

2C (Crossword, Concept Map): A Formative Assessment Approach to Engage Interdisciplinary Program Students in Wireless Communication Course

Kartik R. Patel

Department of Electronics and Telecommunication Engineering
K.J. Somaiya College of Engineering
Mumbai, India
kartik@somaiya.edu

Abstract—Formative assessment is an exercise meant to enrich teaching-learning process. These methods are used to conduct in-process evaluations of student understanding, learning needs, and academic growth during a course. Formative assessments in engineering course are mostly implemented as assignments, multiple choice question, tests etc. Such methods are not engaging, motivating and does not give instant feedback to teachers to make necessary adjustments to modules and delivery techniques, and academic support. Wireless communication is one of the core telecommunication course which consists of students from computer science, mechanical and electronics engineering. In this course we have implemented two techniques: i) crossword puzzle, ii) concept maps in classroom. In this paper, we report the usage of these two methods as formative assessment techniques as we believe that they can evoke high level of engagement, recall, and retention. Though we have not yet conducted controlled studies for effectiveness evaluation of these formative assessment techniques, feedback response from student's reveals that 78% find the techniques engaging.

Keywords—crossword, concept maps, formative assessment, interdisciplinary course

I. INTRODUCTION

The Interdisciplinary courses allow the student to learn by making connections between ideas and concepts across different discipline boundaries [1]. Wireless communication course floated by Electronics and Communication program is offered as an interdisciplinary course (IDC) to students from Computer science, Mechanical and Electronics program.

With a varied background of learners in the wireless communication course the challenge for teacher is to engage and motivate students. Implementing formative assessment techniques like, taking oral feedback about the course, giving assignments, multiple choice questions and conducting test is monotonous for engineering courses where students are not encouraged to think critically, do not visualize relationship between ideas and concepts and does not get instant feedback.

II. RELATED WORK

A. Formative Assessment

Formative assessment is a variety of formal and informal assessment trails conducted by teachers throughout learning process in order to alter teaching and learning activities, instructional methods to improve student performance. Formative assessment constitutes a set of assessment methods, whose goals are to reveal the student's performance and provide feedback to the instructor to design appropriate practices that helps students improve their

performance [1]. Summative assessment is the overall record of accomplishments of a learner in a methodical way [1].

The innovative model for formative assessment for STEM subjects based on automatic evaluation and interactive feedback is proposed in [2]. Three experiments conducted involving 553 students. Interactive feedback ensures that students process the information from the feedback and use it to improve their performance. In [3] the proposed method is based on automatic evaluation of a decision tree constructed by a student, which describes which relevant information is required for solving a diagnostic problem, and how conclusions are reached based on that information. Proposed method is understandable to students and that it can provide them with valuable automatically generated feedback, which is its main value. Use of Crossword Puzzle and Concept Map

Crosswords have been used successfully in many different disciplines, showing their versatility and flexibility [5]. Additionally, these puzzles are often perceived as being recreational activity, therefore making them more enjoyable and less threatening than traditional teaching techniques [6]. Crossword have been revealed to be effective teaching tools of terminology, definitions, spelling and pairing key concepts with related names, resulting in superior retention and memorization facts [5], [7].

III. DESIGN AND IMPLEMENTATION OF 2C

A. Crossword Puzzle

This method has been implemented in academic year 2016-2017 for formative assessment after two months of taking IDC wireless communication course for 14 students. Two chapters were included to style crossword containing mainly clues on identification of process, definitions, terminologies, giving real life examples etc. Two different sets of crossword were designed using open source online software and hard copy (print-out) of it is given to students in classroom for solving. Together across and down there were ten clues (with one optional) and activity was assessed out of ten marks.

B. Concept Maps

The method has been implemented in academic year 2017-2018 for formative assessment after two months of taking IDC wireless communication course for 29 students.

Each student is given a focus question to prepare concept map within span of fifteen days. Students are allowed to prepare map in the form of colorful charts/presentation/animation/video or by using any online platform. Each student has to present concept map in front of

entire class in time duration of three minutes plus two minutes for question answer.

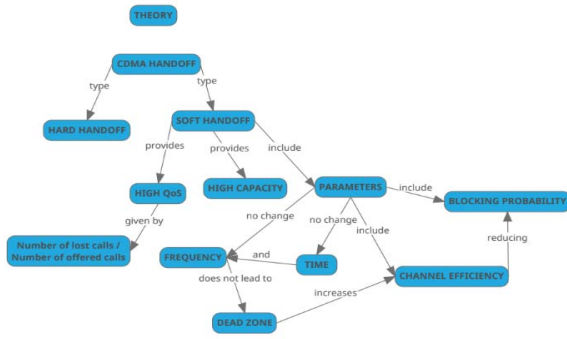


Fig. 1. Example of Concept Map

IV. METHODOLOGY

Crossword puzzle is open for discussion after completion. The concept maps are evaluated by teacher and also survey form on usefulness of concept maps is floated to students. The results in following section show the analysis of student’s response to five point Likert scale questions on concept map and crossword puzzle.

