

Short Paper

Effect of a Virtual Platform on Undergraduate Students' Achievements in Horticultural Crop Production in Northern Nigeria

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Abstract

Purpose – This study intends to test a virtual platform for teaching undergraduate students horticultural crop production in Northern Nigeria.

Method – This research work engaged a quasi-experimental design to test a virtual platform on horticultural crop production achievement among undergraduate students in northern Nigeria. The design was commonly used in this situation because a randomized assignment is not possible in practice, especially in the sampled universities where lecture rooms cannot be re-organised to accommodate the experimentation procedure.

Results – The results revealed that undergraduate students exposed to virtual platforms perform better than those exposed to conventional approaches, a significant difference exists between the mean performance of undergraduate students exposed to the virtual platform and those exposed to conventional approaches.

Conclusion – The application of a virtual platform as substituting approach in teaching horticultural crop production proved to be effective means of improving students' academic performance. In the course of treatment, the experimental group of undergraduate students proved more attentive to the teaching process because the budding, layering and grafting were explained through interactive activities of animations, which contributed significantly to student learning.

Recommendations – It was recommended that the universities management should provide enabling virtual environment and facilities where suitable video and animations should be used to teach undergraduate students and special training should be organized for agricultural science teachers/lecturers on the use of a virtual platform.

Research Implications – The use of virtual instruction has provided replies to encourage the incorporation and adaptation of virtual platform environments in higher institutions of learning as an alternative to conventional approaches to teaching. In addition, virtual classroom instruction and the online education experience in higher institutions of learning are beneficial to undergraduate students' achievement.

Keywords – achievement, horticultural crop production, Northern Nigeria, undergraduate students, virtual platform

INTRODUCTION

The Federal Government of Nigeria (FGN, 2013) in its National Policy on Education emphasized that necessary measures need to be taken to ensure that: teaching shall be "practical, activity-based, experiential and IT-supported". The expectation of the government is in line with New Partnership for Africa's Development (NEPAD) commitment to achieve sustainable information and communication technology development in the 21st century (NEPAD, 2013). Hence, virtual learning, as a component of information and communication technology shall be given attention in higher institutions of learning.

Horticulture is a practical-oriented course (Opeke, 2012). Horticultural Crop Production is a course taught to final-year undergraduate students domiciled in the curriculum of agricultural education in the Nigerian University system (NUC, 2016). The horticultural Virtual platform will offer students a significant opportunity the learn vegetative techniques in horticultural education (*Shannon, 2019*). This is quite a helpful tool because the horticultural Virtual platform allows the student to see how budded trees react to alternative budding practices as applied, avoid mistakes and enable students to conduct virtual tree propagation training via animation to learn from the animated trees and responds to actions in the physical environment (Ning, Ai-Shuang & Dan-Feng, 2009). According to Pelet & Lecarte (2013), Virtual Learning is a process of learning carried out online that uses computer-related technology to deliver instructions to a large number of students in a Virtual Learning Environment through instant messaging, blogs, wikis, microfiches, chat rooms, web surfing using Google Meet.

Virtual agricultural education programming for resourceful Information Communication Technology is the strongest tool for model change from the conventional method of teaching and learning by both lecturers and students (Ekele, 2020). Virtual platform learning has been considered as a substitute for the direct teaching method, if computer assisted instructions used appropriately, lecturers, as well as their students, can use web-based learning materials to overcome perennial problems of inadequate teaching personnel, inadequate teaching and learning equipment facing an educational system of the developing countries like Nigeria (Oye, Salleh, & Jahad, 2011). Moreover, this insufficiency of these facilities has negatively affected students' performance in horticultural crop production for many years and at the same time denies agricultural educators the opportunity to adequately demonstrate the horticultural knowledge needed by the undergraduate students of agricultural education. To overcome this problem in the higher institutions of learning (Beulens, 2012; Carolina, & Gabriel Monteiro, 2016; Yoloye, 2017) emphasized that, an appropriate instructional learning environment using virtual classrooms that improve undergraduate students' performances in many science practical courses needs to be tested in horticultural crop production to find its effect in comparison to the conventional approach used by the Nigeria university lecturers (Bakia, Shear, Toyama & Lasseter, 2012).

The result of this study will hopefully be useful to university lecturers by providing more data to enable them to understand if virtual instructional learning of education provides equity of learning when compared to conventional approaches of lecturing in terms of the academic achievement of the students. The study is also useful to undergraduate students by providing them with the new instructional delivery package for learning horticultural crop production which will go a long way in helping lecturers to deliver instructions in a manner familiar to the current educational reforms.

