

The effect of the demonstration method of teaching on students' academic performance in agricultural science at one Secondary School in Guyana

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Abstract

This mini-research was designed to investigate the outcome of the Demonstration Method of teaching versus the Traditional Lecture Method of teaching on Caribbean Secondary Education Certificate (CSEC) students' Agricultural Science performance at the Grade 10 level at one junior secondary school in region five, Guyana. The findings of this research are specific to the 40 Grade 10 students who participated in this research at one junior secondary school in Region Five, Guyana. This research will add useful information that can provide guidance to teachers on the choice of a more effective pedagogy to teach the practical component of Agricultural Science and bears tremendous significance to the students in their improved performance in Agricultural Science. This research utilized a quantitative approach with the implementation of a Quasi-experimental Pre-test Post-test Control Group Design. The two research questions and two null hypotheses that guided this research respectively were: - *To what extent will the Demonstration Method of teaching affect students' Agricultural Science performance when compared to the traditional Lecture Method of teaching? What is the difference in Agricultural Science performance of male and female students taught using the Demonstration Method versus the traditional Lecture Method of teaching? There will be no statistically significant difference in students' Agricultural Science performance between the control and treatment groups. There will be no statistically significant difference between male and female students' Agricultural Science performance between the control and treatment groups.* The findings revealed that there was a statistically significant difference in the performance of the treatment group who were exposed to the Demonstration Method of teaching when compared to the control group with a p value of 0.016. There was a statistically significant difference between the performance of male and female students with a p value of 0.0007. The null hypotheses were rejected. The analysis of the data, established that the use of the Demonstration Method of teaching is effective in improving students' academic performance in Agricultural Science.

Keywords: Academic Performance; Agricultural Science; Demonstration Method; Practical Skills

1. Introduction

The pedagogical practices of teachers greatly influence the academic performance of students in the various subject areas. Pedagogical practices should be deliberate and specific to the cohort of students and the subject to be taught (1). The appropriateness and innovative pedagogical practices that are implemented by teachers will enable learners to achieve the objectives of the lesson while at the same time the professional competence of the subject teacher will also be exhibited (2). A subject such as Agricultural Science is very relevant in Guyana's context. The many Agricultural practices within the country are spearheaded by experts in the field of agriculture who transfer their knowledge and skills to other agriculture stakeholders. It is therefore necessary for educators to lay the foundation at the level of the school where students are effectively taught to implement their skills in the society (3). With the heavy dependence on

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the proceeds of agriculture which is considered as a major contributor to the country's economy, it is critical that students have adequate knowledge and skills to contribute to the country's agriculture sector. The subject Agricultural Science has its place among the other science related subjects. Guyana depends heavily on its Agricultural produce for its development, as this faculty contributes to the Gross National Product (GNP) and Gross Domestic Product (GDP) (4). In light of this, there is the need for the implementation of relevant methodology to teach Agricultural Science in secondary schools so that the students' performance at internal and external examinations will be excellent, thereby building a strong foundation in candidates' entrance into advanced institutions of learning. It must be noted that every individual learns best in the way he or she is most comfortable and teachers should provide the best opportunities for their learners (5).

Further, the junior secondary school in Region Five, Guyana at the time when this research was conducted has been entering students for the Caribbean Secondary Education Certificate (CSEC) for the past nine years in nine subject areas, of which Agricultural Science was one. The Caribbean Secondary Education Certificate (CSEC) is the standardized matriculation exam in secondary schools in Guyana (6). The Caribbean Examinations Council CSEC Agricultural Science syllabus supports the use of the demonstration method to teach skills in Agriculture required for the CSEC Examination. However, the pedagogical practices of many educators are not very effective since students lack the enthusiasm to write the subject at the CSEC level in the context of the school where this mini-research was conducted. In a practically oriented subject such as Agricultural science, the educator should be able to use physical materials and other tools and equipment and manipulate these in the teaching process as a form of demonstration so that students will be able to apply the theoretical content into the real-life setting (7). In most instances educators do not utilize the demonstration method; rather they use the more traditional approach; that is the lecture method in teaching Agriculture Science in the context of the research site.

