COOPERATIVE LEARNING IN CHEMISTRY

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ABSTRACT

The goal of education is to improve literacy with cooperative learning for the enhancement of mankind. It required teachers to pre structure teaching and task management which motivate the students to enhance the interpersonal skills. The present paper focused on four different cases observed in the undergraduate and postgraduate level chemistry class; such as good in laboratory skill but not in theory, good in theory and laboratory skills but not in analysis, students used common facilities but observed individual attitude in learning while forth case observed that they do score and have leadership qualities but lacking interview skills. The finding shows significant differences observed in slow learners, advanced learners, and average learners.

***Keywords*:** Student anxiety, Basic elements, Transferable skills

INTRODUCTION

The role of science education advances not only science and technology in research-based learning but also for the development of mankind and society in general. Scientific literacy is the gateway to achieve economic survival. However, several teachers may not have been professionally prepared. In science, various concepts are developing day by day, and they need to be handled carefully in the subjective matter.

In day to day life, Chemistry is very important, since it is a core subject in higher secondary school required to get admission in the field of science and technology such as for the medical and engineering, textile and printing technology, agricultural & dairy science, pharmacy and drugs, chemical engineering, etc. (Jegede, 2003). The concept observed in theoretical as well as in the laboratory, most students failed to understand chemistry. Student's anxiety for chemistry learning leads to a loss of interest in the sciences (Keeves, 1992). Hence, to understand its scope and application of chemistry in society, to remove a student's fear, the subject should be students' friendly and enjoyable; the use of cooperative learning strategy needs to be applied.

DATA COLLECTION

Cooperative learning in chemistry studied in 4 different cases are as follows;

Case (1). Chemistry is a common subject at the first-year undergraduate level where students learn theory and practical. Some of the practicals, students do in groups and perform

satisfactorily in laboratory examinations but during viva-voce, it was observed that gross misconceptions regarding chemical phenomena (Grace *et al.*, 2007).

Case (**2**). In other cases, learners are good at theory and laboratory skills. They performed projects in small groups. They do the experimental part nicely with a review of literature and interaction among themselves and also with the supervisor. But it was observed that, while writing the report students were not making up the relation of the experimental part with theoretical and its analysis.

Case (3). Number of time students used common facilities in the laboratory e.g computers, colorimeters, spectrophotometer, working table, weighing balance, deep freezer, etc. and required to cooperate with each other. Nevertheless, sometimes, basic elements are not observed, it may be due to typical types of students and their management while in the fourth case.

Case (4). In other cases student's competencies include problem-solving, communication, leadership, and collaboration, among others. Exam scores, course evaluations, leadership behaviors with communications in language, and student assessment of learning gains (SALG) surveys exhibited students are lacking while employing them (Canelas *et al.*, 2017).

DATA ANALYSIS

Cooperative learning methods applied to solve cases

I] Learning Environment

- Conductive environment is the key to the active participation of students and teachers in the learning process, where students crave for knowledge and subjective information. It will be achieved by understanding through active mental ability, background and gender, and availability of infrastructural facilities. In cooperative learning, students work in a group, the focus of attention is diffused among the group members.

- Jigsaw was originally developed by Aronson and colleagues in 1978. According to Jigsaw, students should work in a group of 5-6 students and exchange all ideas in groups, and each student in the group becomes an expert in the subject (Canelas *et al.*, 2017; Marcalo, 1999). Unfortunately, it does not work effectively because of its individual accountability for contributing to the achievement of a group goal.

II] Interactive learning and Basic elements

The cognitive theory of Jerome Bruner, "learning at its best is thinking, "where students learn to ask questions and to verify answers with group mates; it procures the similar thought of

Aronson (Bruner, 2009). 'Learning Together Model' put forth by Johnson and Johnson's (1994); the key summarized in five, basic elements (Johnson and Johnson, 1994).

- **Positive interdependence:** Students within groups must truly be dependent on one another.
- **Face-to-face interaction:** The interaction and verbal interchange among students that are promoted by positive interdependence which have the greatest effect on educational outcomes.
- **Individual and group accountability:** All students within a group are responsible for learning the study material.
- Appropriate use of **interpersonal skills** in the group.
- **Group processing:** Finally, students must be given enough time for analyzing how well their groups are functioning. With these elements, the Number-Heads-Together model significantly increased the achievement of the students in chemistry, the students' self-efficacy in learning, and attitude towards chemistry in comparison to the lecture-discussion method.

