JIGSAW II STRATEGY OF CO-OPERATIVE LEARNING AND ACHIEVEMENT IN BIOLOGY AT SECONDARY LEVEL

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Abstract

Today in the constructivist paradigm the process of learning has been redefined. The constructivist theories of learning advocate learning approaches that maximise student involvement. Jigsaw II is such a strategy of cooperative learning following constructivist principles that gained worldwide acceptance. The merit of Jigsaw II strategy of co-operative learning in enhancing achievement of secondary school students' in biology is discussed in this paper. This research employs quasi-experimental method with pretest-posttest design. Ninth standard students were selected as the sample for the study. The superiority of the experimental treatment is evident from the results of the study.

Key terms

Jigsaw II Strategy, Co-operative Learning, Achievement in Biology

Introduction

Biology is one of the important school subjects as it opens windows to nature; the study of living things paves way for students to understand the beauty of nature and how nature sustains life on this planet earth. In this modern world of exploitation knowing, experiencing, and preserving nature is highly valuable and imperative. Learning of biology facilitates individuals develop positive attitude towards environmental protection and preservation of natural resources. It develops keen understanding of one's own physical and biological existence and learns the ways to manage a healthy and worthy life. However, because of numerous reasons the learning of biology seems to be difficult for learners; the nature of lesson topics, improper instructional methods, poor study habits, negative feelings and attitudes of students (Çimer, 2012), abstract level of concepts (Lazarowitz & Penso, 1992), lack of student involvement in learning process, overcrowded classrooms, vague content presentation in textbooks, and improper implementation of curriculum are predominant. Teaching that relies on textbooks and the learning that is not related to everyday life makes biology a difficult subject of study for many students.

As biology constitutes an important part of the school science curriculum and is mandatory for all students up to the secondary level, the teaching of biology should be taken seriously. Even though the subject seems to be simple, there are several areas in biology that are considered as complicated by learners (Lazarowits & Penso, 1992; Bahar, Johnstone, & Hansell, 1999). Experiencing complexities in various topics in biology negatively affects the motivation of students and their performance in examinations (Özcan, 2003). Most students complain that biology is too descriptive, boring, and often does not make any sense (Shashidhara, 2011).

The teaching style of teachers is another important reason for the difficulties faced by students; most teachers use teacher-centred methods rather than student centred strategies. The dissimilarity between actuality and classroom learning experiences causes difficulties in learning biology (Hadiprayitno, Muhlis, & Kusmiyati, 2019). Students find difficulties in learning biology due to lack of competence of teachers. Also abstractness of certain topics is another cuse for poor performance in biology (Finely, Stewart, & Yarroch, 1982; Abimbola & Baba, 1996).

Jigsaw II strategy of Cooperative Learning

Cooperative learning an important constructivist teaching-learning method widely employed in the instruction of various subjects. These cooperative learning methods are characterized by individual and group accountability, positive interdependence, and face to face promotive interaction. Cooperative learning was defined by Olsen and Kagan (1992) as "a group learning activity organized in such a way that learning is based on the socially structured transfer of information between learners in groups in which each learner is held accountable for his or her own learning and is motivated to increase the learning of others." Co-operative learning thus trains the students in various interpersonal and small group skills.

A most well known cooperative learning strategy, Jigsaw II was developed by Slavin (1980) based on the Jigsaw strategy of Elliot Aronson in 1970's. In Jigsaw II strategy there are four characteristics delineate it and contribute to its success. They are: mixed ability grouping, individual accountability and responsibility, group reward and motivation, and equal opportunity for success of every participant (Chan, 2004). In Jigsaw classrooms, the lesson to be taught is presented in the whole class which is previously divided in to heterogeneous home groups (teams) consisting of four or five members; from each group, one student is sent to expert group which masters the given sub-topic. Returning back to home groups each 'expert' teaches the content to other group members. The group performance and improvement of scores of individuals are recognized. Even though the tests are conducted individually, learners are encouraged and motivated to work jointly to enhance the overall performance of the group.