STATEMENT OF THE PROBLEM

Teaching Agricultural courses specifically horticultural crop production requires a lot of facilities for students' practical activities. Despite, the importance of such facilities, studies have shown that a significant number of universities in Northern Nigeria have not made them available, and even the available ones are not adequate and functional (Arogundade, 2010; Isah, Wan & Emmanuel, 2017).

LITERATURE REVIEW

Universities all over the world may expose their students to a virtual platform for other educational programmes such as lecturers, video conference, and many different learning activities that uses any of the communication packages. They further stated that Virtual platform learning has been considered a system useful and easy to use with robust functions for the academic learning objectives for agricultural extension programmes (Cofino, Atillo, & Velos, 2021). Accepting virtual cloud computing in tertiary institutions of higher learning is another way in restructuring and manage the structure of the system of education. In addition, Integration of the virtual cloud computing in educational modules in developing countries like Nigeria is believed to have many benefits of declining higher charges of accessibility and easy management of the information and communication technology (Menta, 2022). The introduction of virtual learning into teaching and learning has obliged a serious change from the conventional method of teaching that was teacher centred to the modern method which is learner-centred (Trucano, 2005).

Segundo, Lagarteja, & Taracatac, (2022) in a study that explored the incorporation of technology and price forecast to resolve the problem for high-value commercial crops, the study further showed the best way for a move to bring wider research work in the area of agriculture particularly price forecast of high-value commercial crops. Ekele, (2020), in his study, revealed that digital plan and data picturing, and digital creation organization skills in programme agricultural education are required for inventive Information communication technology in colleges of education. Jain, & Carandang, (2018) Developed an e-commerce virtual spot to give farmers a simple and cost-effective approach to running some of their business processes and agricultural producers can easily manage customer requests and update the record of harvests and prices without stress. They further reveal some of the difficulties farmers use to update their ability to obtain profits from their produce.

Many studies have shown that virtual learning environments have been used in teaching science courses in the higher institutions of learning using the same design used by this research work (quasi-experimental research control group design) but there are very few researches on the virtual learning in the academic achievement of the horticultural crop production and related agricultural education area of specialization. Furthermore, learning using the virtual platform has a significant positive effect on improving student educational attainment (Ghulam, Khuram, Naqvi & Nadeem, 2015; Joseph, 2015; Rita & Menik 2018). A study by Chen, Wu and Su (2008) shows the simulation's effect on undergraduate students' achievement and attitude in a virtual environment. It was revealed that substantial differences existed in students' dependent procedures between the three virtual environment administered treatments (virtual written resources, virtual written plus graphics and virtual written plus models). In a related study, El-Sabagh (2011) online grounded virtual laboratory. The study revealed a significantly greater mean rating of experimental group students especially in two levels using an online grounded virtual laboratory and also post-test scores of the two groups on the effect size remained great for two science process skills. A study by Ting & Xianmin (2018) on Vocal Learning Stylishness. The study discovered a substantial collaboration in the students' accomplishment among vocal learning stylishness and attention.

In another, Gambari (2017) studied the achievement levels as well as the gender of secondary school students using a virtual laboratory in two learning settings. The mean achievement scores of the study revealed no significant difference between high, medium and low students in an individualized setting while contrary results were obtained in a collaborative setting. So also in the study of virtual learning concerning animation Zhen, Xiu-Xia, Yan-Yi, Shu-Yan, & Shao-Jun (2018) carried out a study on the visual-feed-based force platform. The finding revealed that the virtual response-based power platform training with functional electric animation upgraded balance and disallowed drops in order adults.

The study of Judith & Nneka (2018) is related to the study that investigates the effect of the Edmodo (virtual) learning platform on business studies students' achievement at the secondary school level, in Anambra, Nigeria. The result of the study is similar to a current study by reporting achievement scores of business studies students exposed to the Edmodo learning platform were superior to those used in the traditional method of teaching. Despite substantial contributions virtual platform played and serious requests for its incorporation and combination into teaching and learning of vegetative propagation, numerous issues continue to be a problem to its use in various institutions of higher learning in Northern Nigeria which include unsteady electricity power supply, restricted and inadequate computer-assisted instructional package facilities (Issa et al. 2011; Onwuagboke, Singh & Onwuagboke, 2014). Some of the problems include inadequate incorporated course content, insufficient technical skilled personnel and lack of openness to the virtual platform in teachers' training institutions (Issa et al., 2011). Therefore, National Policy on Education Section 11 subsection 102 (d) emphasises that the "Government shall provide facilities and necessary infrastructure for the promotion of Information and Communication Technology at all levels of education" (FGN, 2013).