V. RESULTS

Making concept map based on focus question was a minor challenge identified by 71.4% students (Fig. 1). The concept map exercise “Helped a great deal” to 68.9% students in better understanding the topic like frequency reuse, handoff, cell splitting, sectoring etc. 82.7% students strongly agree that concept map helped them to see relationships between ideas and concept. Since the concept map preparation is left open to student using any platform, 68.2% student agree that these preparations encouraged them to think creatively. Students have explored online open source tools available like “Coggle it”, “Prezi software”, “animations”, “online presentations”, and “colorful chart” for preparing and presenting concept map.

Survey response from student (Fig. 2 below) reveals that 78.5% student agree that idea of crossword puzzle enhanced their knowledge of cellular concepts for specific terms and definitions and was entertaining way to boost our understanding. 85.7% students agree that clues given in the crossword helped them to retain the course content. Also 78.5% students agree that that for every clue which they were not able to solve prompted them to ask questions and forced them to think to find correct answer.

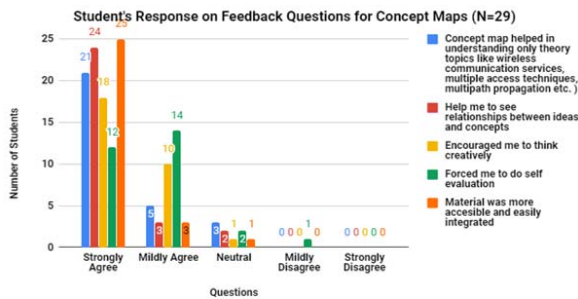


Fig. 2: Students response for concept maps

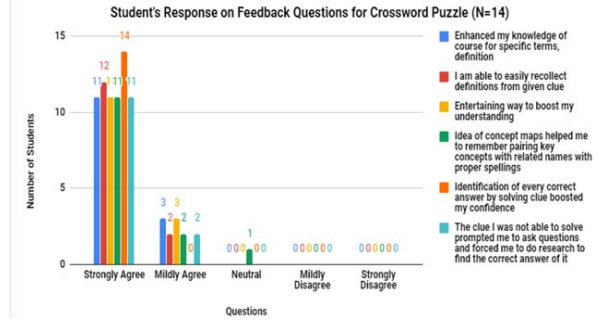


Fig. 3. Students perception crossword puzzle

VI. DISCUSSION AND CONCLUSION

A classroom assessment technique like crossword puzzle and concept map is presented in this paper in context with interdisciplinary course wireless communication. The results from survey and discussion with students shows that implementing crossword puzzle as formative assessment technique helped them to engage in course and boosted their confidence for every correct answer. The concept map helps to visualize the relations and cross links between different concepts. Students have explored online open source tools available like coogle it, prezi software, animations, online presentations and colorful chart for preparing and presenting concept maps.

ACKNOWLEDGMENT

The author wishes to acknowledge the discussion with Prof. Sridhar Iyer, Dr. Mrinal Patwardhan, and Ms. T.G. Lakshmi from IIT Bombay for their valuable inputs and time for this paper.

REFERENCES

- W. Jarlen and M. James, “Assessment and learning:Differences and relationships between formative and summative assessment”, Assessment in Education, vol. 4, no.3, pp-365-379, Nov. 1997.
- Alice Barana, “A Model of formative and automatic assessment and interactive feedback for STEM, 2018 42nd IEEE International Conference on Computer Software & Applications, pp-1016-1025.
- J. Petrovic and P.Pale, “Decision trees in formative prodecural knowledge assessment”,MIPRO 2017, May 22 26,2017,Opatija,Croatia,pp-17-20.
- Delia E. Benchoff, “Personalization of tests for formative self-assessment”, IEEE Iberoamerical Review of Learning Technologies, Vol 13, No.2, May 2018, pp-70-74.
- Chuan-hong Zhou, “Formative assessment research of youth science and technology innovation curriculum based on mind map”,2016 International Conference on Industrial Informative-Computing Technoogy, pp-218-221.
- Childers, C.D. “Using crossword puzzle as an AID to studying sociological concepts”,1996, pp-231-235.
- Crossman, E., & Crossman, S.M., “The crossword puzzle as a teaching tool”, 1983 pp-98-99.