Jigsaw II strategy maximizes student participation in the learning process and eventually facilitates students' academic and non-academic performance. An important outcome of Jigsaw learning is the improvement in learners' involvement in learning activities and interactions among them (Morgan, Rodríguez, & Rosenberg, 2008). Achievement in biology was found to be significantly increased by the use of Jigsaw II strategy (Sasikala & Ravichandran, 2013; Chukwu & Arokoyu, 2019). Also, the effectiveness of this strategy in teaching general science (Garcia, Abrego, & Robert, 2017; Joel & Samuel, 2018), in chemistry (Kumari, 2006; Koç, Doymus, Karaçöp, & Simsek, 2010; Abu-Shouk, 2010), and in physics (Karacop, 2017; Kade, Degeng, & Ali, 2019) was well established. Hence adoption of Jigsaw II strategy can be assumed to be effective in our class rooms for better achievement in school subjects and biology in particular.

Hypotheses of the Study

1. Achievement in biology of students learnt through Jigsaw II strategy will be higher than that of students learnt through the conventional method.
2. Achievement in biology of students learnt through Jigsaw II strategy will be higher than that of students learnt through the conventional method for the instructional objective knowledge.
3. Achievement in biology of students learnt through Jigsaw II strategy will be higher than that of students learnt through the conventional method for the instructional objective understanding.
4. Achievement in biology of students learnt through Jigsaw II strategy will be higher than that of students learnt through the conventional method for the instructional objective application.

Objectives of the Study

1. To compare the achievement in biology of students learned through Jigsaw II strategy and that of students learned through the conventional method

2. To compare the achievement in biology of students learned through Jigsaw II strategy and that of students learned through the conventional method for the instructional objectives (1) knowledge, (2) understanding, and (3) application

Methodology in Brief

Pre-test post-test non-equivalent group design of quasi-experimental method was employed for the present study. Ninth standard students of two divisions of Adwaita Mission High School, at Bounsi, Banka district, Bihar were the sample for the study under discussion. The students of two divisions were randomly assigned to experimental group and control group. The control group was allowed to learn by using the conventional method. Jigsaw II was the learning strategy for the experimental group. Identical topics were given for learning to the two groups. Before the commencement of experimental treatment both the groups were pretested. The same test was given as post test for both the groups at the end of the experiment. The scores secured by the two groups were analysed using ANCOVA to verify the hypotheses formulated.

Results and Discussion

1. Effect of Jigsaw II strategy over the conventional method for enhancing achievement in biology

The pre-test scores and post-test scores (total) of the students in the experimental group as well as in the control group were analysed using ANCOVA to establish the superiority of Jigsaw II strategy in enhancing the achievement in biology compared to the conventional method. The adjusted Y means of students in the experimental group and that of students in the control group were found out and compared. The details are presented in table 1.

Table 1
Comparison of adjusted Y means of the experimental group and that of control group

Group	N	M_x	M_y	M_{yx} (adjusted)	*t* value
Control	40	3.675	13.875	14.083	12.635 ($p < .01$)
Experimental	40	3.950	21.050	20.841	
General means	80	3.812	17.462		

The adjusted Y mean of experimental group is higher than that of control group and the difference is statistically significant. The value of *t*, 12.6352, is much higher than the table value, 2.64 (degrees of freedom = 77), at .01 level of significance. Therefore it can be assumed that learning of students using Jigsaw II strategy is better than learning of students using the conventional method for improving achievement in biology at secondary school level.

2. Effect of Jigsaw II strategy over the conventional method for enhancing achievement in biology based on the objective knowledge

The pre-test scores and post-test scores (for the objective knowledge) of the students in the experimental group as well as in the control group were analysed using ANCOVA to establish the superiority of Jigsaw II strategy in enhancing the achievement in biology compared to the conventional method. The adjusted Y means of students in the experimental group and that of students in the control group were found out and compared. The details are presented in table 2.

