

THE IMPACT OF TECHNOLOGICAL DEVELOPMENT IN AGRICULTURAL SCIENCE ON SENIOR SECONDARY SCHOOL STUDENTS' LEARNING OUTCOMES IN ONDO STATE, NIGERIA

Olanrewaju Pius OGUNJOBI¹, Francis Bosede ADEBAYO², Oluwaseun Matina OLALEKAN³, & Remignous Olawale FAMIWOLE⁴

¹Department of Agriculture and Technology, School of Agriculture and Technology, Bamidele Olumilua University of Education, Science and Technology, Ikere Ekiti, Ekiti State Nigeria

ORCID: 00000002-5544-5555 ogunjobi.olanrewaju@bouesti.edu.ng adebayo.francis@bouesti.edu.ng

²Department of Vocational and Technical Education, Ekiti State University, Ado Ekiti

Corresponding author's email: ogunjobi.olanrewaju@bouesti.edu.ng +234 803 493 2904

Abstract

The study examined the Impact of Technological Development in Agricultural Science on Senior Secondary School Students' Learning Outcomes in Ondo State, Nigeria. Specifically, the study sought to examine the concept of technological development in agriculture on Senior Secondary School Students in Ondo State. This paper adopted a qualitative research approach where findings were drawn from online journals and/or literature reviews. It was thus concluded that technological development in agriculture is not readily available to SSS students in Ondo State. The utilization of modern farm technologies in teaching agriculture will not only provide learners with modern skills for farming but also create motivation for farming among upcoming generation. The use of modern farming technology therefore, could serve as a medium of arousing or changing students' attitudes towards agriculture as a career. Based on the findings of this study, it was recommended that there should be training and re-training among teachers and students of agricultural science on the use of modern agricultural technology for teaching and learning in secondary schools with a preference for practical skill development, Government should provide necessary inputs and farm machinery (technologies) for teaching and learning agricultural science, Schools should ensure the establishment of demonstration farms to encourage practical work among students, Farm workshops and agricultural Laboratories should be provided where student can use agricultural technology related facilities and students of Agricultural science should go for field-trips and excursion in technology-oriented farms to enhance to further boost their motivation from agriculture among others.

Keywords: Technology, students, learning outcomes, senior secondary school

Introduction

Technology has to do with the application of scientific knowledge for practical purposes. It also involves the use of machinery and equipment developed from the application of scientific knowledge. In a simpler form, technology can be explained as the application of scientific knowledge to the practical aims of human life. When used to support both teaching and learning, technology includes classrooms with digital learning tools such as computers, handheld devices, and learning materials and increased students engagement and motivation to learn. Technology can also be described as the application of information in the design, production and utilization of goods and services and the organization of human activities.

Technology also increased the interactivity of students. They find it much more interactive, as well as full of interesting areas, when aided by technology. The

transfer of knowledge becomes very easy and convenient, as well as effective. What this means is that the minds tends to work faster when assisted with the use of modern technology. The reliance and dependence on such an innovation, which simply makes life an easy, smooth journey is completely unavoidable these days even in schools, universities and colleges in the study of the study of agricultural science.

Agricultural Science can be described as the science of rearing animals and cultivating of crops for raw materials, human consumption and industrial purposes. It can also be described as the study of plants and soils to develop ways of improving food quantity and quality. The objectives of Agricultural science are to improve crop production to benefit farmers, and consumers and increasingly to reduce potential

environmental impacts. Studies, therefore, focus generally on crop development, resilience, quality, reproduction and their relationship with the surrounding environment.

Agricultural science is one of the core vocational curricular subjects taught at both junior and senior secondary schools in Nigeria. Famiwole (2017) defined Agricultural Science as a process of training learners in the process of Agricultural productivity as well as the techniques for teaching agriculture. Agricultural science education is a broad multidisciplinary field that deals with the selection, breeding and management of crops and domestic animals for economic production. It is a subject taught in secondary schools as a means of self-reliance and preparation for further studies. Agricultural science is therefore designed for the inculcation of the necessary skills for the practice of agriculture for effective citizenship and contribution to food security for national sustainability. In 2014, the FRN in NPE outlined the seven major objectives of teaching and learning agricultural science to including the: ability to stimulate students interest in agriculture, to enable students to acquire basic knowledge of agriculture, to develop basic agricultural skills in students, to enable students integrate knowledge with skills in agriculture, ability to expose students to opportunities in the field of agriculture, to prepare students for further studies in agriculture and to prepare students for occupations in Agriculture through effective teaching.

