Using Collaborative Learning to Enhance Home Economics Students' Understanding of Some Basic Concepts in Ecology. A Case Study at Kade Senior High Technical School

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Abstract
Collaborative learning is an educational strategy that makes use of groups to improve learning through teamwork. Students work together in groups of two or more to complete assignments, resolve issues, or come up with new ideas. This study sought to determine the effects of using collaborative learning to enhance students' understanding of some basic concepts in ecology at Kade Senior High Technical School in the Kwaebibirem Municipal assembly in the Eastern region of Ghana. The sample consisted of 45 students which were selected from 2 Home Economics A. The research instruments used for the study were tests on ecology. The researcher used appropriate groupings as an intervention. The data were examined statistically by computing the percentage scores for each test. Results from the pre-test revealed that students have difficulties with the description and explanation of some of the basic concepts in ecology and the differences between these concepts. After the intervention, the student's ability to describe and explain some of the basic concepts in ecology and distinguish between them improved enormously. They grasped the basic understanding of the ecosystem, its various components, and the environment as a whole. Based on the results obtained, interesting findings came about and upon the findings, recommendations were made.
Keywords: Collaborative learning, Ecology, Appropriate groupings, Teamwork

1. Introduction
Science is a way of looking at the world that is precise, reliable, and relentless in its examination of the data (Huxley,1866). Science is always looking for ways to understand the world better. Science education has been identified as an indispensable mechanism in the development of every nation in the world. Bearing this in mind, the government through policy formulations has made quite a few efforts to enhance the teaching and learning of science at all levels of education in Ghana.

Ghana as a developing country has incorporated science into all levels of its education from the elementary to the tertiary levels and beyond to accelerate its progress. In the second-cycle institutions (Senior High Schools), Biology is among the elective subjects studied when pursuing a general science course.

The ultimate goal of biology education must be to describe the living world using scientific concepts. It also aims to teach students how to observe and measure, forecast and formulate hypotheses, conduct experiments and investigations, record data and evaluate results, make conclusions, and communicate them to the rest of the world. Biology is essential for national development since it exists in many different fields. Biology education is found to play a fundamental role in many areas of medicine, biotechnology, agriculture, pharmacy, botany, and other related fields.

The inability of students to properly comprehend biology lessons could be a result of several factors. Lazarowitz & Penso (1992) cite several causes for why students struggle to understand biological topics. Lazarowitz & Penso assert that learning biology is challenging due to the abstract nature of the topics. According to Osborne & Collins (2001), the overloaded science curriculum content is another reason why students' enthusiasm for learning science and other science subjects is waning. Using ineffective teaching strategies and separating science from society are the main reasons why it is difficult to grasp biology. Students' performance will continue to be poor if the right instructional strategies are not used. The approach a teacher takes to teaching is extremely important and has been proven to have an impact on how well students comprehend a subject (Asaolusam, 2022). According to Asaolusam, some of the methods of teaching Science include; the field trip/ excursion method, demonstration method, project method, process-based teaching method, inquiry approach method, laboratory or experimental method, lecture method, cooperative/collaborative learning, discussion method, and teacher exposition.

According to Sanchez-Alonso (2016) before selecting any teaching strategy, the instructor must take into account at least three key factors:

1. "The learning objectives, to make sure the method is appropriate"
2. "The nature of the materials"
3. "How we want students to interact with this information."

Yussif (2022) also opines that thinking about your student's needs will help you determine the best teaching approaches for your classroom. Since each class is unique, you must modify your approaches to match the needs of the many pupils. Yussif believes that the teacher should also consider his or her teaching style and what works best for him/her.

Collaborative learning refers to a broad range of educational strategies that involve cooperative intellectual work from students or both students and teachers. Students typically work in groups of two or more, seeking insights, solutions, or meanings together or producing a final product While collaborative learning activities can take many different forms, they often focus on students' discovery or use of the course information rather than just the teacher presenting or describing it. (Smith, B.L. & MacGregor, J.T., 1992). People who practice collaboration take responsibility for their actions, respect their peers' abilities and contributions and learn from them. Collaboration is a philosophy of involvement. (Panitz, 1999).

