidya.sisale@cumminscollege.in

***Abstract*—**It is important to introduce innovative teaching and learning methods to motivate students to develop thinking abilities and to motivate faculty to break monotonous lectures. There are multiple innovative teaching-learning methods, a few to name are crosswords puzzles, flipped classroom, mind map, Think share pair, one-minute paper, etc. This paper discusses the usage and impact of innovative teaching method, technical crossword puzzles. Simple puzzles on some specific topics are made using open source and trial softwares by giving the clues for the down and across. The crossword puzzle is given to a group of two students to solve within a time limit. Even though they need to focus and think a lot to solve a crossword, students also find it very interesting. They feel satisfied and accomplished if they can solve the whole puzzle correctly. From the faculty perspective designing a crossword by creating a set of questions with single-word answers that can be fitted into a crossword puzzle is a tedious task. Creating a puzzle by the faculty and solving the puzzle by a student is equally challenging and satisfying. Crosswords were created for multiple subjects like Systems Programming and OS, Artificial Intelligence, Computer Networking, etc. Feedback from the students is taken orally and in the written form which indicates that such innovative teaching-learning methods increase their focus, thinking ability, and interest in the subject and are fun. The feedback shows that 100% students enjoyed solving the puzzle. 92.7% students agreed that their thinking ability improved, 72.2% students say that they were able to recall the topics to solve the puzzle. 74.1% of students gave feedback that crossword puzzles can be a part of the evaluation system. 98.1% students also agreed that student interaction increased as they solved puzzles in a team.

***Keywords*—**Crossword Puzzles, Innovative Teaching-Learning, Thinking ability, Focus, Evaluation, Student Interaction.

I INTRODUCTION

Undergraduate students have to grasp various concepts in a stipulated time. The traditional lecture method imparts basic theoretical knowledge and is monotonous. Once students attend such a lecture they are not able to recall the topics. The teachings with blackboard chalk or white board and pens or power point presentation at times become dull and tiresome. In such lectures students are in a purely passive role and their concentration fades off after 15-20 minutes. Students are unable to concentrate in the teaching session due to multiple reasons like language barrier, financial difficulties, depression, home sickness, social media platforms, etc. Innovative teaching-learning methods make the students more attentive and engaging in the learning process.

Students can be engaged in activities such as group discussions, debates, role-plays, quizzes, and puzzles.

As a result of active learning, students can better recall the information they studied. It breaks the monotony but also helps in the active involvement of students thus improving thinking level, and problem-solving. and group discussion to solve crossword puzzles by making teams promotes teamwork and also complements the traditional method of Teaching.[1].The paper aims to evaluate the usefulness of Crossword Puzzle as an innovative teaching- learning tool. This pedagogy can be as useful because it can challenge learners from any professional field.

II LITERATURE REVIEW

Stacy A. Costa et al. in [1] presented brief examples of a puzzle-based seminar style that has been used in engineering undergraduate programs. Solving puzzles entails the ability to compare hidden information in a puzzle with information already in memory, and, more importantly, the ability to combine the information to form novel information and ideas. It is the innovative implementation of puzzle-based learning. It is recommended that Problem based, puzzle-based learning can be part of the curriculum and research being done in this area. Ekansh et al. discussed a Cross-sectional Observational study conducted at an institute for a three months period. In a team of four students, a crossword puzzle was given as a pretest before the lecture. After the delivery of the lecture, the post-test crossword puzzle was solved by students which showed a significant improvement in their performance [2].

[3] conducted a simple crossword with clues given “across” and “down” using the puzzle maker website. The puzzle was solved by a team of students, they discussed and enjoyed a two-hour game. students agreed that it was a unique, fun, and educational change introduced by the department. The brief comments in the feedback given by the students include Crossword puzzles contribute to a restful environment after monotonous lectures, Interactivity, fun to guess the correct spellings and learn subject at the same time, helped consolidate knowledge and all students agreed that more crossword puzzles should be offered in the future.