One of the major phases of teaching Agricultural Science in secondary school is Farm Technology and Agricultural Engineering. The National Educational Research and Development (2019) also specifies Agricultural Engineering and Mechanization as one of the areas to teach in secondary schools. A look into most of the secondary schools in Ondo State would reveal the poor state of farm machinery and the application of farm technology to handle farm activities. Students learn agricultural concepts better when they see, touch or manipulate the equipment or facilities in schools and colleges.

It seems most graduates of secondary schools lack basic vocational and entrepreneurial skills expected to be acquired from agricultural science. Products of these secondary schools still wallow about in search of white-collar jobs instead of becoming self-reliant and employers of labour. The inadequate use of technology for the teaching and learning process on the part of the agricultural science teachers in Nigerian secondary schools seems to have grossly affected learning outcomes in Agricultural Science.

Technological development has greatly shaped agriculture throughout time. From the creation of ploughing to the global positioning system (GPS) driven precision farming equipment, humans have developed new ways to make farming more efficient and grow more food. Based on the contradictions and corroborations in the findings of scholars on different variables in technological development, especially in Agricultural Science; it is therefore, pertinent to investigate the impact of technological development in agriculture on Senior Secondary School Students in Ondo State.

The purpose of this paper was to examine the impact of technological development in agriculture on Senior Secondary School Students in Ondo State. Specifically, the paper sought to:

- i. examine the concept of technological development in agriculture on Senior Secondary Schools Students in Ondo State
- ii. find out the level of use of technology-related facilities (tools, software, PC) in senior secondary schools in Ondo State and
- iii. investigate the measures to improve technological development in agriculture on Senior Secondary School Students in Ondo State

The Concept of Technological Development in Agriculture

The term technology has been given various definitions by the previous literature. According to Kumar *et al.* (2013) technology consists of two primary components: a physical component which comprises items such as products, tooling, equipment, blueprints, techniques, and processes; and the informational component which consists of know-how in management, marketing, production, quality control, reliability, labor and functional areas. Sahal (2017) viewed technology as 'configuration', observing that the transfer object (the technology) relies on a subjectively determined but specifiable set of processes and products. The current studies on technology transfer have connected technology directly with knowledge and more attention is given to the process of research and development (Dunning, 2017).

According to Sani (2011), the three major roles played by technology as stated in the Nigerian curriculum,

- Learning about Technology: This is when technology becomes the subject or an area of study for the learners. In this case, the learner's study technology's composition, structure and functions.

- Learning with Technology: This is concerned with the use of technology as a medium of facilitating classroom instruction.
- Learning through Technology: This is concerned with technology as a critical tool or component of the course of study that teaching and learning of course without the use of technology becomes relatively impossible.

Agricultural operations in modern times is exceedingly different compared to those performed decades ago, basically because of alarming scientific and technological advancement in the modern society. Consequently, modern agriculture engages in the usage of various sophisticated technologies. It is in this view that Rehman, Jingdong, Khatoon and Hussain (2016) noted that in modern agriculture external inputs such as inorganic fertilizer, pesticides, animal feedstuffs, tractors and other agricultural machinery have substituted natural resources and processes. Pesticides have replaced biological, cultural and mechanical methods of controlling pests, weeds and diseases. Inorganic fertilizers have been substituted for livestock manure, composts and nitrogen-fixing crops. So, agricultural technology in modern times is far beyond cutlass and hoe, rather than the integration of scientific knowledge to develop techniques, machines and useful chemicals for enhanced agricultural operation.

According to Okon (2008), agro-modern technology generation aims to develop better techniques of land development, crop and animal management and achieve higher yields. Agricultural technology involves the application of mechanical, chemical and biological inputs such as tractors, fertilizers, agrochemicals, livestock breeds, high yielding crops, storage and processing facilities to improve food production. Agricultural technology entails the appliance of modern farm machineries, new farming methods and agrochemicals to agriculture (Bolade 2010). Based on the forgoing description of agricultural technology, teaching and learning agriculture requires the utilization of modern agricultural methods, machineries and farm inputs for updated transfer of knowledge. The use of modern technologies in teaching and learning do not only create motivation for learning among learners but also boost their interest and enhance their decision to choose agriculture for future career.

