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Activity-based instructional strategy, students' performance and retention in agricultural Science

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Abstract
The study investigated the effect of activity-based instructional strategy on students' academic performance and retention in Agricultural Science. Two research questions and two hypotheses guided the study. The study adopted quasi-experimental design. The sample for the study comprised of 118 Senior Secondary School two (SSS II) students that were drawn from two schools in Owerri Zone of Imo State. The instrument used for data collection was titled Agricultural Science Achievement Test (ASAT) and Agricultural Science Retention Test (ASRT). The instruments were validated by two (2) experts in the field of test and measurement. A reliability coefficient of 0.82 and 0.84 through Cronbach alpha method was obtained for ASAT and ASRT respectively. Findings of the study include; students exposed to Activity-Based Instructional Strategy have high mean scores than their counterparts in the control group. Furthermore, there was significant difference in academic performance between senior secondary students taught agricultural science using Activity-Based Instructional Strategy and their counterparts taught same concepts using talk-chalk method. Students exposed to Activity-Based Instructional Strategy have higher mean retention scores than their counterparts in the control group and this difference was also found to be statistically significant. In conclusion, Activity-Based Instructional strategy facilitates effective learning of Agricultural science concepts. Based on these findings, it was recommended among others that, the teaching of Agricultural Science should be conducted in such a way that students effectively learn and retain the concepts presented to them and that the use of the Activity-Based Instructional Strategy seems to be relevant in achieving this goal hence, it should be incorporated into the teaching of Agricultural Science at the secondary school level.

Keywords: activity-based instructional strategy, students' performance and retention, agricultural science

1. Introduction

At senior secondary school level Agricultural science was introduced for the purpose of giving foundational skills and knowledge for subsequent Agricultural Science studies at a higher level. The acquisition of appropriate skills and the development of mental, physical and social abilities and competencies for the individual to live in and contribute to the development of the society in which he lives, especially in food production and sustainability, has been a major concern of agricultural science. The above explanation shows that the teaching and learning of agricultural science is not just a collection of data and facts neither is it an assembly of sterile body of knowledge but that, it involves engaging in hands-on activities.

Agricultural science education is a process of training learners in the process of agricultural productivity as well as the techniques for the teaching of agriculture (Egbule, 2004) [10]. Osinem (2008) [22] opined that agricultural science is an important school subject that is offered at all levels of education, ranging from home to the school and the community; implying that it can be formal, informal and non-formal. Osinem (2008) [22] further explained that Agricultural education provides learners with sound academic knowledge and skills as well as ample opportunity to apply this knowledge through classroom activities, laboratory experiments, project participation, and supervised agricultural experiences.

Academic performance refers to the outcome of a student in education and the accomplishments on the different tasks that teachers assigned. Academic performance is the extent to which a student, teacher or institution achieved his or their short or long-term educational goals**.** Poor academic performance can be caused by a variety of factors, very few of which have to do with a moral or intellectual failing on the part of the student. Often, a combination of internal and external factors influences a student's academic performance and retention. Getting to the root of these causes can increase academic performance and retention dramatically. Some examples of academic achievements include clubs, a high-grade point average (GPA), awards and extracurricular activities. However, (Ngozi 2012) [21] opined that several factors indicate a student's academic performances and retention which include holding leadership positions in several student groups, and scoring high on standardized tests. People often consider grades first when defining academic performance and retention.

The definition of academic performance according to (Usman, 2017) [28] extends to achievement outside the classroom. Some of the brightest students do not learn straight but are extremely well-rounded, succeeding at everything from music to athletics. The ability to master a diverse set of skills illustrates intelligence, curiosity and persistence, qualities attractive to universities and employers. Some colleges will admit and even award scholarships to students who earned average grades but display a pattern of achievement by consistently learning new skills. Many businesses also see this as a selling point, thinking these candidates are eager to learn and will be easy to train.