Hypotheses

Based on the above discussion, this study was guided by two research hypotheses: **Ho1:** No significant difference exists in the mean scores of the pre-test undergraduate virtual platform learning students and the conventional approach learning students group in horticultural crop production before the treatment.

Ho2: No significant difference exists in the mean scores of the post-test undergraduate virtual platform learning students and the conventional approach learning students group in horticultural production after the treatment.

METHODOLOGY

Data Analysis

The analyses of the research data were done using an independent t-test for the two hypotheses. An Independent t-test is used as a statistics tool for calculating the mean mark of the two dissimilar groups (Rebeca, 2020). In testing null hypotheses the scores of the test for the two groups were run using Statistical Package for Social Sciences (SPSS). Any hypothesis with a p-value greater than or equal to (0.05) significant level was accepted while a hypothesis with a p-value less than (0.05) significant level was rejected. (Garba, Abdulhamid, Bishir, & Umar, 2020).

Design

This research work engaged a quasi-experimental design to test a virtual platform on horticultural crop production achievement among undergraduate students in northern Nigeria (Smits, 2019). This design is widely used in a situation where a randomized assignment is not possible in practice, especially in a school situation where classes cannot be re-organised to accommodate the experimenters' study. If two intact groups were used but randomly assigned into experimental and control groups and neither of the group has been earlier open to the treatment before the pretest. (Enemali, 2010). A pretest and post-test control group is a design that involved randomized experimental and control groups. The design of this study is as follows:

Groups	Randomization	Pretest	Treatment	Posttest	
G1	R	Y ₁₁	Х	Y ₁₂	
G ₂	R	Y ₂₁		Y ₂₂	

G1----- Experimental group taught using a virtual platform approach

G2----- Control group taught using a conventional approach

R ----- Randomization of the subject to both experimental and control groups

X ----- Treatment to both experimental and control groups

Figure 1. Treatment flow chart

The Population of the Study and Sampling

The population of the study covered 356 final-year agricultural education undergraduate students in all 8 universities offering agricultural education in northern Nigeria (Academic Division of various universities, 2020). Horticulture is in the final year curriculum of the agricultural education undergraduate students in federal universities offering agricultural education in northern Nigeria.

Three geo-political zones of Northern Nigeria (North-East, North-Central and North-West) were considered as three clusters. North-East and North-West were randomly selected as two clusters out of the three. Abubakar Tafawa Balewa University Bauchi from the North-East cluster to be control group while Bayero University Kano from the North-West cluster is the experimental group (Sambo, 2008). In placing the undergraduate students into experimentation, intact classes were used and a total number of the students in those three clusters formed the population of the study which has been 356 final year horticultural crop production students from the three clusters. A simple random sampling technique was used in organizing two universities (clusters) into experimental and control groups. Abubakar Tafawa Balewa University, Bauchi with sampled 55 undergraduate students as experimental group and Bayero University Kano with sampled 55 undergraduate students as control group respectively out of the total population. Even though both two sampled universities run four and five years programmes, there were no variations in the duration of the study since the course content and credits units of horticulture from the two universities are the same.

Research Instrumentation

Horticultural Crop Production Performance Test (HCPPT) was used as an instrument for data collection, which had 60 items objectives test with 5 options adapted from Career technology horticultural testing (2009) based on the course content coverage of the study. The instrument was pilot-tested outside the study area on undergraduate students of agricultural education that are not part of the population but have similar characteristics. The instrument was exposed to the validity and reliability test. Instrument reliability was determined using Cronbach alpha and .865 reliability was obtained. Based on the view of Taber (2018) any value above 0.73 Cronbach alpha is reliable. The instrument for collecting data was also certified by two experts from Ahmadu Bello University, Zaria specialising in agricultural education and one from the University of Agriculture, Makurdi specialising in measurement and evaluation (Hamed, 2016) all ideas and contributions from the experts have been updated to the final copy of the instrument. Horticultural Crop Production Performance Test (HCPPT) was used for both pretest and post-test assessment but multiple-choice questions of the test were manipulated after the pretest.