Nnodim and Raji (2020) posited that agricultural technologies increases agricultural production and sustainability substantially. For example, new disease resistant hybrid reduces the rate of risk and uncertainties in crop and livestock farming.

This shows that farm inputs are also aspect of agricultural technologies, which are needed for effective impartation of agricultural knowledge to students.

Challenges of Using Agricultural Technology in Secondary School

The use of Agricultural technology has a great potential to reform or even transform education, besides the relative advantages, some of the problems were faced by the students while learning. They are related to Information Communication Technology compatibility with course curriculum and internet acquaintance were also noted as significant barriers (Layfield *et al.*, 2000; Hew & Brush 2007; Keengwe *et al* 2008; Anandaraja *et al.*, 2012 and Ogunjobi, 2023). To overcome the problems facing by students, they also seemed to need preparatory training especially in ICT skills in order to enhance their learning effectiveness. Training is an essential process to increase knowledge, change attitudes and develop skills. It enhances self-confidence, competency and proficiency in communicating desired knowledge among peers and clients. Corroborating and updating the ICT course materials and technical components should be considered through proper feedback and training mechanism. The comprehensive academic competitive situation mandates students to pay rigorous attention to develop necessary digital skills (Nallusamy *et al* 2015).

Technology is an effective tool for learners. It provides so many alternatives as making learning interesting and more productive in terms of advancement. It plays a vital role in stimulating activities for learners. The use of technological tools is significant for effective learning because it enhances the way of learning in classrooms. The use of technological tools in classroom shows a real learning experience that increases learners' responsibility. The application of multimedia also makes use of print, film, and internet gives learners the chance to collect information and also enhance learners' linguistic knowledge (Bennett *et al* 2000; Drayton *et al* 2010; Keser *et al* 2011; Arifah 2014, Pourhossein Gilakjani 2014 and Adeoluwa and Sikeade, 2018). While using technological tools the learners were having advantages viz., provision of tools to enable students to independently solve problems, acquisition of technological skills through practice with tools and computer, cost effectiveness, developing student's self-discipline, students are more likely to stay engaged on task and reducing behavioural problems in the classroom (Pavel, *et al* 2015).

Measures to improve technological development in Agriculture

Measures to improve technological development in agriculture on senior secondary students includes (Abang, 2020):

- i. Maintenance of available facilities,
- ii. Agricultural facilities should be used for the purpose they are made for,
- iii. Non-available agricultural technology facilities should be improvised
- iv. Some agricultural technologies should be imported by the school/government to boost technological development In agriculture
- v. Mark should be given to SSS students having/using the appropriate technology/facilities to carry out farm operations

Agricultural Technology Facilities in Secondary Schools

Technological advancements in society are largely the result of the ability of education systems to teach students how to think critically and solve problems related to technology. The implementation of machinery resources could increase the effectiveness of teaching and learning of agricultural science as a subject as many students would be able to acquire needed skills to operate farm machines (Tessa, 2018). He however stated that the lack of tractors and other farm implements for teaching could increase drudgery to students working on schools' farms which, in turn, hinders students from realizing the value of machines and modern implements in simplifying farm activities. It is based on this demand that World Bank has been investing heavily in the effective implementation of Agricultural science curriculum in secondary schools so that young ones would see simplicity in agricultural practices negating their traditional believes on agriculture (World Bank, 2005).

Nnodim and Raji (2020) posited that agricultural technologies increases agricultural production and sustainability substantially. For example, a new disease-resistant hybrid reduces the rate of risk and uncertainties in crop and livestock farming. This shows that farm inputs are also aspect of agricultural technologies, which are needed for effective impartation of agricultural knowledge to students. In teaching agricultural science, modern farm input should be an indispensable resource when carrying out practical exercises of the agricultural science curriculum. United Nations Educational Scientific Cultural Organization (2012) asserted that effective

teaching and learning of the curriculum requires efficient systems that would provide supportive learning environment, motivated teachers with mastery of pedagogy and their subject matter, adequate access to teaching and learning resources as well as students who are ready to learn. Utilization of modern agricultural inputs such as fertilizers, agrochemicals and improved seeds in delivering agricultural science curriculum content helps to create awareness among agricultural science students on modern inputs available to them for efficient farm productivity. (Laugo, 2009 and Ogunjobi, 2023). This demand will also in turn enables Agricultural science teachers participate in agricultural extension activities from the schools.