As a consequence, this practice is definitely a tremendous draw-back for students who are preparing to write the subject at the CSEC level. CSEC Agricultural Science requires candidates to demonstrate skill competence in both crop production and livestock production. Candidates are expected to perform five skills for crop production and five skills for livestock production. In the context of the school under study, students are moderated by a moderator who is competent in the field and selected by the Ministry of Education to visit schools to grade students in both oral and practical skills. Many students may provide answers to questions asked (theory) but fail to perform the practical skills effectively. The number of students who opt to write the subject is very low, with students at the Grade 10 level dropping the subject when they enter Grade 11 to write the subject at the CSEC Examination. This can be due to several reasons such as performing poorly at written exams, not mastering the practical skills required to be completed for CSEC as well as the inability to transfer the theory into practice as they were not exposed to continuous practical activities.

Therefore, Agricultural Science teachers would have to work with the students until they have gained mastery in the practical component of the subject. If the teachers teach the practical skills by not utilizing appropriate methodologies, the students cannot grasp the concepts, and then the method of teaching would have to be examined to decide whether to keep, improve or terminate it all together. The merits of utilizing the Demonstration Method of Teaching to teach skills in the Agricultural Science field of study are tremendous. One mechanism by which students' practical skills can be improved is by the utilization of the Demonstration Method of teaching (8). The lack of enthusiasm and students not opting to write Agricultural Science at CSEC may be as a result of students in many secondary schools in Guyana being taught practical Agriculture in a Lecture Method hence leading to students failing to grasp concepts efficiently. When students are faced with School Base Assessment skills they may drop the subject at the Grade ten level. Students are unable to transfer the knowledge taught when faced with demonstration of skills; which is very difficult, because of the "know that" and not the "know how" (9). To capture student's interests, promote their competencies in the practical skills, and ultimately influence their choice of the subject at the CSEC level, the use of the demonstration method should be utilized instead of depending entirely on the traditional method of teaching the subject as a whole. Teachers continue to use the lecture method solely rather than a method fitting to the needs of the learners and the components of the subject in their pedagogical practices.

1.1. Purpose of the Study

The purpose of this Quantitative Approach Quasi-Experimental Pretest Posttest Control Group Design mini-research is to determine whether the use of Demonstration Method of Teaching in the Agricultural Science classrooms at one Junior Secondary School in Region Five, Guyana will have an impact on Caribbean Secondary Education Certificate (CSEC) students' academic performance in Agricultural Science.

1.2. Research Questions

- To what extent will the Demonstration Method of teaching affect students' Agricultural Science performance when compared to the traditional Lecture Method of teaching?
- What is the difference in Agricultural Science performance of male and female students taught using the Demonstration Method versus the traditional Lecture Method of teaching?

1.2.1. Research Hypotheses

- **Ho1-** There will be no statistically significant difference in students' Agricultural Science performance between the control and treatment groups.
- **Ha1-** There will be a statistically significant difference in students' Agricultural Science performance between the control and treatment groups.
- **Ho2-** There will be no statistically significant difference between male and female students' Agricultural Science performance between the control and treatment groups.
- **Ha2-** There will be a statistically significant difference between male and female students' Agricultural Science performance between the control and treatment groups.

1.2.2 Significance of the Study

This research will add useful information that can provide guidance to Agricultural Science teachers on the choice of a more effective pedagogy to teach the practical component of Agricultural Science and bears tremendous significance to the students in improving their performance in Agricultural Science. It is therefore hoped that students acquire the knowledge and the skills needed through demonstration of Agricultural Science concepts, and be empowered to pursue careers in Agricultural Science which is critical in Guyana's context. This mini-research can also be used as reference in the conduct of other researches on a larger scale in the area under study.