Treatment Procedure

The treatment is the process of teaching using an instructional virtual platform that contains suitable video and animations adapted by the researchers from Ken (2013), and Smart school (2018) on vegetative propagation and text materials were uploaded/updated into the virtual platform by the researchers and satisfied by experts for its suitability for teaching undergraduate students considering their curriculum, socio-cultural and psycho-cognitive status (see appendix A). Four (4) control groups and four (4) experimental group research assistant lecturers with a master's degree in agricultural education and 3-5 years of lecturing experience were randomly selected to conduct the experimentation at the selected universities. The selected assistant lecturers were exposed to two weeks of training on how to teach using a virtual platform. The concepts of various types of cuttings for asexual propagation: (Root cuttings, Grafting, Budding and layering) were taught during experimentation and covered the period of four weeks, from 6th November to 4th December 2019 and executed to the only experimental group using the virtual platform approach.

Both the two groups were pre-tested to determine their entry behaviour, the instructional virtual platform that contains suitable horticultural video and animations was used to teach the experimental group only, while the conventional approach was also used to teach the same content to the control group by the assistant lecturers. The lecturers also teach the control group in the same weeks using the conventional approach of teaching cuttings for asexual propagation, then both the groups were posttested. The post-test result was marked automatically by the platform and the pretest result was collected by the research assistant lecturers and submitted to the researcher for marking using the same marking scheme for the post-test group. The classroom activities of the virtual platform were hosted using the local server of the experimental group (Abubakar Tafawa Balewa University Bauchi) computer centre by the researcher under this URL: http://educational-Vegetative Propagation-virtual-Platform.com

Common characteristics of the two							
groups							
Conventional Approach		Virtual Learning Environment					
 Writing manuscript 	Organization	 Virtual platform resources 					
• Writing note	Plan of lesson	• Video, 3D Animations					
• lecture	Method of delivery	Virtual platform approach					
 Happening same time 	Mode contact	 Happening at different times/ happening same time 					
 Duration/centred on a lecture hall 	Interaction space	• Duration / centred on virtual platform environment					

Table 1. Showing different characteristics of conventional and virtual groups

RESULTS

The result of descriptive Statistics in table 2 Shows that there was no significant difference between the mean achievement score of undergraduate students who taught with virtual platform learning (M = 24.300, SD = 4.7910) and conventional approach undergraduate students (M = 23.306, SD = 4.3985). Hypothesis 1 was, therefore, accepted. The result shows that two groups of undergraduate students originated from a similar population as they displayed matching achievements at the pre-test stage.

Groups Ν SD Μ Virtual Group 24.300 4.7910 55 **Conventional Group** 23.306 4.3985 55 Total 47.606 9.1895 110

Table 2. Descriptive analysis for pre-test between virtual and conventional groups

The result independent sample t-test statistics for pre-test between virtual and conventional groups in table 2 Shows that there was significant difference in the mean achievement score of virtual platform (M = 24.300, SD = 4.7910) and conventional approach (M = 23.306, SD = 4.3985) and table 3 shows conditions; t (78) = .632, p = .233. These results suggest that teaching using the virtual platform has no significant effect on the achievement of undergraduate students than the conventional approach of teaching horticultural crop production at pre-test. Hence, the null hypothesis was accepted.

Levene's Test for Equality of Variances										
Groups	F	Sig	Т	Df	Sig. (2- tailed)	Mean Diff.	Std. Error Diff.	95% Col Interva Diffe	95% Confidence Interval of the Difference	
								Lower	Upper	
Virtual Group	.893	.279	.632	78	.233	.76667	1.2139	1.6633	5.1967	
Conventi onal Group			.632	57.093	.233	.76667	1.2139	1.6642	5.1975	

Table 3. Independent sample t-test statistics for pre-test between virtual and conventional groups

The result of the descriptive analysis in table 4 revealed that the mean achievement score of undergraduate learners who taught with the virtual platform method (M = 4.8667, SD = 1.3081) was significantly above the mean achievement score of undergraduate learners who were taught with the conventional method (M = 3.7667, SD = 0.2881).

Table 4. Descriptive analysis for post-test between virtual and conventional groups

Groups	Ν	Μ	SD
Virtual Group	55	4.8667	1.3081
Conventional Group	55	3.7667	0.2881
Total	110	8.6334	1.5962

The result independent sample t-test statistics for post-test between two groups in table 4 Shows significant difference in the mean achievement score of virtual platform (M = 4.8667, SD = 1.3081) and conventional method (M = 3.7667, SD = 0.2881) and table 5 shows conditions; t (8) = 2.68, p = .020. These results suggest that teaching using the virtual platform has a more significant effect on the achievement of undergraduate students than the conventional approach to teaching horticultural crop production. Hence, the null hypothesis was rejected.