The type of Agricultural technologies in secondary school to improve learning include:

- Technologies for land preparation and cultivation (e.g., improved varieties, production or natural resource management practices, fertilizer, pesticides, knapsack sprayers, ploughs, irrigation, and other farm power)
- Harvesting technologies (e.g., hand tools, reapers)
- Post-harvest operations and processing technologies (e.g., solar drying equipment, threshers, improved marketing or processing practices)
- Labor-, time- and energy-saving technologies for household tasks (e.g., fuel-efficient stoves, key-hole gardens, technological and institutional innovations for greater access to water and energy)
- Information and communication technology – ICT (e.g., mobile phones, rural radio, internet, television, print media)

We can further group these technologies into;

- (1) Intangibles (knowledge-based or management practices);
- (2) Tangibles or physical technologies;
- (3) Biological technologies incorporated in the seed or planting materials. This classification can highlight the complementarities among these technologies and may have different implications on the relative role of institutions and organizations, adoption decisions, and access of these technologies. For example, improved knowledge-based management practices, information and extension systems (intangibles), and ICT (intangibles and tangibles) can help facilitate adoption of the biological and physical technologies. Physical infrastructure, transport and distribution systems (tangibles) can facilitate access and adoption of other tangible and biological

technologies, and mobility of frontline professionals who deliver information and intangible technologies.

Methodology

This paper adopted a qualitative research approach where findings was drawn from online journal and/or literature review.

Findings and Discussion

The findings of this paper according to Abang (2020) revealed that the availability of agricultural facilities in teaching and learning Agricultural science in Senior Secondary school is low. Findings also showed non-availability of solar drying equipment, Plough, digital soil mapping, logging technology, chain saw, laser technology and tractor. However, the study revealed a low availability of computer software, sprayers, feed mixers, irrigation facilities, fertilization applications, planting equipment and feeding troughs. The availability of Shelter, radio, television and mobile phone are revealed in the study to be high.

The finding of this paper is in agreement with the position of Wasilah *et al.*, (2020) which revealed that ICT devices for teaching agricultural science are poorly available in secondary schools. This is also similar to the findings of Ngwu (2014) which revealed that ICT devices are not adequately available in schools

Conclusion and Recommendations

Conclusion

Agricultural technologies increase agricultural production and sustainability in new disease-resistant hybrid, reducing the rate of risk and uncertainties in crop and livestock farming. Furthermore, farm inputs are also an aspect of technological development in Agriculture, which are needed to effectively impart agricultural knowledge to senior secondary students in Ondo State. In teaching agricultural science, modern farm input should be an indispensable resource when carrying out practical exercises of agricultural science curriculum. Utilization of modern technological development in agriculture was also observed from the literature to help in deliver agricultural science curriculum content and

create awareness to agricultural science students on modern inputs available to them for efficient farm productivity. The implementation of technological development in agriculture could increase the effectiveness of teaching and learning of agricultural science as a subject, as many students would be able to acquire needed skills to operate farm machines.

It was thus concluded that technological development in agriculture is not readily available SSS students in Ondo State. The utilization of modern farm technologies in teaching of agriculture will not only provide learners with modern skills for farming but also create motivation for farming among upcoming generation. The use of modern farming technology therefore, could serve as a medium of arousing or changing students' attitude towards agriculture as a career.

Recommendations

Based on the findings of this study, the following recommendations were made;

- i. There should be training and re-training among teachers and students of agricultural science on use of modern agricultural technology for teaching and learning in secondary schools.
- ii. Government should provide necessary inputs and farm machineries (technologies) for teaching and learning agricultural science.
- iii. Schools should ensure the establishment of demonstration farms in order to encourage practical work among students.
- iv. Farm workshops and agricultural Laboratories should be provided where student can use agricultural technology related facilities
- v. Agricultural science students should go for field-trips and excursion in technology-oriented farms to enhance to further boost their motivation from agriculture.
- vi. Government should fund and invest in agricultural education programmes in higher institutions, especially in agricultural technology, so as to equip student and teachers in agriculture.