1.3. Definition of Key Terms

- **Academic performance-** "gaining knowledge; acquiring skills and competencies; securing high grades and similar academic achievements; securing a progressive career; and intention and persistence towards education" (10, p. 3093)
- **Agricultural Science-** "the body of knowledge derived from the study of the cultivation of plants and rearing of animals that are of benefit to man" (11).
- **Demonstration Method-** "is a teaching method where an educator showcases a process, experiment, or technique to students, often in real-time. It's a practical and visual way of illustrating how something works, or how a concept is applied in the real world" (12)
- **Practical Skills-** "Practical skills include the ability of students to carry out work in the field, the ability of students to handle work equipment and on the student's manipulative skills" (13, p. 1935).

2. Review of Literature

2.1. An Examination of the Demonstration Method of Teaching

The complex nature of teaching and learning must be considered by educators in the implementation of pedagogical practices (14). Students have multiple intelligences and have preferred learning methodologies. The teaching strategies that are utilized by teachers must be in conjunction with students preferred learning methodologies (15). When students preferred learning strategies are catered for, these students will be in the trajectory of achieving course objectives, while at the same time the goal of all teachers are to ensure that their students are able to accomplish all objectives with the highest percentage possible (16). In conjunction with students preferred learning methodologies, teachers should be able to master the art of knowing which teaching methodology to utilize when delivering specific concepts in a particular subject such as Agricultural Science. The demonstration method of teaching according to (17, p. 4) is "A process of teaching someone how to make or do something in a step-by-step process. As you show you tell what you are doing." The demonstration method of teaching is utilized to a great extent in the Natural and Technical Sciences field in several practical aspects in these subject areas. The demonstration method has also been used in other subject areas and has been proven to be very effective in the teaching and learning process (18).

To add, the Demonstration method of Teaching has several benefits. Students are able to apply the theoretical content into practice with the utilization of concrete materials in a "hands on" approach. The Demonstration Method encourages reflective and critical thinking as well clarifies underlying principles in the subject area (16). Students' creativity is also increased with the use of the Demonstration Method of teaching as they are exposed to real life practices. Students can

find creative ways to complete tasks by discovering alternative ways of performing skills (19). Research has also shown that when students are exposed to the Demonstration Method of Teaching and when this method is incorporated into the pedagogical practices of teachers, students' psychomotor domain of learning is enhanced along with the cognitive and affective domains (20). In other instances, the Demonstration Method of pedagogy is more effective than theoretical teaching alone as the concept can only be understood when practical demonstrations are conducted (21). According to (22, p. 822) "The Demonstration Method helps students acquire physical skills through observation and direct practice."

2.2. Demonstration Method of Teaching and Students' Academic Performance

Many researchers have conducted studies over the years with the Demonstration method of teaching as an independent variable measuring its effect on students' academic performance in several subject areas. In a study conducted by (23) in Cross River Nigeria, titled *"Effectiveness of Demonstration Method on Students' Academic Achievement in Senior Secondary School (SSII) Chemistry,"* it was found that students mean performance were statistically significantly different when taught using the Demonstration Method when compared to the traditional Lecture Method of teaching. In (24) study, the impact of the Demonstration method on students' academic performance was also reflected. The study titled *"Effect of demonstration method on academic achievement of Business Studies students in Junior Secondary Schools in Moro Local Government Area of Kwara State"* involved 120 participants in the Business Studies field. It was found that students performed statistically significantly better when taught different components of the business studies in Shorthand and Keyboarding using the Demonstration Method of Teaching. As was examined, the effectiveness of the Demonstration method of Teaching in the subject areas of Chemistry and Business Studies was meritorious. In the diverse subject areas where the Demonstration Method of teaching was used as an independent variable gives an indication of the efficacy of such teaching method. This is also true for (25) study where the effect of the Demonstration method of teaching in Mathematics was examined. The title of the study *"Effectiveness of the Demonstration Teaching Method on Students' Academic Achievement in Mathematics in Rivers State Nigeria,"* included 78 students with both males and females. A mathematics Achievement test as the instrument for the study was utilized. The results of the study revealed that the students who were taught using the Demonstration method of teaching had higher scores than their colleagues who were taught using the Deductive method of Teaching. A 0.05 level of significance was used for this study as the threshold, a value of $p = 0.00$, $P < 0.05$ was obtained.

