Collaborative Learning Enhances Achievement in Environmental Chemistry

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Abstract

Environmental chemistry which including air, water, soil, and all life forms on earth. The complete composition of Chemicals and all the essential components of the atmosphere, hydrosphere, geosphere, lithosphere, and biosphere are discussed in detail. Collaborative learning strategy considered for environmental Chemistry contains taught easily with deep understanding in a short period, enabling one to understand it while ensuring important elements are taking into account. The term Collaborative learning (CL) refers to an instruction method in which learners at various performance levels work together in small groups toward a common goal. CL is an educational approach to teaching and learning that involves groups of learners working together to solve a problem, complete a task, or create a Conclusion. CL activities vary widely, but most center on students' exploration or application of the course material, not simply the teacher's presentation or explication of it.

Keywords: Environmental Chemistry, Collaborative Learning, Constructivist Learning, Higher Secondary School Students.

Introduction

Constructivist learning is an umbrella of a variety of educational approaches involving a joint intellectual effort by students, or students and teachers together. Collaborative learning (CL) is part of Constructivist learning. School students are working in groups, mutually searching for understanding, solutions, or meanings, or creating a product. CL activities vary widely, but most center on students' exploration or application of the course material, not simply the teacher's presentation or explication of it.

CL represents a significant shift away from the typical teacher-centered or lecture-centered milieu in School classrooms. In collaborative classrooms, the lecturing/ listening/note-taking process may not disappear entirely, but it lives alongside other processes that are based on students' discussion and active work with the course material. Teachers who use CL approaches tend to think of themselves less as expert transmitters of knowledge to students, and more as expert designers of intellectual experiences for students-as coaches or mid-wives of a more emergent learning process.

Collaborative learning represents a significant shift away from rigid teacher-centered or lecture-centered teaching School classroom practices. In collaborative classrooms, the lecturing/ listening/note-taking process may not disappear entirely, but it lives alongside other processes that are based on students' discussion and active work with the course contents. Teachers who use CL approaches tend to think of themselves less as expert transmitters of knowledge to students, and more as expert designers of intellectual experiences for students-as coaches or midwives of a more emergent learning process (Smith, B. L. & MacGregor, J. T., 1992). CL is possible through student-student collaboration, student-teacher collaboration, and many other ways in the classroom.

Student-Student Collaboration

Collaborative learning engages students with content, and also helps students build the interpersonal skills needed to be successful attain content. The strategies associated with CL such as role assignments, collaborative problem solving, and task and group processing, this all helpful in deeply understanding the concept.

There are a plethora of instructional and learning strategies that encourage student collaboration, including peer teaching, peer learning, reciprocal learning, team learning, study circles, study groups, and workgroups, to name just a few (Johnson & Johnson, 1986). Collaborative inquiry, which combines many of the elements of student collaboration just mentioned, is a research-based strategy in which learners work together through various phases "of planning, reflection, and action as they explore an issue or question of importance to the group" (Goodnough, 2005). Collaborative inquiry brings together many perspectives to solve a problem, engaging students in relevant learning around an authentic question. It allows students to work together toward a common purpose to explore, make meaning, and understand the world around them (Lee & Smagorinsky, 2000).

Teacher-Student Collaboration

The purpose of collaboration in an educational setting is to learn and unpack content together to develop a shared understanding. Harding Smith (1993) points out that the CL approach is based on the idea that learning must be a social act. It is through interaction that learning occurs. Johnson and Johnson (1986) similarly emphasize that when students and teachers talk and listen to each other; they gain a deeper understanding of the content and can develop the skills necessary to negotiate meaning throughout their lives. Collaboration requires a shift from teacher-led instruction to instruction and learning that is designed by both teachers and students. Collaboration between students and the teacher plays a critical role in helping students reflect and engage in their own learning experiences. The constructivist learning movement is one current example of efforts to increase the amount of collaboration between student and teacher occurring in the classroom. Mayer (2004) defines constructivist learning as an "active process in which learners are active sense makers who seek to build coherent and organized knowledge" (p. 14). Students co-construct their learning, with the teacher serving as a guide or facilitator. The teacher does not function in a purely didactic (i.e., lecturing) role.

Environmental Chemistry

Environmental chemistry is a Part of Chemistry that including air, water, soil, and all life forms on earth. The complete composition of Chemicals and all the essential components of the atmosphere, hydrosphere, geosphere, lithosphere, and biosphere are discussed in detail. Numerous forms of pollutants and their toxic effects along with sustainable solutions are provided. Not only knows the basics of environmental chemistry, but it needs to discuss many specific areas and issues, and its practical solutions. The problems of non-renewable energy processes and the merits of renewable energy processes along with future fuels, making this a comprehensive many other relevant fields which try to fill with the knowledge gap of probable solutions.

Teaching Strategy

The difference between groups was that the controlled group was taught by the traditional method while the experimental group was instructed by the CL method.

The traditionally-designed chemistry instruction was based upon lessons employing a lecture method to teach concepts of Environmental Chemistry. Teaching strategy depends upon teacher explanations, discussions, and textbooks contain Environmental Chemistry. The teacher treated the entire class as a unit, wrote notes on the blackboard about the definition of different terminology, and drew diagrams related to geometry. After the teacher's explanation, the concepts were discussed, recapitulated by the teacher's questions. The direction of communication in the classroom was from teacher to student only. Here the teacher is the focal point of discussion and dispenser of the knowledge.