References

- Abang, H. P. (2020) *Identification of Agricultural Technology Facilities for Teaching Agricultural Science in Ekiti State Secondary School*. Unpublished Undergraduate Final Year Project, Ekiti State University.
- Anandaraja, N., Balasubramaniam, R., Amasubramanian, M., & Sebastian, S. 2012. Orientation and Utility of Information and

- Communication Technology Tools by Agricultural Students and Research Scholars. *Journal of Agricultural Extension Management*, 13 (1), 47-60.
- Arifah, A. 2014. *Study on the use of technology in ELT classroom: Teachers' perspective*. M.A. Thesis, Department of English and Humanities, BRAC University, Dhaka, Bangladesh.
- Bennett, D., Culp, K. M., Honey, M., Tally, B., & Spielvogel, B. 2000. *It all depends: Strategies for designing technologies for educational change*. Paper presented at the International Conference on Learning Technology, Philadelphia, PA.
- Bolade E. O. (2010). Technological Innovation for Nigeria Fisheries Development. Issues and Analysis. *The Nigerian Journal of Agricultural Extension*. 5 (1) 27-32
- Drayton, B., Falk, J. K., Stroud, R., Hobbs, K., & Hammerman, J. 2010. After installation: Ubiquitous computing and high school science in three experienced, high-technology schools. *Journal of Technology, Learning, and Assessment*, 9(3), 1-57
- Dunning, J. H. (2017). Multinational Enterprises and the Global of Innovatory Capacity. *Research Policy*, 23, 67-88
- Egbule, P. E. (2004). *Fundamental and practice of agricultural education*: Owerri: Totam publishers Ltd.
- Hew, K. F., & Brush, T. 2007. Integrating technology into K-12 teaching and learning: Current knowledge gaps and recommendations for future research. *Educational technology research and development*, 55(3), 223-252.
- Keengwe, J., Onchwari, G., & Wachira, P. 2008. Computer technology integration and student learning: Barriers and promise. *Journal of Science Education and Technology*, 17(6), 560-565.
- Keser, H., Uzunboylu, H., & Ozdamli, F. 2012. The trends in technology supported collaborative learning studies in 21st century. *World Journal on Educational Technology*, 3(2), 103-119.
- Laugo, J. (2009). *Vocationalized secondary education*. In: *International Handbook of education for the Changing World of Work*. (Edited by Maclean, R. and Wilson, D.). Springer Science + Business Media B.V, Netherlands. pp 2295-2312.
- Layfield, K.D., Radhakrishna, R.B., & Scanlon, D.C. (2000). An assessment of Pennsylvania secondary agricultural teachers' perception of and use of the Internet. *Journal of Southern Agricultural Education Research*, 50(1), 54–61
- Nallusamy, A., Balasubramaniam, S., & Chellappan, S. K. 2015. Use of information and communication technology (ICT) to achieve information literacy in agriculture. *International Journal of Agricultural Extension*, 3(2), 111-122
- Nnodim, A. U. & Raji W.I. (2020). Assessment of Agricultural Technology Adoption Behaviour among Crop Farmers in Ikwerre Local Government Rivers State. *Asian Research Journal of Agriculture* 12(2): 16-26
- Ogunjobi, O.P (2023). Effects of technology-enhanced instruction on Agricultural science students' learning outcome in senior Secondary schools in Ekiti State, Nigeria. Unpublished Masters Thesis, Ekiti State University, Ado Ekiti.
- Okon O.E. (2008). Nutritional Assessment of some Nigerian Land and Water Snail Species. *Ethiopian Journal of Environment Studies and Management* 1(2).
- Pavel, A. P., Fruth, A., & Neacsu, M. N. 2015. ICT and e-learning–catalysts for innovation and quality in higher education. *Procedia economics and finance*, 23, 704-711.
- Pourhossein Gilakjani, A. 2014. A detailed analysis over some important issues towards using computer technology into the EFL classrooms. *Universal Journal of Educational Research*, 2(2), 146-153.
- Rehman, A. Jingdong, L. Khatoon, R., Hussain, I. (2016). Modern Agricultural Technology Adoption its Importance, Role and Usage for the Improvement of Agriculture. *American-Eurasian Journal of Agricultural & Environmental Sciences* 16 (2) 284-288.
- Sahal, D. (2017). Alternative Conceptions of Technology. *Research Policy*, 10, 2-24.
- Sani, I. D. (2011). *Effects of computer assisted concept mapping and digital video instruction on students achievement in Chemistry*. An unpublished Ph.D. thesis.
- Tesha, M.W. (2018), *Effectiveness of teaching and learning agricultural science subject in selected secondary schools in Tanzania*. An unpublished Thesis of Sokoine University of Agriculture. Morogoro, Tanzani