In addition, the Demonstration method was used in teaching Building Construction in a study conducted by (26). The study titled *"Effect of Demonstration Method of Teaching on Students' Achievement in Building Construction in North East Nigeria Technical Colleges"* comprised of 78 students who completed a 40-item achievement test. The findings of the study revealed that the mean performance on Post Test of students who were taught using the Demonstration Method of Teaching was higher than the mean performance on Post Test of students who were taught using the Lecture Method of Teaching with means scores of 22.79 and 18.63 respectively. In like manner to this research, the use of the Demonstration Method of Teaching Agricultural Science has found to be advantageous over the traditional Lecture Method. In a study conducted by (27) titled *"Effect of Demonstration Method of Teaching on Students' Achievement in Agricultural Science,"* a sample of 480 students from 6 secondary schools in Kogi East Education Zone of Kogi State participated in this study. The instrument that was used to measure students' academic performance was a 30-items Agricultural Science Achievement Test. The results showed that there was a statistically significant difference in the performance of students who were taught using the Demonstration Method of Teaching when scores were compared with the students who were taught using the traditional Lecture Method as the calculate F-value of 273.73 was higher than the table F-value at 0.05 significance level.

Therefore, the advantages of utilizing the Demonstration method of Teaching are numerous and diverse. Students' academic performances were significantly greater when they were taught using the Demonstration Method for the practical components in several subject areas in comparison to other methods of teaching. It can be seen that in examining researches that utilized the Demonstration Method of teaching, subject areas such as Chemistry, Business Studies, Mathematics, Building Construction and Agricultural Science were some of the areas where the Demonstration method of Teaching was found to be highly impactful on students' academic achievements. The Demonstration Method of Teaching can be used to teach aspects of all subject areas in combination with other teaching strategies (28).

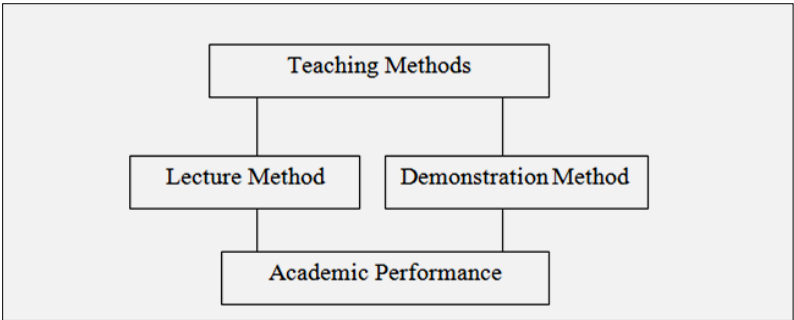


Figure 1 Conceptual Framework Showing the Logical Alignment of the Research Variables

Figure 1 shows the independent and dependent variables. The independent variables that were systematically controlled by the researcher were the Teaching strategy (Demonstration Method), Test (Pre-test and Post-test) and Classroom activities (Individual and Collaborative practical activities). The variables that were dependent on the teaching strategy, classroom practical activities and tests were the dependent variables namely; the Test Scores which ultimately influenced students’ performance in Agricultural Science.