The Collaborative Learning Theory is rooted in the work of Lev Vygotsky's (1978) social development theory and zone of proximal development. In Vygotsky's social learning theory, the Zone of Proximal Development is a crucial concept. According to this theory, there is a third zone, known as the zone of proximal development, between the person's ability and incapacity zones. To learn what is in this zone, a person needs assistance. New skills that are still forming can be found in this zone. If they have access to those who can instruct them, a person will acquire the abilities located in their zone of proximal development.

Vygotsky also developed the idea of the More Knowledgeable Other (MKO). A more knowledgeable other is someone who possesses the skills or backgrounds the learner is seeking. It might be a parent, teacher, or more senior adult, but it might also be a peer. According to Vygotsky, interactions with this person allow a learner to observe desired behaviour being modelled or acquire crucial knowledge. As the learner seeks knowledge, internalizes the knowledge offered by the More Knowledgeable Other, and then uses that knowledge to direct their activities, Vygotsky referred to this as collaborative discourse. With the assistance of people who have more experience, the learner can operate within the Zone of Proximal Development.

2. Objectives of the Study
The study is geared to answer the following research questions;
➢ To determine the knowledge level of students before the introduction of collaborative learning to teach some of the basic concepts in ecology.
➢ To determine the effects of the use of collaborative learning to teach some of the basic concepts in ecology.

3. Research Questions
The following research questions are addressed in this study;
A. What was the knowledge level of the students before the introduction of the collaborative learning approach to teach some basic concepts in ecology?
B. What are the effects of the use of a collaborative learning approach to teaching some of the basic concepts in ecology?

4. Population, Sample, and Sampling Technique
4.1. Population
According to Burns (2003), the population is made up of all the components that satisfy the requirements for research inclusion. A population, according to Bluman (2014), is made up of all the study subjects (human or otherwise). This study was carried out in Kade Senior High Technical School which had a student population of 2300 at the time of the study. The accessible population for the study was all Home Economics students in form two at Kade Senior High Technical School for the 2021/2022 academic year. The entire form two Home Economics classes were made up of 100 students. 94 of the students were females and 6 were males at the time of the study.

4.2. Sample and Sampling Procedure
The act of choosing a subset of the population to represent the complete population is known as sampling (Wallen &Fraenkel, 2000). The sampled population for the study was two Home Economics A students of Kade Senior High Technical School comprising 45 students of which are females. The sample from the population was chosen using a purposive sampling technique. This was because the researcher taught that class and thus had sufficient knowledge of the student's performance.

5. Instrumentation: Test Design and Implementation

According to Denzin and Lincoln (2008), a research instrument is a measuring tool such as a test, questionnaire, interview, and observation, meant to collect data on a topic of interest from research subjects. The main instrument for the pre and post-tests was a class test since the researcher realized that most students did not take their class exercises seriously, but they give their all when it was time to take a class test.

The pre-test consisted of two sections The first section was to test their knowledge in describing some of the basic concepts in ecology. They were asked to describe; habitat, environment, population, community, and atmosphere. The second section was to test their knowledge of ecological factors by asking them to discuss the difference between abiotic (physical) and biotic (biological) factors and also to group some ecological factors as either physical or biological. The factors were; rainfall, temperature, insects pollinating flowers, and carnivores eating other animals. There were five questions in each section. Each test item was worth two marks with total marks of ten for each section. The test item was administered to all forty-five students in Form Two Home Economics A. The test lasted for 30 minutes.

The class test used for the post-test after the intervention had taken place was the same test used for the pre-test. It was also divided into two sections. The test item was administered to all forty-five students in Form Two Home Economics A. The test lasted for 30 minutes.

6. Data Collection

The scripts of the students were gathered, marked, and scored to gather data for the pre-test. The scripts were put into two groups. Students who scored five or more marks for each section were grouped. Using frequency counts, a different group was created for those who scored less than five marks in each section. Students who scored less than five were deemed to have failed the pre-test, while those who scored five or more were deemed to have passed. To better understand the performance of the two groups, the range of marks was converted to percentages. To gather information for the post-test also, the students' scripts were graded and grouped according to the same standards used during the pre-test. Utilizing descriptive statistics, the acquired data was examined

7. Data Analysis, and Discussion

7.1. Pre-Intervention Data and Analysis

Table 1: Overall performance of 2 Home Economics A students in the first year of biology at Kade Senior High School.