Levene's Test for Equality of Variances									
Groups	F	Sig	Т	Df	Sig. (2- tailed)	Mean Diff.	Std. Error Diff.	95% Co Interval Differenc	nfidence of the ce
								Lower	Upper
Virtual Group	1.460	.247	2.675	8	.020	2.0000	.6821	.4121	3.5796
Conventi onal Group			2.675	6.561	.023	2.0000	.6821	.3528	3.5672

Table 5. Independent sample t-test statistics for post-test between virtual and conventional groups

DISCUSSION

The first finding revealed that undergraduate students' performance was not statistically different before the treatment among the virtual and conventional groups. The result further showed that both virtual and conventional groups have almost the same academic ability at pre-test before the treatment and the null hypothesis was accepted. This finding is supported by Tareq, Thabe & Kalyankar (2014), in the study of the virtual learning method of traction and they revealed that both the two groups were equal in Achievement during the per test period. The finding is further maintained by Chinna & Dada (2013) who reported that no substantial difference existed between the mean achievements of the subjects at pre-test. The finding is also supported by Bishir (2015) who reported substantial differences in the performance of learners in the control and experimental group before administering the treatment.

The second finding revealed that the effect of the virtual platform was significant on undergraduate students' achievement in the experimental group taught horticultural crop production using the virtual platform. The finding is in support of Sheng, Boxiang & Xinyu (2013) in a study on the effect of virtual computer Augmented Geometry on student performance.

The result of the experimental group discovered a substantial difference between the mean performances of the subjects at the post-test. Some previous studies have stated that virtual platform laboratories as an experimental group simplify the formation of conceptual models by bringing activities that improve cognitive skills than in the conventional approach of teaching (Pekdag, 2010). This finding disagreed with Adegoke (2010) that shown experimental students in the animation + on-screen text performed lesser than those in the conventional lecture approach. The finding of Vanessa (2015) also disagreed with the finding of this study. This was achieved by using an independent sample *t-test* to compare the significant difference between the mean of student achievement outcome levels for online (virtual instructional model) and traditional instructional models on the North Carolina End of Course Test and revealed no significant differences exist in student achievement outcome levels between online (virtual instructional model) and traditional instructional model) and traditional instructional model.

Other findings of Hassan (2011) that agreed with the result, also reported science students' mean scores at the post-test of the experimental group using the conceptual understanding which is significantly higher than the pretest scores mean, the finding revealed a substantial mean scores difference between post-test and pre-test in support of the post-test result Web-Based Virtual Lab. In another of his findings of science students' mean scores at the post-test of the experimental group using science process skills which are significantly higher than the pretest scores mean, the finding revealed a substantial mean scores difference between post-test and pre-test in support of the posttest result Web-Based virtual lab. The finding is in disagreement with that of Anil (2018) on the effect of computer-supported education on the student's success. His study indicated that experimental group students exposed to computer-supported approach lessons do not progress more significantly than the control group students. Other findings of Ozgur (2015) disagreed with the findings of the virtual live classroom for physics using an independent t-test study, findings revealed substantial variation among virtual live classroom for physics followers regularly and virtual live classroom for physics followers groups' scores at two different test levels. From the findings, the classroom for virtual physics followers regularly group scored higher than the virtual live classroom for physics followers' group in the experimentation.

CONCLUSIONS AND RECOMMENDATIONS

The application of virtual platforms as substituting approach in teaching horticultural crop production proved to be effective means of improving students' academic performance. In the course of treatment, the experimental group of undergraduate students proved more attentive to the teaching process because the budding, layering and grafting were explained through interactive activities of animations, which contributed significantly to student learning. The virtual platform has more effect in comparison to the conventional approach to teaching and learning which improve undergraduate students' academic performance. Therefore, Agricultural science teachers/lecturers should learn to integrate vegetative propagation into a virtual platform to be used as an instructional package for practically oriented courses like horticultural crop production. Universities proprietors should be used to teach undergraduate students horticultural crop production in all Nigerian universities. Special training should be organized for Agricultural science teachers/lecturers on a virtual platform for teaching horticultural crop production to improve students' performances.

Government should provide needed facilities where suitable video and animations should be used to teach undergraduate students horticultural crop production in all Nigerian universities.

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APPENDIX A

VIRTUAL PLATFORM TREATMENT