3. Methodology

This research utilized a Quantitative Approach with a Quasi-experimental Pre-test Post-test Control Group Design. Two groups of Caribbean Secondary Education Certificate (CSEC) students in Grade 10 participated in this mini-research. One group of students served as the Treatment Group while one group of students served as the Control Group. The group to serve as either the treatment or control group was randomly selected. Both groups were pretested. The treatment group was taught using the Demonstration Method while the control group was taught using the traditional Lecture Method as was the consistent methodology that was utilized. The following Table 1 shows the design of the research.

Table 1 Research Design

GROUPS	PRE-TEST	TREATMENT	POST-TEST
Group One- Treatment	Yes	Yes	Yes
Group Two- Control	Yes	No	Yes

The following Tables 2, 3 and 4 highlight the sample of participant inclusive of both genders and the number of students who comprised the Treatment and Control Groups.

Table 2 Sample of Participants

CLASS	GENDER		TOTAL SAMPLE
GRADE 10	MALE	FEMALE	40
	26	14	

Table 3 Sample of Participants in the Treatment Group

CLASS	GENDER		TREATMENT GROUP TOTAL
GRADE 10	MALE	FEMALE	20
	14	6	

Table 4 Sample of Participants in the Control Group

CLASS	GENDER		CONTROL GROUP TOTAL
GRADE 10	MALE	FEMALE	20
	12	8	

3.1. Research Instrument

Performance tests were given to both groups in the form of Pre-tests to assess students' abilities prior to the implementation of the Demonstration Method to the Treatment group. Both groups were also post-tested. The performance tests were validated by two experts in the area of Agricultural Science. The areas that were tested were cultural practices associated with land preparation, soil texture characteristics, brooding, land preparation and nursery management. The contents were taken from the Grade ten scheme of work that was prepared at the time this research was conducted. The scheme was compiled from the National Agricultural Science CSEC Syllabus, as a result, making it valid since the students in this survey are in Grade ten. This instrument was used to test the dependent variable, that is, the students' performance in Agricultural Science.

3.2. Ethical Considerations

The ethical principles of confidentiality, informed consent from participants, and participants' withdrawal at any point in the research guided the implementation of this research. The Ministry of Education, Guyana as the main education gatekeeper in Guyana permission was sought. The head teacher of the research site permission was also sought while the teachers who assisted in the conduct of this research were briefed on the data collection procedures and the context of the research. The findings of the research were shared with the stakeholders of the research site and a copy of the research was lodged for future reference.

3.3. Presentation of Data, Findings and Discussion

3.3.1. Research Question 1 and Hypothesis 1

In response to the first research question which asked, *to what extent will the Demonstration Method of teaching affect students' Agricultural Science performance when compared to the traditional Lecture Method of teaching?* The descriptive statistics of the performance of students when gain scores were computed in comparing the students from both groups are highlighted in Figure 2.

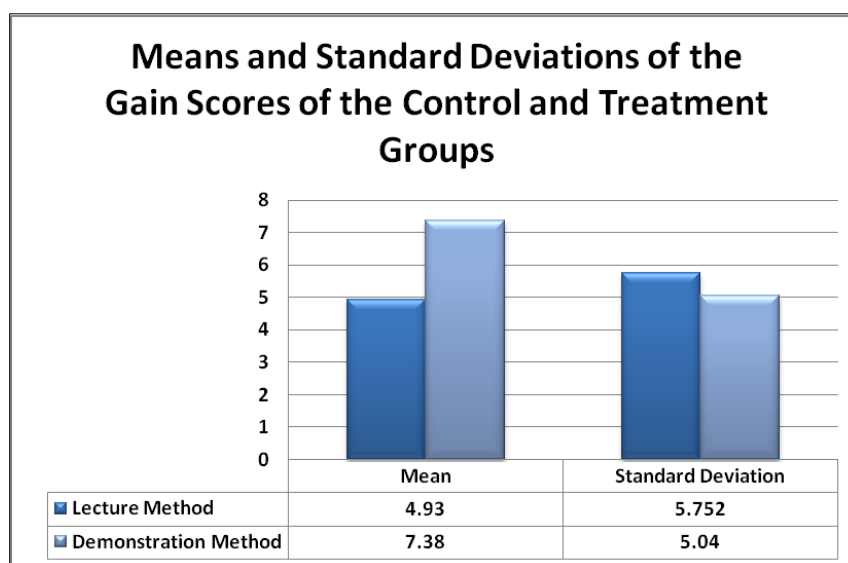
**Figure 2** Descriptive Statistics of the Gain Scores of both the Control and Treatment Groups