Grade	Number of students	
	First Semester	Second Semester
A1	0	0
B2	0	5
B3	5	6
C4	5	5
C5	3	5
C6	3	4
D7	5	7
E8	12	6
F9	12	7
Total	45	45

Table 1 displays the overall Biology performance of 2 Home Economics A students during their first year at Kade Senior High School in the 2020/2021 academic year. As compared to the first semester, student performance improved as the second semester rolled around. Grades A1 to C6 in the WASSCE classification denote a strong pass, whereas D7 to F9 indicate poor performance. From the table, the number of students who had A1 to C6 increased from sixteen students in the first semester to twenty-five students in the second semester. The number of students with grades between D7 and F9 also decreased, from twenty-nine in the first semester to twenty in the second. The figure is still high because it accounts for nearly 50% of all the pupils enrolled in the class.

Table 2: Students' pre-test results in terms of scores obtained describing some fundamental ecological concepts.

Range of Marks	No. of Students	Percentage %
1-4	30	67%
5-10	15	33%
Total	45	100

Table 2 shows the percentage scores attained by students on a pre-intervention test that asked them to describe some fundamental ecological concepts (habitat, environment, population, community, and atmosphere). It revealed that thirty students representing 67% had below the pass mark of five. They were not able to describe

most of the ecological concepts. Out of the total number of 45, 15 students representing 33% were able to meet the pass mark for the test. This showed that the majority of the students in 2 Home Economics A who participated in the pre-intervention assessment test found it challenging to describe the ecological concepts (habitat, environment, population, community, and atmosphere).

Table 3: Students' pre-test results in terms of scores obtained in distinguishing between abiotic and biotic factors.

Range of Marks	No. of Students	Percentage %
1-4	35	78%
5-10	10	22%
Total	45	100

The percentage scores students obtained on the pre-intervention test on the distinction between abiotic(physical) and biotic(biological) factors, as well as the classification of some ecological factors as either biotic or abiotic, are shown in Table 3. From the table above, it was seen that thirty-five students representing 78% of the class had less than the threshold of five. They failed to effectively separate the biotic from the abiotic and properly group the ecological factors. Just ten students (22 % of the class) managed to score at or above the passing threshold on the test. This indicated that most of the students in 2 Home Economics A who partook in the pre-intervention assessment test had trouble distinguishing between abiotic and biotic factors and grouping some ecological factors.

7.2. Post-intervention Data and Analysis

Table 4: Students' post-test results in terms of scores obtained describing some fundamental ecological concepts.

Range of Marks	No. of Students	Percentage %
1-4	6	13%
5-10	39	87%
Total	45	100

Table 4 displays the percentage scores attained by students on a post-intervention test that asked them to describe some basic ecological concepts (habitat, environment, population, community, and atmosphere). The table above shows that six students (13% of the class) scored below the passing mark of five. They were unable to accurately describe some fundamental ecological concepts (habitat, environment, population, community, and atmosphere). However, 87% of the class representing thirty-nine students were able to meet the pass mark and beyond. This revealed that most of the 2 Home Economics A students who participated in the post-intervention assessment test had gotten past the challenge of explaining some fundamental ecological concepts (habitat, environment, population, community, and atmosphere).

Table 5: Students' post-test results in terms of scores obtained in distinguishing between abiotic and biotic factors.

Range of Marks	No. of Students	Percentage %
1-4	7	16%
5-10	38	84%
Total	45	100

The percentage scores students received on the post-intervention test on the distinction between abiotic(physical) and biotic(biological) factors, as well as the classification of some ecological factors as either biotic or abiotic, are shown in Table 5. From the table above, it was seen that seven students representing 16% had less than the threshold of five. They failed to distinguish biotic from abiotic factors and properly group the ecological factors. Nonetheless, thirty-eight students (84 percent of the class) managed to score at or above the passing threshold on the test. This showed that the majority of the 2 Home Economics A students who participated in the post-intervention assessment test had overcome the challenge of differentiating between abiotic (physical) and biotic (biological) elements and grouping some ecological factors.