According to Inekwe (2012) [13], Activity-Based Instructional Strategy isthe method that enables students to learn with the same vigour that marks their natural activity. David (2007) [8] expressed that element of joy, team spirit; respect for each other's opinions reduces the abstractness in science concepts. Mari (2014) [16] opined that in this method, the work is carried out in a friendly manner, gladly with motivating spirit and activeness throughout the whole lesson, even to an uninteresting topic. Activity-Based Instructional Strategy is in-line with Piagetian tasks as it affords the students a variety of activities and experiences that involve the use of concrete objects. This hastens the learners' ability to order events through application, knowledge and predict changes. According to Mari (2014) [16], adequate and appropriate use of this method through a rich variety of stimulating experiences, progress from concrete to abstract and then a powerful conceptualization maybe achieved. Thus, the learner now will reason or make hypothesis with symbolic ideas rather than needing objects, in physical world as the basis for thinking. The learner according to him can, therefore, use a hypothetical, deductive procedure that no longer ties his thought to existing reality but could consider all possible explanations to problem and can evaluate alternative explanations or solution to the problem.

In the Activity-Based Instructional Strategies, local resources are effectively utilized in the teaching process. Activity-Based is a type of research-oriented teaching technique recommended for Basic Science instruction by National Policy on Education, Federal Ministry of Education (2004). Activity-Based instructional strategy promotes instruction in the three domains of knowledge. Activity-Based teaching enables students to handle concrete materials which reduce the abstract nature of the concept learned. This makes learning more meaningful and when concepts are meaningfully learned, it enhances retention and improves students' performance and achievement. Activities given to students help to widen the mental horizon of the students. Students begin to see that many other matters, besides those of purely scientific interest are involved when scientific knowledge is used to benefit a community.

The Activity-Based Strategy of teaching agricultural science encourages group interactions among students, and if properly used, the spirit of teamwork, exchange of ideas and respect for each other's point of view will be enhanced at early stages of learning. Another feature of Activity-Based Instructional strategy is that local resources can be effectively utilized in the teaching process. In typical students' Activity, costly scientific equipment is often substituted with locally available teaching aids. According to Lowenstein (2012) Activity-Based Instructional Strategy makes students active participants, aids retention of materials learnt, builds confidence, helps students maximize their potential and favour intrinsic motivation. This according to Lowenstein (2012), Activity-Based Instructional Strategy is fundamental to academic achievement and effective teaching and learning of agricultural sciences in schools. Usman (2017) [28], attributed the poor performance of students in science concepts to rote learning. This according to him is as a result of non-exposure of students to activities in their classes due to lack of science teaching facilities. However, David (2007) agreed that though science teaching facilities are necessary but many teachers of science are ill-equipped and ill-prepared to guide students towards inquiry. The teachers seemto find activity-oriented instruction difficult to manage.

Research carried out by Bennett, Barrie, Carol Rolheiser-Bennett and Laurie Stevahn (2014) [4], showed that learners of 19th and 20th centuries practised talk-chalk curriculum, which is usually traditional lecturing methods and text-based. Regrettably, 21stcentury learners who are known to be active and constructive learners are caught up with such Instructional Strategy which they see as abstract and non-beneficial to them because it does not allow them to express themselves and fully get involved in the teaching and learning process. Teachers must find suitable methods to teach the students in order to determine the best practices for classroom delivery and minimize achievement loss, using the resources available to them. However, the use of activity makes learning learner-centred, give students opportunity to make plausible hypothesis and test them to generate ideas, which are expected in their own language.

Despite the importance of agriculture, there is evidence that the number of students taking agricultural science is low. Therefore, this study sought to ascertain the effects of activity-based strategy on academic performance and retention in Agricultural Science among senior secondary school students. The study is hinged on the theory of engagement.

The National Council for Agricultural Education (2000) in the United States devised a strategic plan that called for all students to have access to seamless, lifelong instruction in agriculture, food, fibre and natural resources system through a variety of delivery methods and educational settings. One of the strategic plans stated that agricultural education instructional system and materials must be in diverse learning styles. Thus, different learning strategies must be employed by the teacher in lesson delivery in agricultural science.

