Active Learning and CO Attainment through Collaborative Learning in Engineering Chemistry

Dr. Bharati Choudhari
Dept. of Sci. and Hum., K. J. Somaiya College of Engineering., (Autonomous College affiliated to Univ of Mum)
Mumbai, India- 400077
bharati.c@somaiya.edu

Dr. Jitendra Satam
Dept. of Sci. and Hum., K. J. Somaiya College of Engineering, (Autonomous College affiliated to Univ of Mum)
Mumbai, India- 400077
jitendrasatam@somaiya.edu

Dr. Pushpendra Rai
Dept. of Sci. and Hum., K. J. Somaiya College of Engineering, (Autonomous College affiliated to Univ of Mum)
Mumbai, India- 400077
pushpendrarai@somaiya.edu

Dr. Druman Utekar
Dept. of Sci. and Hum., K. J. Somaiya College of Engineering, (Autonomous College affiliated to Univ of Mum)
Mumbai, India- 400077
drumanutekar@somaiya.edu

***Abstract*— Co-operative learning is becoming increasingly popular and gaining importance in modern education. It is more effective than traditional forms of learning. In this paper, we report the use of 'Structured' collaborative learning, in a course "Engineering Chemistry". The objective of this paper is to investigate the effectiveness of collaborative learning on improving undergraduate engineering students' learning in the subject of Engineering Chemistry. The students were actively involved and showed more enthusiasm and participation. A survey conducted at the end of the course shows that students were satisfied with the pedagogical approach and the CO is attained.**

***Keywords*— collaborative learning, active and deep learning; social and personal skills; engineering education; CO attainment**

I. INTRODUCTION

Collaborative learning is important in knowledge building, sharing, and distribution and has a significant impact on learning outcomes [1], [2], [3]. In collaborative learning, students of different capabilities and interests work together in small groups to complete a project. Engineering Chemistry being a non-core subject for the technical students, many students lose their interest in learning as they feel the subject is unimportant because it is not part of their syllabus after F.Y. throughout their program. In such case, the students remain passive learners and then desired CO is not attained. It is thus an important and difficult task to create interest in such subject and transform the students into active learners. Some of the thinking strategies [1] are considered as "Collaborative Learning to accomplish a common goal. This indicates that students engaged with this pedagogy may be co-dependent, co-active and co-ordinated.

II. IMPLEMENTATION

A. Academic Context

The course "Engineering Chemistry" is compulsory for F.Y.B.Tech. students in the undergraduate program at the Engineering College. This is a one semester course and about 300- 325 students are enrolled for the course and overall for the academic year 600 to 650 students are enrolled. So, we have 5 classes of 60 to 65 students in each class, in every semester. 60 to 65 students from a class were further grouped in a group of 10 to 12 students per group. The activity had a double role: students were learning about e-learning with the aid of e-learning and were able to learn in practice everything heard or read in the lectures while preparing their presentation/s.

B. Approach to Collaborative Learning and Learning Activities

We followed the Group Investigation method [7]. This method was taken up for study because it gives more freedom to students and have less specified group rewards and get students think creatively and learn social and personal skills. The aspects made clear to the students included- Group goal, Sharing ideas and materials, Division of labor, Preparing and presenting the power point presentation, Grades to Individual in the group and to the group as a whole.

The topic allotted to each group for making presentation was with reference to syllabus contents of "Engineering Chemistry" for F. Y. B. Tech. With respect to the topic allotted to the group, students were instructed to include history, present, future, industrial applications, acknowledgement, references. They were free to include short videos, demonstrations, etc. to show their creativity in their presentation. The complete activity was supervised by the faculty in-charge of the group. Students prepared presentation as per the procedure, presented their presentation as per the allotted time-table and submitted the report. The report is graded by faculty in-charge of the group based on rubrics.

III. INSTRUMENT USED

The instruments used for the study are

A. Survey Questionnaire

After defining the questions, scope, target audience and methodology, this survey instrument was developed and converted to online Google form. The questionnaire was reviewed before release. Table I gives the structure of the survey questionnaire given to the students.

B. End semester examination test paper

This instrument was designed by the instructor/s and external examiner. The question paper covered the complete curriculum for the course and 20 percent questions were targeting the conceptual understanding of the topic/s allotted for presentation/s.

