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Original Article

Cooperative and Self-regulated Learning Styles on Students' Achievement in Biology

Hamilton Ekeke, Joy Telu*

Department of Science Education, Niger Delta University, Wilberforce Island, Bayelsa State, Nigeria.

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Cooperative learning (CL) is a learning style that refers to small, heterogeneous groups of students working together to achieve a common goal. This involves student-student interaction within small groups in a way that each group member's success is dependent on the group's success. Self-regulated learning (SRL) style believe on what 'knowing' is and how one 'comes to know.' SRL recognizes that individuals may to some extent control their own learning through contexts, relationships, and situations. The purpose of this study was to determine how these two learning styles impact on students' achievement in Biology. The influence of sex and ability (high and low) were also investigated when comparing CL and SRL styles.. The study was carried out in third term of 2013/2014 academic session in Bayelsa State, Nigeria on senior secondary 2 students aged 14-17 years. The biology ability test question (BATQ) which was adopted from standardised West African examination council (WAEC) past examination question papers on the topics in the syllabus that were covered within the period of the research, was used for data collection. Significant higher achievement test scores were observed for students of varying abilities in cooperative learners in comparison with self-regulated learners; No significant difference in test scores achievement was observed between the male and female students. Moreover, no significant interaction effect was observed between sex and ability, sex and method, ability and method and among method, sex and ability on achievement. The implication of this in teaching/learning of Biology is that teachers should model their instructions to enforce student – student interaction.

Keywords: Learning style, achievement, biology, cooperative learning, self-regulated learning, Nigeria

The purpose of education is not merely to enable students to accumulate facts. A major goal is that by the time students finish school; they should be able to solve problems that will enable them to be happy and successful in life and to contribute to society. To achieve this goal, students need to develop high order thinking skills which can be through various learning styles which include cooperative learning (CL) and self-regulated learning (SRL). These two learning styles have their varying merits and demerits. According to Brown and Ciuffetelli (1) the basic elements of CL are positive interdependence, individual accountability, equal participation, and simultaneous interaction. It is generally agreed that CL leads to positive outcomes for students (2). Among various CL styles, the Spencer Kagan's structure which stresses positive interpersonal peer relationships, equality,

*Correspondence: Department of Science Education, Niger Delta University, Wilberforce Island, Bayelsa State, Nigeria.
E-mail: joytelu@yahoo.com

self-esteem, and achievement (3) is the most prominent. According to this structure, students are allowed to work together on materials or contents selected either by themselves or by the teacher. The aims of CL is to build team spirit and positive relationships, promote information sharing and critical thinking, help to develop communication skills and memorizing specified material. Many of the structures can achieve simultaneously as parts of the above aims, and also educators can mix and adapt different structures to a particular student group.

On the other hand, SRL is another learning style which became popular in the 1980's and involves students responsibility by encouraging them to learn by them-selves. SRL is guided by metacognition (thinking about one's thinking), strategic action, and motivation to learn (4). Although almost any student can perform SRL, however it does not mean that all students do take effective charge of their own learning. When faced with a learning task, self-regulated learners typically may analyze and interpret tasks according to their knowledge, set specific goals helping them to achieve their objectives, monitor their own progress through internal feedbacks, readjust their efforts and strategies, use motivational strategies, or loop back through existing strategies to make necessary adjustments in order to attain their goals (5). In other words, they take care of their own learning by coordinating the thinking skills. Therefore, SRL is made up three components which are self-observation, self-judgment, and self-reaction. That is, learners regulate their own learning by observing their own capacity, then compare it with a fixed standard, make judgments about the quality of this performance, and finally make plans about future efforts. The objective of the present study was to evaluate whether there is a difference in achievement in Biology between students who learn cooperatively and those who learn through SRL.

Materials and methods

Studied population

The studied population comprised 60 students (aged 14-17 years) offering Biology course; consisting of 30 each from 2 senior secondary two (SS2) classes in the Government Secondary School Amassoma, Bayelsa State, Nigeria. The students were randomly selected from the class register; selecting every third name on the registry from each class.

Test instrument

The test instrument was the biology ability test question (BATQ) which was adopted from standardised West African examination council (WAEC) past examination question papers on the topics in the syllabus that were covered within the third term of 2013/2014 academic session. The test consisted of 5 multiple choice questions.