Teaching-learning strategies are traditionally referred to as methods of teaching (Kisirikio, Wachira & Malusu, 2008) [14]. A teaching method is a plan of action designed to achieve learning programme design for a learner (Merlot, 2015) [17]. It could be a master plan or programme procedure schedule to achieve a particular objective (Aneke, 2015) [2]. Methods of teaching can be categorized into Field and Non-field related teaching methods. Field teaching methods include teaching carried out within or outside the school setting of which laboratory instruction is an example. Non-field teaching methods include classroom-based strategies of teaching.

Activity-Based teaching is a learning method in which students are engaged in the learning processes (Prince, 2014) [24]. Higgins (2007) [12] defined Activity-Based learning as the learning process in which student is actively involved in doing or in seeing something done. In this method, students learn by doing. It is employed when the teacher allows students to carry out a piece of work and learn at the same time. In Activity-Based teaching /learning environment, the teacher is a facilitator, motivator, guide and a coach not a sage on the stage (Stolen, 2009) [26].

In Activity-Based method, the learner examines learning requirements and thinks on how to solve a problem at hand. The students do not learn about the content, rather they learn about the process to solve the problem. As they go towards the solution of the problem, they also learn about the content (Churchill, 2013). Activity-Based method of teaching is

applicable in subjects such as agriculture, home economics, and basic science among others. In doing the activity, students should know the purpose beforethey become interested in it. According to Enekwe (2012) [11], Activity-Based method of instruction enables students learn with the same vigour that marks their natural activity.

The benefits of an Activity-Based method of teaching cannot be overemphasized. It is a successful teaching model in the field of the sciences such as agricultural science. Learning activities if based on real-life experience help learners to transform knowledge or information into their personal knowledge which they can apply in different situations (Edward, 2011). Activity-Based method introduces some elements of joy, team spirit, respects for each other opinions and reduces abstractness in science concepts (David, 2007). With activity-based method of teaching agriculture, an uninteresting topic becomes interesting. In teaching students, the strategy that should be used should attempt to accommodate the diverse needs of the students in a class and allow for optimum learning by directly involving students in the teaching-learning process. The activity-based method addresses this concern.

Activity-Based teaching also helps students to construct mental models that allow for'higher-order' performance such as applied problem solving and transfer of information and skills (Churchill, 2013). Activity-Based teaching, if carried out in an effective manner develops skills such as Team-working, Communication, Design, Leadership, Project management, Research, Problem-solving, Reflection and Life-long learning in the learners (Khan, Naiz, Maqsood, Fiaza&Sher, 2012). These activities, they said if based on real life experiences, can help students to apply the same in their practical life and hence,prepare students for future life.To this end the study sought to:

1. determinewhether there is mean difference in the performance score of students taught Agricultural Science through Activity-Based Instructional strategy and those taught with talk-chalk method.
2. Ascertain whether there is a mean difference in the retention score of students taught Agricultural Science through Activity-Based Instructional strategy and those taught with talk-chalk method.
3. The following research questions guided the study:
4. What is the mean difference in the performance score of students taught Agricultural Science through Activity-Based Instructional strategy and those taught with the talk-chalk method?
5. What is the mean difference in the retention score of students taught Agricultural Science through Activity-Based Instructional strategy and those taught with the talk-chalk method?
6. The above research questions were transformed into two null hypotheses which were tested at 0.05 level of significance.

$H0_1$: There is no significant difference between the mean performance score of students taught Agricultural science using Activity-Based Instructional Strategy and those taught agricultural science using the talk-chalk method.

$H0_2$: There is no significant difference between the mean retention score of students taught agricultural science using Activity-Based Instructional strategy and those taught using talk-chalk methods.

Methodology

The design of the study is Quasi-experimental. Specifically, the pre-test, post-test, post-post-test non-equivalent, control group design. Thedesign is graphically illustrated thus:

	Pre-test	Treatment	Post-test	Post post-test
E	O_1	X_1	O_2	O_3
C	O_4	-	O_5	O_6

Where: C = Control Group; E = Experimental Group;

O_1 = pre-test for Experimental Group; O_2 = Post-test for Experimental Group;

O_3 = Post post-test for Experimental Group; O_4 = Pre-test for Control Group;

O_5 = Post-test for Control Group; O_6 = Post post-test for Control Group;

X_1= Treatment for Experimental Group (Activity-Based Instruction);

= No treatment for Control Group (Talk-Chalk Method)

---------- = Intact class

The population for this study consisted of all SSII students who offer Agricultural science in all the secondary schools in Owerri Education Zone (OEZ) of Imo State. The sample for the study comprised of 118Senior Secondary School two (SSS II) students that were drawn from two schools in Owerri Educational Zone of Imo State. The sample was obtained through a multistage sampling technique. Two instruments, titled: Agricultural Science Achievement Test (ASAT) and Agricultural Science Retention Test (ASRT) were used for data collection.