[4]Piyusha S. Shetgar et al. discussed the crossword implementation. 4 groups from 72 students were made and Multiple choice questions test was conducted as a pretest. Further after the pretest a crossword puzzle was given to the students as post test. Then the comparison of the performance of MCQ test results and the crossword results was done which showed students performed better in crossword puzzles by 60%. Also students agreed that it was motivating and challenging to solve a crossword puzzle [5].

Amitkumar Maheshwari et al. presented the study on 150 students to assess the changes in students' grasping power, memorizing power, and interest in learning using two different teaching-learning methods "Crossword Puzzle" and "Traditional method". The crossword method has been found to be significantly more effective than the traditional method. Crossword puzzles promote critical thinking and small-group discussion [6].

Dr.Runki Saran et al. discussed a crossword puzzle designed using from online resources and was validated by two experts from the department. Hard copies of the crossword puzzle were given to a group of students, group discussions were encouraged. After analytical feedback, 93% of the students strongly agreed that solving crossword puzzles was a fun experience and they enjoyed learning through recreation [7].

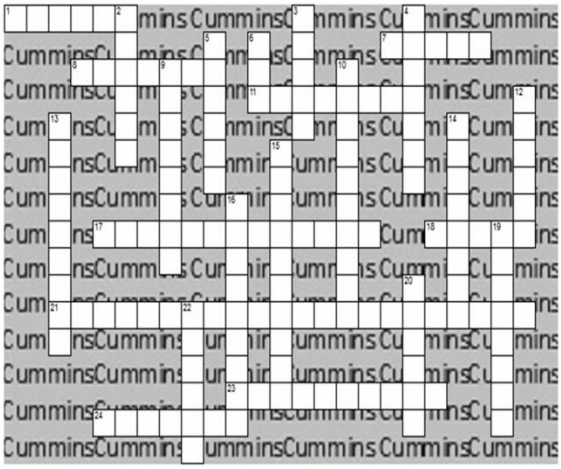
In [8] the authors have represented the deep study of Introducing innovative crossword puzzles in the undergraduate students teaching-learning process. Crossword puzzles make the teaching interesting and the learning process becomes interesting, motivating for the students, and is a good chance for students from the routine lectures.

III METHODOLOGY

The crosswords were created using trial software such as crossword forge (https://crossword-forge.en.softonic.com/) and online websites such as puzzle maker (https://puzzlemaker.discoveryeducation.com/). The questions with single-word answers are provided to the software. The software generates the crossword. The software can generate multiple different crosswords using the same set of questions and answers.

The print of the crossword was given to a group of 2 students to solve in a duration of 30 minutes for around 25 questions. Students get deeply engrossed in solving puzzles and really enjoy the process. The students solved the crossword without any external help such as books or the internet. After the completion of solving the crossword puzzle papers were exchanged between students for checking and the answers were revealed. It gives a very content and happy feeling to see students solving puzzles, expressing happiness when they get the answer right.

Fig. 1 shows a sample puzzle with the questions in cross and down given to the students in printed form. A Google form for the feedback was posted to the students to get their genuine feedback on the crossword puzzles. Eight questions were asked to the students.



Across

1. AI Definition : Systems that think like .....
7. ------first search always expands the deepest node
8. ----has flat evaluation function in Hill Climbing search
11. -----chess program was created by IBM
17. -----search run s two simultaneous searches
18. In ---- arithmetic alphabets are represented using unique numbers
21. .....term was coined by McCarthy in 1956.
23. AI Definition : Systems that acts .....
24. In PEAS, "S" indicates -------

Down

2. Crossword puzzles the task environment is ------
3. ---- is a kind of reflex agent program
4. in ----Algorithm the successor state are generated by combining two parent states
5. ---- test is used to check Systems that think like humans
6. ----- is one of the 5 logical connectives used in complex sentences
9. In ------task environment, the agent's experience is divided into atomic episodes.
10. Task environment can be fully or partially
12. ------ task requires skill development and/or intelligence and only some specialists can perform them well.
13. -----quantifier is basic element of FOL
14. The chess game has ----- state environment
15. An --------agent knows the actual outcome of its actions
16. In PEAS ------ are the Controls
19. Agent takes set of inputs called ----- from environment
20. Rubik's Cube is ---- player game
22. ----- tasks are easy for humans