7.3. Discussion of Research Questions

Research Question 1: What was the knowledge level of the students before the introduction of the collaborative learning approach to teaching some basic concepts in ecology?

To answer this research question, students were tested on three areas of ecology. These were: describe some basic ecological concepts (habitat, environment, population, community, and atmosphere) and differentiate between abiotic (physical) and biotic (biological) factors, and also group some ecological factors as either physical or biological during the pre-intervention stage. The factors were; rainfall, temperature, insects pollinating flowers, and carnivores eating other animals. A pre-test with two sections and five questions in each section was provided to them. The percentage scores attained by 2 Home Economics A students showed that they had a poor understanding of ecology. From Table 2 thirty students representing 67% of the class had below the pass mark of five suggesting they were not able to describe the ecological concepts. Yet again Table 3 showed that thirty-five students representing 78% of the class had less than the threshold of five. They failed to

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effectively separate biotic from abiotic factors and properly group the ecological factors. Just 33% of the class (15 students) passed the pre-test on describing some fundamental ecological concepts (habitat, environment, population, community, and atmosphere). Again, ten students (22 % of the class) managed to score at or above the passing threshold on the pre-test that asked them to distinguish between abiotic(physical) and biotic(biological) factors, as well as the classification of some ecological factors as either biotic or abiotic. This showed how much ecology was challenging for the students.

Research Question 2: What are the effects of the use of a collaborative learning approach to teaching some of the basic concepts in ecology?

The pre-test and post-test student data were compared to answer this research question. The comparative analysis showed that following the intervention, the student's performance significantly improved. From Table 2, thirty students representing 67% of the class, were unable to describe the ecological concepts in the pre-test. The post-test results, however, reveal significant progress in performance following the intervention. Now, as indicated in Table 4, 39 students, or 87% of the class were able to describe the ecological concepts. Yet again, in differentiating between abiotic (physical) and biotic (biological) factors and grouping some ecological factors, 35 students representing 78% of the class as shown in Table 3 failed to effectively separate biotic from abiotic elements and properly group the ecological factors in the pre-test. However, this improved following the intervention, as indicated in Table 5, where as many as 38 students (84 percent of the class) were able to distinguish between biotic (biological) and abiotic (physical) factors and categorize the ecological factors. The substantial increase in the percentage indicated a significant improvement in the student's performance. According to the findings of the post-test, the adoption of a collaborative learning strategy enabled students to describe accurately some of the basic concepts in ecology and to also differentiate between abiotic(physical) and biotic (biological) factors, and group some ecological factors. Because they were more engaged at each level of the course, this approach undoubtedly helped students comprehend ecology better.

8. Conclusion

The students were able to understand ecology thanks to the collaborative learning approach that was used in the classroom. The student's understanding of several fundamental ecological concepts, as well as the differentiation between biotic and abiotic elements, was enhanced by the intervention exercises. Because of this, educators must take care to choose methods that can provide pupils with the skills they need to feel more confident and motivated. Applying and developing collaborative learning skills in the youth of today can only help our communities become stronger together.

9. Recommendations

At the senior high school level, ecology is an important topic in Biology that students need to learn. It equips the students with the knowledge they need to comprehend other aspects of biology. Owing to the interactions with 2 Home Economics A students when the interventions were applied, the following recommendations were made to help students, teachers, policymakers, and all stakeholders of education and the general public to ensure that prompt measures are taken to ensure the improvement of students understanding in biology as a subject

- Students must be placed at the centre of the teaching and learning process to be actively involved in the lesson.
- Students should as often as possible be made to work in groups where the high achievers in the class are mixed with the low achievers to enable the low achievers to learn from the high achievers.
- Prompt feedback should also as much as possible be given to students after every work done to enable them to know their strengths and weaknesses and work on them.

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