The instruments were validated by two (2) experts in the field of test and measurement. A reliability coefficient of 0.82 and 0.84 through Cronbach alpha method was obtained for ASAT and ASRT respectively. Descriptive statistics mainly mean and standard deviation were used to analyse and answer the research questions while inferential statistics mainly t-test was used to analyse the null hypotheses at $p \leq 0.05$ level of significance. Furthermore, the pre-test scores generated were used to ascertain the equivalence of the groups before treatment. With the successful establishment of the equivalence of the two groups, comparison was thereafter focused on the students' post-test scores and post-post-test scores only as could be seen in the results.

Results

Research Question 1: What is the mean difference in the performance score of students taught Agricultural Science through Activity-Based Instructional strategy and those taught with the talk-chalk method?

$H0_1$: There is no significant difference between the mean performance score of students taught Agricultural science using Activity-Based Instructional Strategy and those taught agricultural science using the talk-chalk method.

To answer this research question and test the corresponding hypothesis, data generated via the Agricultural Science Performance Test (ASPT) were subjected to mean, standard deviation and t-test statistics to determine if there was any difference between the performance of the experimental group and the control group after treatment and also to determine if the difference is significant statistically. The

result is as presented in Table 1.

Table 1: t-test Analysis of the Mean Scores of Post Test Data of the Experimental Group Exposed to Activity-Based Method and the Control Group Exposed to Talk-Chalk Method

Group	N	$\bar{x}$	Sd	t_{cal}	df	Sig.	Decision
Experimental	60	23.45	2.84				
				20.088*	116	.000	Significant
Control	58	13.98	2.23				

*Significant, p (.000) < 0.05 level of significance

Table 1 showed that the experimental group had a mean score of 23.45 which is greater than that of the control group which was 13.98. the result is that there is a difference in performance in favour of Activity-Based Instructional Strategy. On further statistical testing via t-test, the calculated t(116) = 20.088, p = .000 which was significant. Hence, the stated null hypothesis is rejected. The result is that there is significant difference between the mean performance score of students taught Agricultural science using Activity-Based Instructional Strategy and those taught agricultural science using talk-chalk method in favour of the Activity-Based group.

Research Question 2: What is the mean difference in the retention scores of students taught Agricultural Science through Activity-Based Instructional strategy and those taught with the talk-chalk method?

$H0_2$: There is no significant difference between the mean retention score of students taught agricultural science using Activity-Based Instructional strategy and those taught using talk-chalk methods.

To answer this research question and test the corresponding hypothesis, data generated via the Agricultural Science Retention Test (ASRT) were subjected to mean, standard deviation and t-test statistics to determine if there was anydifference between the retention ability of the experimental group and the control group after two weeks of post-treatment and also to determine if the difference is significant statistically. The result is as presented in Table 2.

Table 2: t-test Analysis of the Mean Scores of Post post-test Data of the Experimental Group Exposed to Activity-Based Method and the Control Group Exposed to Talk-Chalk Method

Group	N	$\bar{x}$	Sd	t_{cal}	df	Sig.	Decision
Experimental	60	24.02	2.27				
				25.580*	116	.000	Significant
Control	58	14.24	1.85				

*Significant, p < 0.05 level of significance

It is clear from Table 2 that the experimental group had a mean score of 24.02 which is greater than that of the control group which was 14.24. Also, the calculated t(116) = 25.580, p = .000 which was significant hence, the stated null hypothesis is, therefore, rejected. The result is that there is significant difference between the mean retention score of students taught Agricultural Science using Activity-Based Instructional strategy and those taught using talk-chalk methods. It is thus empirically established that students exposed to Activity-Based Instructional Strategy have higher retention ability mean scores than their counterparts in the control group.