IV. OBSERVATIONS AND DATA GATHERED

It was observed that the students were more active. Some of the weak students who find it difficult to digest a topic on individual basis were able to understand it and also solve

978-1-7281-4227-2/19/$31.00 ©2019 IEEE
DOI 10.1109/T4E.2019.00075

problems on the topic after the activity. Those students who were less active during regular lectures were more excited and prepared for the presentation/s. Students were discussing their problems and were focusing on justification of their method. Majority of the misconceptions were solved and students were satisfied with their new additions to the topic in their presentation with creative idea. The students formed a nice bonding with their batch mates and developed good interpersonal relations. Some introvert students were also involved in discussion and were able to share idea/s with class without hesitations. Most important and encouraging observation was the attainment of CO.

The following data was gathered-

The marks obtained by students in the end semester examination in 2017- 18; the marks obtained by the students in the end semester examination in 2018- 19; student responses to the four point Likert scale questions.

V. RESULTS

A. *Results of end semester examination*

We were interested in scores of students and the CO attainment in the end semester examination. The difference in the scores is significant and the CO attainment level has improved as expected.

Figure I shows improvement in the CO attainment level.

TABLE I STRUCTURE OF THE SURVEY QUESTIONNAIRE

Sr. No.	Section Title	Number of question	Type of question *Four point Likert*
1.	Social skills and team work	1	4
2.	Deep Learning	1	4
3.	Exam Score	1	4
4.	Study Material	1	4
5.	Future Involvement	1	4

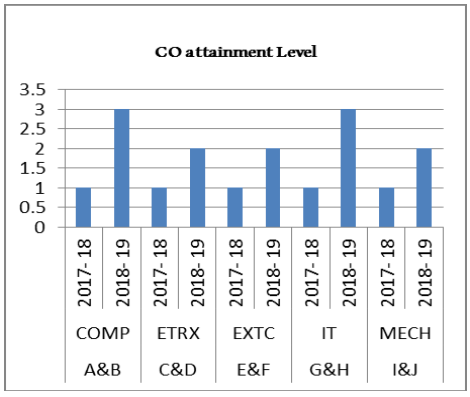

Fig. 1 Attainment of CO

B. *Results of exit survey*

Figure II illustrates the students' response to the 4 point likert scale in the form of bar graph. As it can be seen for all the parameters more than 50% of the students strongly agree that they enjoyed the collaborative learning activity and it was useful for them to enhance their social skills. More than 31% students agree that it helped them in better and deep understanding of the core concept/s related to the topics and that they would like to be part of such activity in the future.

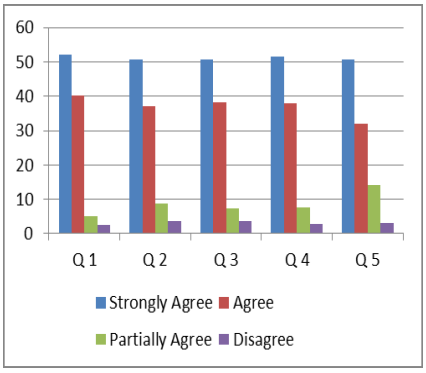

Fig. 2 Analysis of students' response to likert scale in the exit survey in the form of bar graph

VI. CONCLUSION

Collaborative learning served the purpose of creating active learning environment in the non-core subject such as Engineering Chemistry. Students participated in the learning process and appreciated learning through this technique. The technique proved to be good to enhance social and personal skills of students. It also helped them score good marks in the end semester exam and the CO could also be attained.

ACKNOWLEDGMENT

We would like to thank our Principal and management for constant encouragement for use of new technology in teaching. We are also thankful to faculty and staff for their constant support.

REFERENCES

[1] D. Gillet, A. V. Nguyen Ngoc, and Y. Rekik, "Collaborative web-based experimentation in flexible engineering education," IEEE Trans. Educ., vol. 48, no. 4, pp. 696–704, Nov. 2005.

[2] Z. Berge and M. Collins, "Introduction," in Computer Mediated Communication and the Online Classroom. Cresskill, NJ: Hampton Press, 1995, pp. 1–10.

[3] M. S. Khine and A. Lourdusamy, "Blended learning approach in instructor education: Combining face-to-face instruction, multimedia viewing and online discussion," Br. J. Educ. Technol., vol. 34, no. 5, pp. 671–675, Nov. 2003.

[4] S. Berman, Thinking strategies for science, grades 5-12, 2nd ed., Thousand Oaks: Corwin Press, 2008.

[5] B. Gross-Davis, Tools for Teaching. San Francisco, CA: Jossey-Bass, 1993.

[6] E. R. Kemery, A. Aggarwal, Ed., "Developing On-Line Collaboration," in Web-Based Learning and Teaching Technologies—Opportunities and Challenges. Hershey, PA: Idea Group, 2000, pp. 226–244.

[7] S. Sharan & Y. Sharan, "Small group teaching", Educational Technology publications, Englewood Cliffs, New Jersey, 1976.