Figure 2 shows that the mean gain score of the treatment group who was taught using the Demonstration Method was 7.38 when compared to the control group who was taught using the traditional Lecture Method mean gain score of 4.93, the mean gain score of the treatment group is greater than the control group mean gain score by 2.45. When the

standard deviations of the mean gain scores were calculated for both the control and treatment groups, it was found that the mean gain scores of the control group were further away from the mean in comparison with the mean gain scores of the treatment group. The standard deviations of the control and treatment groups were 5.752 and 5.04 respectively.

Table 5 Statistical Significant Effect of Descriptive Statistics of the Gain Scores of both the Control and Treatment Groups

Groups	Mean	Standard Deviation	p-Value
Control (Lecture Method)	4.93	5.752	0.0161
Treatment (Demonstration Method)	7.38	5.04	

Table 5 shows the factorial Analysis of variance for gain scores on the significant effect of the traditional Lecture Method and Demonstration Methods, revealed a p-value of 0.0161; this is an indication that there is a statistically significant difference in the two teaching methods. In this case the f-value is greater than the f-critical, thus there is a significant difference with a p-value of 0.0161 which is less than the significance level of alpha 0.05.

3.4. Research Question 2 and Hypothesis 2

In response to the second research question which asked, *what is the difference in Agricultural Science performance of male and female students taught using the Demonstration Method versus the traditional Lecture Method of teaching?* The mean gain scores of male and female students were calculated to compare the performance of students from both groups and are highlighted in Figure 3.

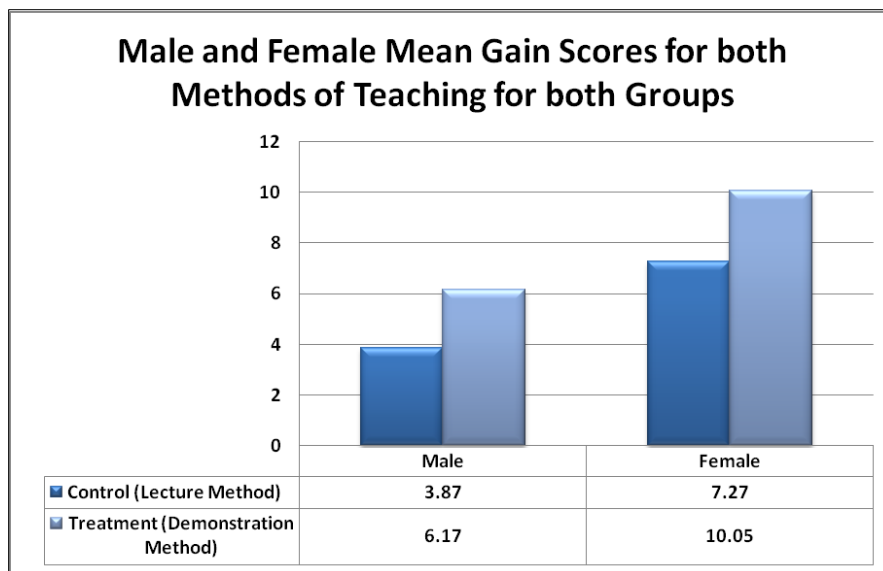


Figure 3 Mean Gain Scores of Male and Female students from both the Control and Treatment Groups

Figure 3 shows that the mean gain score for both male and female students are higher in the Demonstration Method than the Lecture Method. The female gain scores for both methods are higher than the male gain scores. Overall, the females gain scores are higher than the males.