Collaboratively-designed chemistry instruction was based upon lessons employing collaboration to teach concepts of Environmental Chemistry. Teaching strategy depends upon students' explanation, discussion, and Environmental Chemistry of the textbook contain. A teacher is working as an instructor and facilitator in the classroom. Teacher makes strategy on teaching concepts, develop materials and lesson plan, and implement in the classroom. The student follows instructions and works with the teacher, peer group, and peer students in collaboration.

Srinivas (2017) explained Collaborative Learning Strategies; two strategies out of four are given below:

- **Think-Pair-Share**: This strategy followed three steps: (1) The instructor poses a question, preferable one demanding analysis, evaluation, or synthesis, and gives students about a minute to think through an appropriate response. This "think-time" can be spent writing, also. (2) Students then turn to a partner and share their responses. (3) During the third step, student responses can be shared within a four-person learning team, within a larger group, or with an entire class during a follow-up discussion. The caliber of discussion is enhanced by this technique, and all students have an opportunity to learn by reflection and by verbalization.
- **Numbered Heads Together:** Members of learning teams, usually composed of four individuals, count off: 1, 2, 3, or 4. The instructor poses a question, usually factual, but requiring some higher-order thinking skills. Students discuss the question, making certain that every group member knows the agreed-upon answer. The instructor calls a specific number and the team members originally designated that number during the count-off respond as group spokespersons. Because no one knows which number the teacher will call, all team members have a vested interest in understanding the appropriate response.

Research Methodology

In the present study Non-Randomized Two Groups Design quasi-experimental: Post-test only design was used. In the present study effectiveness of independent variable, method of teaching (two levels): (1) Constructivist learning and (2) traditional teaching method was required to be checked on dependent variable (achievement), thus the researcher decided to use two groups post-test only design (Best & Kahn, 2009). The design of the study is presented as below:

E X O_1
C - O_2

Where,

X = Treatment
O_1 and O_2 = Post-test
E = Experimental group
C = Control group

Objectives and Hypotheses

The major purpose of this study was to investigate the effect of using problem solving method in teaching chemical equilibrium at Higher Secondary level Chemistry.

Objective: To compare the achievement of students taught by problem solving method and students taught by traditional method.

Null Hypotheses: There is no significant difference between the achievement of the controlled and experimental group in post-test.

Population and Sample

This study examined the effectiveness of traditional learning versus collaborative learning in enhancing Academic achievement. The subject matter was the Environmental Chemistry of Chemistry textbook of Standard XI (GCERT). All students studying at eleven Standard in public and private high schools Gujarati medium in Gujarat state taken as the population of the study. A convenient sampling technique was used. Twenty-two standard XI students of Sadabhavana Vidyalaya, Surat, Gujarat as experimental group and thirty-four A. V. Patel high school, Surat, Gujarat as a control group, were taken as the sample of the study. Both group made equal by achievements marks in science and mathematics of standard X Gujarat Secondary and Higher secondary board.

Tool for the Study

A self-developed Achievement test was used as an instrument. The researcher developed a test after reviewing the related literature and consultation with experts. The test included 5 questions containing multiple choice questions, 5 one line questions, 6 short answer questions and long answer questions to measure students 'academic achievement. All the items in the test based on Environmental Chemistry from Standard XI chemistry textbook. The test was constructed in such format that it covered the areas of knowledge, comprehension, application

level and Higher Order Thinking (HOT) level. Chemistry achievement test was used post treatment test. The scale was standardized with reliability coefficient 0.71 which shows high reliability. Reliability is ensured using test-retest method. The instrument was pilot tested with 15 students in a school not participating in the study but within the same area of study. Validity is ensured as content validity. The Content validity of the items was assessed by experts. Experts hold position as Chemistry teacher in School and lecturer in Education College.

Data Analysis

Data was collected through post achievement tests. Posttest based on Standard XI chemistry unit (i.e. Environmental Chemistry). Data were analyzed through mean, median, standard error, and Mann Whitney U-test. Manna Whitney U-test calculated by the online calculator.

Group	N	mean	SD	Mann Witney U-test value	z- Value	Level of significance
Experimental group	22	18.09	0.91	157	-3.632	(p < = 0.01)
Control group	34	13.76	0.59			

From the descriptive statistics, Mean score greater for Experimental group **(**x = 19) than for Control group (x = 13). Mann-Whitney test indicated that the Achievement test was greater for the Experimental group **(**Mdn = 19) than for the Control group (Mdn = 13), U = 410.5, the p-value is 0.00028. The *z*-Score is -3.632. The result is significant at $p < .01$. Thus, the researcher found out there was a significant difference between the experimental group and the control group. A low standard deviation (Control group SD = 0.59) indicates that the data points tend to be very close to the mean compare to a high standard deviation (Experimental group SD = 0.90) indicates that the data points are spread out over a large range of values. So this shows that the experimental group achievement score is more spread within-group than a control group. Thus, the collaborative learning method is more effective than the traditional method.

Major Findings

- There is an easy way to learn and enrich knowledge through CL of higher secondary school students.
- There is a significant difference between group achievement scores more experimental group than a control group.

Conclusions

In the present study, the Collaborative learning medium provided students with opportunities to analyze, synthesize, and evaluate ideas collaboratively. A collaborative formal setting facilitated discussion and interaction. Group interaction helps a student to learn from each other's scholarship, skills, and experiences. The students had to go beyond mere simple concepts to complex concepts and synthesizes over a particular broader concept. Thus, collaborative learning provides scope for enhancement knowledge and academic achievement in Environmental Chemistry.

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