Fig. 1 Sample crossword puzzle for subject Artificial Intelligence

Following are some representative questions included in the feedback:

- Did you enjoy solving crossword Puzzle
- Do you feel you are required to think for solving and this helped in improving your thinking ability?
- Do you feel you are required to focus to solve the puzzle
- Were you able to recall the topics while solving the puzzle
- Do you feel a crossword puzzle can be used to evaluate a student too
- Do you feel crossword puzzle solving can increase interaction among the students

- Any suggestions

The undergraduate and postgraduate students solved the crossword puzzles for multiple course subjects like Artificial Intelligence, Systems Programming and OS, etc. in a group of two.

III Result and Discussion

The feedback analysis for the crossword puzzle as an innovative teaching-learning method was done. All 100% of the students enjoyed solving the crossword puzzle.

Fig. 2a and Fig. 2b Show the feedback from the students regarding the thinking ability and focus required to solve the crossword puzzle.

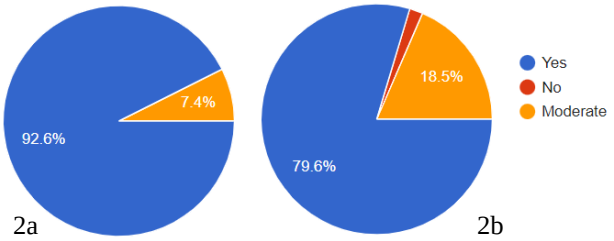


Fig. 2a) Feedback on Thinking ability

Fig. 2b) Focus on solving a crossword puzzle

Fig 2a) indicates 92.6% of students feel that they are required to think for solving puzzles to improve their thinking capability while 7.4% moderately agreed. Fig. 2b) indicates the student's response regarding the need to focus and concentrate on solving the puzzle. 79.6% of students agree that focusing is required, 18.5 % moderately agree while 1.9% of students don't agree.

Fig 3a) and Fig. 3b) show the response of the students regarding their ability to recall the theory topics to solve the puzzle and their opinion about whether the crossword puzzle should be used for evaluation purposes.

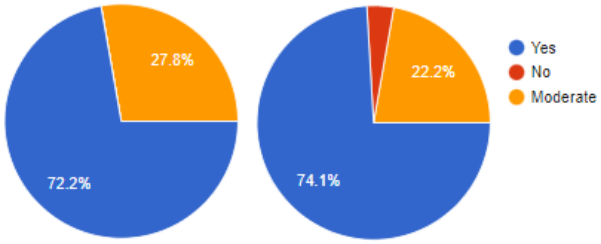


Fig. 3a) Ability to recall theory topics

Fig. 3b Opinion on usage of crossword for evaluation

Fig. 3.a) indicates that 72.2 % students agree that they were able to recall the studied topics while 27.8% indicated they were able to recall topics moderately. Fig. 3b) talks about the opinion of the students regarding the usage of the crossword for evaluation purposes. 74.1% of students agree that crossword puzzles can be used for evaluation while 3.7% of students disagree.

Fig. 4 shows the opinion of the students regarding improvement in their interaction with the other students.

Fig. 4 Shows that 98.1% of students agree that the interaction between them increased due to solving crosswords together.

Fig. 4 Shows that 98.1% of students agree that the interaction between them increased due to solving crosswords together.