Table 6 Statistical Significant Effect of Mean Gain Scores of Male and Female students from both the Control and Treatment Groups

Groups	Male	Female	p-Value
Control (Lecture Method)	3.87	7.27	0.0007
Treatment (Demonstration Method)	6.17	10.05	

Table 6 shows the factorial Analysis of variance for gain scores on the significant effect of Mean Gain Scores of Male and Female students from both the Control and Treatment Groups revealed a p-value of 0.0007; this is an indication that there is a statistically significant difference in the performance of male and female students. There is a significant difference with a p-value of 0.0007 which is less than the significance level of alpha 0.05.

4. Discussion

Descriptive statistical analysis was conducted using the gain scores derived from the pre-test and post-test scores of students from the treatment group who were taught using the Demonstration Method and from the control group who were taught using the Lecture Method of teaching and learning. The results revealed a higher mean in the Demonstration Method as compared to the traditional Lecture Method. The overall means were 7.38 and 4.93 respectively. The overall standard deviation of the Traditional Method was 5.752 which is higher than the Demonstration Method with a standard deviation of 5.04. These results give an indication of how concentrated the data are from the mean scores. The variance was also calculated with the traditional Lecture Method having a variance of 33.08 and the Demonstration Method having a variance of 25.39, these results indicate the variability of spread in the data sets.

Factorial Analysis of Variance was conducted to examine if any significant difference existed between the Demonstration and Lecture Methods given the Pre-test, Post-test and Gain scores of students from both groups. The gain scores for both groups revealed a statistically significant difference with $p = 0.0161$ which is less than the significance level of alpha of 0.05. Thus, there was a statistically significant difference between the Demonstration and traditional Lecture Method of teaching, therefore the first null hypothesis was rejected which stated that; *There will be no statistically significant difference in students' Agricultural Science performance between the control and treatment groups.* An ANOVA two-way replication was done to observe if any difference existed between the gain scores of male and female students who have been exposed to the Demonstration Method and traditional Lecture Method of teaching. The mean scores of both male and female students in the Treatment group who were taught using the Demonstration Method were higher than the male and female students gain scores in the traditional Lecture Method group. However, the mean gain scores of female students were higher than males from both groups. The results were statistically significant as comparison revealed $p = 0.0007$ which is less than alpha 0.05. Thus, there was a statistically significant difference in the performance of male and female students and therefore the second null hypothesis was rejected which stated that; *There will be no statistically significant difference between male and female students' Agricultural Science performance between the control and treatment groups.*

Recommendations

The Demonstration Method of teaching should be made an integral aspect of teaching Agricultural Science. Education training institutions should place more emphasis on educating teachers about using demonstrative teaching and learning techniques in the Agricultural Science classroom.

Professional Development is recommended to enlighten Agricultural Science teachers who are currently facilitating CSEC students on the effectiveness of utilizing other methods of teaching for specific components of Agricultural Science.

Materials that are needed to facilitate the Demonstration Method of teaching should be made available by the Ministry of Education to schools in order to adequately facilitate the effective delivery of concepts in Agricultural Science.

5. Conclusion

To summarize, analysis of the data, established that the use of the Demonstration Method of teaching was effective in teaching Grade 10 CSEC Agricultural Science at one junior Secondary School in Region Five, Guyana, and more so in the practical components of the subject. The use of the Demonstration Method saw a noticeable improvement in the students' performance and it accounted for the significant difference between the overall performances of the treatment and control groups. Female students performed statistically significantly higher than male students when overall gains scores were compared. The Demonstration Method in and out of the Agricultural Science classroom has provided a different dimension and perception to learning as it appeals to learners senses. Students were afforded the opportunity to make observations, think critically, interpret and apply practical skills to real life situations.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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