Instrument administration

Out of the 60 respondents (students) in SS2, 30 were respondents for CL and were divided into six groups of five students each, while the remaining 30 respondents represented the students for SRL. A pre-test was conducted, and after a month interval another test (post-test) was conducted. During the one month period, students in the CL classrooms were instructed and monitored by teacher alongside the researcher. The teacher in the CL group incorporated the basic elements of CL into the group's experiences such as positive interdependence, face-to-face interaction, individual accountability, social skill development, and group processing. In addition, the teacher specified both the academic and social skill objectives, explained the tasks and goal structures, assigned roles within the groups and described the procedure for the learning activities.

In the SRL group, the whole class was taught the same topics. The teaching of students in this group was still centred on the use of the recommended textbook. Instead of discussing the material, helping each other, or developing projects in groups, students read the assigned reading material silently, completed assignments independ-

ently at their seats, engaged in discussions with the teacher in response to the teacher's questions. The teacher instructing this group dispensed facts to the students; this is the most dominant method for teaching science in Nigeria.

Statistical analyzes

In order to analyze the data obtained with respect to the specific research questions, frequency counts, mean, standard deviation, sum of squares and mean square were computed The analysis of co-variance statistic was used for analyzesand $P< 0.05$ was considered as statistically significant.

Results

The CL group scored higher marks on the post-achievement test than the SRL respondents in Biology as shown in Table 1.

A significant difference in achievement was found between the cooperative learners and the self-regulated learners, as shown in Table 2 ($f = 6.663$, $P< 0.05$). However, non-significant interaction effects on achievements were found between sex and ability, sex and method, ability and method, and among sex, ability and method.

On post-test, the male and female cooperative learners achieved slightly different scores (Table 3). The males had mean scores of 60.94 while the mean score of females was 63.29. However, this difference was not significant according to the data presented in Table 2 ($f = 0.907+0.901+1.039-1.397= 1.45$, $P> 0.05$).

On post-test in SRL group, the male and female students showed also slightly different scores. The males had mean scores of 53.11 while

Table 1. Comparison of the effects of CL and SRL styles on students' achievements in Biology

Group	N	Unadjusted Mean	SD
Pre-test			
CL	60	26.23	7.05
SRL	60	26.93	7.02
Post-test			
CL	60	56.11	9.60
SRL	60	38.62	10.34

CL: cooperative learning, SRL: self-regulated learning.

Table 2. Analysis of co-variance of achievements (post with pre) test scores on instructional method, sex, and ability

Source	Type III Sum of Squares	*Df*	Mean Square	F	Sign F
Corrected model	22,383.070	8	2,797,884	1.758	.093
Intercept	15,630.291	1	15,630.291	9.823	.002
Pre-Test	474.929	1	474.929	.298	.586
Sex	1,817.725	1	2,710.887	1.704	.195
Method	10,602.501	1	10,602.501	6.663	.011
Sex * Ability	1,443.656	1	1,443.656	.907	.343
Sex * Method	1,433.070	1	1,433.070	.901	.345
Ability* Method	2,222.288	1	2,222.288	1.397	.240
Sex * Ability * Method	1,652.602	1	1,652.602	1.039	.310
Error	176,623.706	111	1,591.205		
Total	479,755.930	120			
Corrected Total	199,006.776	119			

r^2=112 (adjusted r^2= .049).

the mean score of females was 45.62 (Table 4).

However, this difference was not significant (f=1.45, P> 0.05).

High ability cooperative learners scored higher marks on achievement tests than their counterparts self-regulated learners (Table 5). Similarly, low ability cooperative learners scored higher marks on the achievement tests than their counterparts of the SRL style (Table 6).

Significant differences were found between students of varying abilities (high and low ability) in the CL style and those of the SRL style, with f = 31.468, P< 0.05 (Table 7a) in high ability groups, and f =100.803, P< 0.05 (Table 7b) in low ability groups. Therefore, there was a significant difference in achievements between students of varying abilities instructed with CL style and those of SRL style.