Table 2
Comparison of adjusted Y means (under the objective knowledge) of the experimental group and that of control group

Group	N	M_x	M_y	M_{yx} (adjusted)	*t* value
Control	40	1.825	5.650	5.659	9.696 (p< .01)
Experimental	40	1.875	7.725	7.715	
General means		1.850	6.687		

The adjusted Y mean of experimental group is higher than that of control group and the difference is statistically significant. The value of *t*, 9.6960, exceeds the table value, 2.64 (degrees of freedom = 77), at .01 level of significance. Therefore it can be inferred that learning of students using Jigsaw II strategy is better than learning of students using the conventional method for enhancing achievement in biology at secondary school level with regard to the objective knowledge.

3. Effect of Jigsaw II strategy over the conventional method for enhancing achievement in biology based on the objective understanding

The pre-test scores and post-test scores (for the objective understanding) of the students in the experimental group as well as in the control group were analysed using ANCOVA to establish the dominance of Jigsaw II strategy in enhancing the achievement in biology compared to the conventional method. The adjusted Y means of students in the experimental group and that of students in the control group were found out and compared. The details are presented in table 3.

Table 3
Comparison of adjusted Y means (under the objective understanding) of the experimental group and that of control group

Group	N	M_x	M_y	M_{yx} (adjusted)	*t* value
Control	40	1.400	5.60	5.591	10.827 (p< .01)
Experimental	40	1.375	9.00	9.008	
General means		1.387	7.30		

The adjusted Y mean of experimental group is higher than that of control group and the difference is statistically significant. The value of *t*, 10.827, exceeds the table value, 2.64 (degrees of freedom = 77), at .01 level of significance. Therefore it can be inferred that learning of students using Jigsaw II strategy is better than learning of students using the conventional method for enhancing achievement in biology at secondary school level with regard to the objective understanding.

4. Effect of Jigsaw II strategy over the conventional method for enhancing achievement in biology based on the objective application

The scores for pre-test and post-test (for the objective application) of the students belonging to the experimental group as well as the control group were analysed employing ANCOVA to establish the dominance of Jigsaw II strategy in increasing the achievement in biology compared to the conventional method. The adjusted Y means of students in the experimental group and that of students in the control group were found out and compared. The details are presented in table 4.

Table 4
Comparison of adjusted Y means (under the objective application) of the experimental group and that of control group

Group	N	M_x	M_y	M_{yx} (adjusted)	*t* value
Control	40	0.450	2.625	2.736	5.409 ($p < .01$)
Experimental	40	0.700	4.325	4.213	
General means	80	0.575	3.475		

The adjusted Y mean of experimental group is higher than that of control group and the difference is statistically significant. The value of *t*, 5.409, surpasses the table value, 2.64 (degrees of freedom = 77), at .01 level of significance. Therefore it can be inferred that learning of students using Jigsaw II strategy is better than learning of students using the conventional method for enhancing achievement in biology at secondary school level with regard to the objective application.

The Jigsaw II strategy of cooperative learning is found to be useful than the conventional method of teaching in augmenting the achievement in biology among secondary school students. This strategy also proves to be relevant in improving achievement under various instructional objectives - knowledge, understanding, and application.

Conclusion

Learning biology is not an easy task for a number of learners due to diverse reasons. Jigsaw II strategy provides a solution for this problem faced by the students to a great extent. The findings of this study establish that cooperative learning through Jigsaw II strategy is far more efficient than the conventional method in enhancing achievement of secondary school students in biology. These findings substantiate the findings of previous research in the same subject (Sasikala & Ravichandran, 2013; Chukwu & Arokoyu, 2019). So it is proposed that Jigsaw II strategy should be promoted in educational institutions for teaching biology and other school subjects. Proper training for school teachers should be organized to help them adopt Jigsaw II strategy in classrooms. Similarly, the practice of this strategy should be included in the teacher education curriculum also.

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