Discussion

The discussion was done with the following as sub-headings

1. Activity-Based Instructional Strategy versus Talk-Chalk method and Students Academic Performance.
2. Activity-Based Instructional Strategy versus Talk-Chalk method and Students Retention Ability.

Activity-Based Instructional Strategy versus Talk-Chalk Method and Students' Academic Performance

The result here showed that students exposed to Activity-Based Instructional Strategy had higher mean scores than their counterparts in the control group. On further statistical analysis through t-test statistic, the result showed that there was significant difference in academic performance between senior secondary students taught Agricultural Science using Activity-Based Instructional Strategy and their counterparts taught same concepts using talk-chalk method.

This shows that there is a connection/link between teaching-learning, performance and methodology in shaping the learners in Agricultural Science. According to Abdullahi (2015), Activity-based Instructional Strategy makes the learner construct his own knowledge to be used in a later age; so teachers should pick from the Agricultural Science curriculum topics that involve activities for the learners to discover solution themselves and as such teachers are expected to guide them.

In Activity-Based Instructional Strategy students have the opportunity to work with concrete materials and engaged in activities, which enhanced meaningful learning and reduces abstract nature from concepts and provide a motivating environment for teaching and learning (Mari, 2014). In fairly recent literature it was stated in Stanley (2018) that science is an intellectual activity carried on by human that is designed to discover information about the natural world in which we live and to discover the way in which this information can be organized to benefit human race.

Activity-based instructional strategy versus talk-chalk method and students retention abilities

The post-post-test result showed that the experimental group exposed to Activity-Based Instructional Strategy retained the taught Agricultural Science Concepts significantly better than their counterparts in the control group who were exposed to talk-chalk method. The statistically significant difference between the two means scores suggests that the Activity-Based Instructional Strategy experience led to more effective learning and higher retention level than the talk-chalk method. According to Mari (2014) adequate and appropriate use of Activity-based method through a rich variety of stimulating experiences progress from concrete to abstract and then a powerful conceptualization maybe achieved. Thus, learner would now reason or make hypothesis with symbolic or ideas rather than needing objects in the physical world as the basis for his thinking.

The learner according to him can, therefore, use a hypothetical deductive procedure that no longer tieshis thought to existing reality, but consider all possible explanations to problem and can evaluate alternative explanation or solution to the problem.

This finding agrees with that of Abdullahi (2015) and Usman (2017) [28] who reported that the conventional lecture method used by most teachers is inferior in promoting effective learning. Teachers use it only for easy coverage of the school syllabus, the teacher being active while students are always passive learners. It is further characterized by one-way flow of information and encourages rote learning and yields little retention. Meaningful and concretely learned concepts by students are always retained and even coded in the memory for easy recall when the need arises.

Conclusion

From the findings of this study, it was concluded that Activity-Based Instructional Strategy facilitates effective learning of Agricultural Science concepts. Also, students that were taught Agricultural Science concepts using Activity-Based Instructional Strategy retained the learned concepts significantly better than those taught the same concepts using talk-chalk (Lecture) Instructional Strategy. In addition, Talk-Chalk method of teaching Agricultural science appear to be inferior to Activity-Based Instructional Strategy in the teaching of Agricultural science concepts as student's academic performance and retention of the learned concepts did not significantly improve.

Recommendations

On the basis of the findings and conclusions reached in this study, the following recommendations are made:

1. The teaching of Agricultural Science should be conducted in such a way that students effectively learn and retain the concepts presented to them. The use of the Activity-Based Instructional Strategy seems to be relevant in achieving this goal. It should, therefore, be incorporated into the teaching of Agricultural Science at the secondary school level.
2. In-service training programmes for Agricultural Science teachers in formof seminars, workshops and conferences should be conducted onhow to use Activity-Based Instructional Strategy in teaching of Agricultural Science concepts.
3. Agricultural Science textbook writers should endeavour to incorporate the concept of Activity-Based Instructional Strategy in their books. Especially, on concepts that require activities on the part of the learners in view of its potency in improving retention among students.

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