Table 3. Comparison of male and female cooperative learners achievements

Group	N	Unadjusted Mean	SD
Pre-test			
Male	30	25.73	7.06
Female	30	26.73	7.133
Post-test			
Male	30	60.94	8.74
Female	30	63.29	10.6

Table 4. Comparison of male and female self-regulated learners achievements

Group	N	Unadjusted Mean	SD
Pre-test			
Male	30	22.24	5.92
Female	30	22.20	4.83
Post-test			
Male	30	53.11	9.60
Female	30	45.62	10.34

Table 5. Comparison of achievement test scores of high-ability cooperative-learners with self-regulated learners

Group	N	Unadjusted Mean	SD
Pre-test			
CL	30	30.27	5.69
SRL	30	32.00	5.26
Post-test			
CL	30	58.50	7.54
SRL	30	47.59	3.34

CL: cooperative learning, SRL: self-regulated learning.

Table 6. Comparison of achievement test scores of low ability cooperative learners and self-regulated learners

Group	N	Unadjusted Mean	SD
Pre-test			
CL	30	22.20	5.92
SRL	30	22.19	4.83
Post-test			
CL	30	43.4	3.8
SRL	30	31.0	6.3

CL: cooperative learning, SRL: self-regulated learning.

Table 7a. Summary of analysis of co-variance of achievement (post with pre) test scores on high ability students

Source	Type III Sum of Squares	*df*	Mean Square	F	Sign F
Corrected model	2,192.546[3]	2	1,096.273	16.709	,000
Intercept	5,068.213	1	5,068.213	77.247	.000
Pre-Test	7.273	1	7.273	.111	.740
Method	2,064.609	1	2,064.609	31.468	.000
Error	3,739.795	57	65.610		
Total	17,1065.930	60			
Corrected Total	5,932.342	59			

r^2= .370 (adjusted r^2= .347).

Table 7b. Summary of analysis of co-variance of achievement (post with pre) test scores on low ability students

Source	Type III Sum of Squares	*df*	Mean Square	F	Sign F
Corrected model	2,791.452	2	1,395.726	50.863	.000
Intercept	3,536.902	1	3,536.902	128.891	.000
Pre-Test	2.072	1	2.072	.076	.784
Method	2,766.124	1	2,766.124	100.803	.000
Error	1,564.137	57	27.441		
Total	84,648.690	60			
Corrected Total	4355,590	59			

r^2= .641 (adjusted r^2= .628).

Discussion

The findings of this study have demonstrated the effectiveness of CL in the teaching and learning of Biology at the higher secondary school level of education in Nigeria. One major finding of this study is that the cooperative learners scored higher marks in the achievement test than those of the SRL style. This may have been achieved by the high participation level of students in classroom activities. All the respondents in the cooperative group performed specific roles in solving problems which are presented in the classroom to the benefit of all members of the group. Correspondingly, when learners are confronted with problems which they must solve, they are forced to reason and think critically in order to solve the problems. This finding is in agreement with the findings of other researchers (6). It is believed that when properly and carefully used, CL activities engage the students in the learning process and seek to improve the critical thinking, reasoning and problem solving skill of learners (7-10).

It was pointed that CL is important in helping learners acquire from the curriculum the basic cooperative attitudes and values they need in the classroom and outside the classroom (11). The attitudes exhibited by students in the CL class may also be explained, at least in part, by intense and prolonged interaction among students.

In the present study, achievement results were not affected by sex. In fact, what matter most in CL are role expectations and responsibilities.

Although non-significant interaction effects on achievement were found between sex and ability, sex and method, ability and method, and among sex, method and ability, it is believed that the higher thought processes as required for higher achievement, are induced by the interaction with one another more than with the traditional treatment from books and classroom teachers. This, again,

may have contributed to the noticed significant difference in achievement scores between students in the cooperative classroom and those in the traditional classroom. Student-student interaction constitutes the majority of time and activity during CL. It is generally believed by researchers that an essential ingredient of CL is each learner's desire to facilitate the task performance of fellow group members.

It appears that CL which is also empirically supported, as described in this study, is a viable option compared to SRL method for teaching Biology in secondary schools. But caution should be taken not to over generalize since the method has the potential of making students believe that instructional problems cannot be tackled independently. The major purpose of teacher-student interaction during CL is to promote independent thinking.

Further investigations on CL could help to understand what influence student's change of attitude in CL class; the relationship between CL and knowledge about the world; and teachers' sex differentials and use of CL as an instructional approach.

Conflict of interest

The authors declared no conflict of interest.

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