III] Three different types of students and student anxiety

During the performance of the experimental work students group's task is they must exchange ideas, make plans, and propose solutions. Competitive, individualistic, and cooperative students are three different types of students in the classroom and also during laboratory work and educators/tutors need to plan accordingly. Effective teaching strategies address these competitive, individualistic, and cooperative students (Sarah *et al.,* 2006; Marcalo, 1999). Achievement anxiety has a relationship with student study behavior and academics. Each group mirrored the make-up of the class regarding ability, background, and gender (Daniel and Awokoy, 2010). Among all the instructional strategies for enhancing science achievement, the emphasis is laid on the importance of group work achievement.

IV] Relationship between Basic elements and types of students & student anxiety

During laboratory practicals, students perform in small-group learning and theory classroom lectures and their individual accountability is considered. Due to this learning process, and rewards for appropriate group functioning, students feeling in the classroom as an individual and in a group with warmer classroom climate enhances its ability of understanding and execution, thereby promoting learning and achievement. But these three types of students have their goals while in the Cooperative learning system, they are working together to

achieve common or shared goals. Owing to students' anxiety, they may not interact with each other and not participate in the classroom as well as in the laboratory (Daniel and Awokoy, 2010; Johnson *et al.*, 1991). Mainly these students belong to slow learners, mainly in case 2. To observe all elements and types of students up to the fulfillment level of satisfaction, teachers are facilitating a variety of study materials and advancing students in various technologies by arranging workshops, seminars and by providing training. Many find that a well-balanced program is arranged for the students.

At the undergraduate level, Sem I and II syllabus is included, the foundation of chemistry where the basic arithmetic skills and understanding the fundamental concept in chemistry along with laboratory skills such as solutions and aqueous reactions, kinetics, equilibrium, acids and bases, solubility and equilibrium, thermodynamics, electrochemistry, and nuclear chemistry etc. After observation of their elements and students, their groups were formed for the applications of cooperative learning and methodologies (Powell *et al.*, 2020).

V] Key transferable skills

In cooperative learning, students promote each other's success by helping, supporting, encouraging, and praising each other to learn. When students have to organize their thoughts to explain ideas to teammates, they must engage in cognitive elaboration that enhances their understanding (Eilks and Byers, 2009). It is observed in case 2 project students.

The main goal of cooperative learning is to help students expand their repertoire of problem-solving approaches, while its minor goal is to help them develop collaborative skills-leaderships, decision-making, communication, etc. These goals can only be achieved if students have enough time to develop group dynamics and overcome difficulties in working together (Dorian *et al.*, 2017; Alebiosu, 1998). It is observed in case 4 students.

When compared their chemistry knowledge mentioned all in four cases, required constructive, cooperative controlling during recitation, and laboratory content. Due to cooperative learning. Behaving as an effective teammate and the leader with the comfort level reported more growth. This skill observed a very less percentage in cases 2 & 3 who are slow learners.

DISCUSSION

To collect the relevant data in all four cases Chemistry Anxiety Scale (CAS) the instruments were used. After analysis of collected data exhibited various feelings like a state of discomfort, threatening to self-esteem, leads to panic, tension, helplessness, fear, distress, shame, inability to cope with the current syllabus learning process. Hence, leads to sweaty

palms, nervous stomach, difficulty in breathing, and loss of ability to concentrate that made them withdraw their participation in the teaching and learning process (Aksela, 2000). Lack of participation may be found in teaching methodologies that move away from the more traditional, teacher-centered classrooms and concentrate more on student-centered, cooperative learning techniques problem-solving strategy in chemistry reduced chemistry classroom anxiety in students it's only due to the effects of cooperative learning in form of peer feedback.

The basic elements, Positive interdependence, Face-to-face promotive interaction, Individual accountability, Interpersonal and small group skills, and Group processing are quality criteria for cooperative learning where processes of cooperation and competition are required to do the theory as well practical's in chemistry.

Recently, the learning paradigm shift is observed due to the development in various fields, and it's in chemistry too which has various branches including paperless and solventless chemistry. Learning together with parallel traditional teaching, mentoring, convener, and collaboration with teachers to teacher's interaction, students to students' interaction, and teacher-students interaction for the students' inquiry, students may develop higher-order cognitive skills with satisfactions.

These all the above data vary as per the student's background, learning & mental ability in all four cases.

CONCLUSION

The essential component in cooperative learning is cooperative tasks and structure among the teachers and students. During cooperative learning, teachers should provide repeated exposure to students in the group while performing laboratory practicals and learning theory processes. Staying on-task, allowing students to make decisions undependable, and continuous structural support of teachers will definitely solve the problem in chemistry cooperative learning.

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