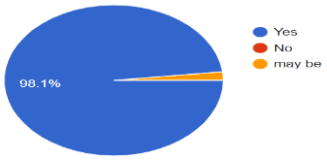


Fig. 4 Interaction among the students

Table 1 Analysis of student feedback

Feedback Question	**Feedback Answers in Percentage**			
	Yes	**No**	**Moderate**	**May be**
Did you enjoy solving crossword Puzzle	100	0	NA	NA
Do you feel you are required to think for solving and this helped in improving your thinking ability?	92.6	0	7.4	NA
Do you feel you are required to focus to solve the puzzle	79.6	1.9	18.5	NA
Were you able to recall the topics while solving the puzzle	72.2	0	27.8	NA
Do you feel a crossword puzzle can be used to evaluate a student too	74.1	3.7	22.2	NA
Do you feel crossword puzzle solving can increase interaction among the students	98.1	0	NA	2.9

Table 1 shows the analysis done on the basis of the student feedback. The analysis shows that students genuinely liked and enjoyed the innovative teaching-learning through the crossword puzzles.

Students expressed their views and suggestions through the feedback. Students said that crossword puzzles were a great quiz, interesting and helpful, they enjoyed it and would definitely like to have more such activities in class after a topic is taught which will help students to prepare for the concepts. Students expressed it was fun solving and challenged the memory as well as the thought process.

CONCLUSION

Crossword puzzles are an innovative teaching-learning method. It's a challenge for faculty as well as students to make and solve it respectively. Students fully enjoy solving the crossword puzzles, they are helpful in remembering and understanding the concepts. It also increases technical interaction between the students. It can be used for partially evaluation of the students for a course. Open-source software is easy to use and makes multiple crosswords using a single set of question answers. Overall the crossword puzzles should be given to students to solve to make teaching-learning a great experience.

REFERENCES

[1] Stacy A. Costa, Puzzle-Based Learning: An Approach to creativity, Design Thinking & Problem Solving .Implication For Engineering Education. University of Toronto, .Proceedings of the Canadian Engineering Education Association (CEEA), November 2017,
DOI: 10.24908/pceea.v0i0.7365

[2] Ekansh Rathoria, Richa Rathoria, Utkarsh Bansal and Anjana Agarwal, Innovative learning: Crossword puzzle as a learning tool for undergraduates; Hind institute of medical sciences Safedabad Barabanki Uttar Pradesh India, International Journal of Scientific Research, August 2021, 10(8): 74-76 DOI:10.36106/ijsr_8699611207_3011789.pdf.

[3] Shobith Bangera, LathaRajendra Kumar and Padmini Thalenjeri, Introducing innovative crossword puzzles in undergraduate physiology teaching-learning process, January, Science and Education & Sports (IEI, Mumbai) ,
2015, Archives of Medicine and Health Sciences 3(1):127, DOI:10.4103/2321-4848.154964.

[4] Nickolas Falkner, Raja Sooriamurthi Zbigniew Michalewicz Puzzle-Based Learning for Engineering and Computer Science, Published by the IEEE Computer Society 0018-9162/10/$26.00 © 2010 IEEE

[5] Mrs. Piyusha S. Shetgar1, Dr. Ms. Asha V. Thalange , Crossword Puzzle: An Active Learning Strategy, International conference on research developments in Arts,

[6] Amitkumar Maheshwari, Bhavesh Sadariya, Hardikkumar N Javia, Dinesh Sharma , Crossword Puzzles- An Interesting Teaching Tool to Facilitate Teaching Learning Process , National Journal of Laboratory Medicine. 2021 Jul, Vol-10(3): BO09-BO12

[7] Dr.Runki Saran, Dr. Saurabh Kumar , Use of crossword puzzle as a teaching aid to facilitate active , Indian Journal Of Applied Research, Volume, 5 ,Issue : 4, April 2015, ISSN - 2249-555X

[8] Shobith Bangera, LathaRajendra Kumar and Padmini Thalenjeri, Introducing innovative crossword puzzles teaching-learning process, January 2015, Archives of Medicine and Health Sciences 3(1):127, DOI:10.4103/2321-4848.154964.

[9] V. A Kulkarni (2019), “Use of an Active Learning Strategy to Teach Quality Control”, Conference on National Symposium on Innovations in Teaching-Learning Process, DYPCoE, Pune.