SCIENCE EDUCATION FOR EDUCATIONAL LEADERSHIP AND INNOVATION IN NIGERIA

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ABSTRACT

The discussion of educational leadership and innovation is one that will not leave out the mention, impact and influence of teachers, students, parents, curriculum planners and government bodies that constitute the stakeholders in the field of education. It is a field or technique that combines different approach or styles to influence stakeholders in education, to produce creative ideas, process product and services. Also, a critical look at the aims, goals and purpose of science education reveals that it portends a great potential to steer stakeholders to educational leadership and innovation. Science education has been acknowledged, worldwide, as a prerequisite for scientific and technological development. Since science and scientific and technological development is crucial to innovations, it is logical to accept that sharing of science contents and process (i.e. science education) with individuals is a means for actualizing education leadership and innovation. The challenges related to principles, processes and practices militating against science education for educational leadership and innovation is presented. This paper presents the overlap and interconnectivity of skills or process of science education and educational leadership and innovation. Recommendations are given on how to view, re-align and adopt science education for educational leadership and innovation

Keywords: *Science, Education, Science Education, Educational leadership and innovation*

INTRODUCTION

Education has diverse definitions which are influenced by cultural and philosophical inclinations of different people of different ages. It could be seen as a process, a long-life process, a direction, a preparation for life and a product among others. Ijaya (2019) gives a common characteristic of education, irrespective of whether defined in a western way or traditionally, as change. Since it has a dynamic nature, the definition of education as a process shall be considered. According to National Council of Educational Research and Training (2014), education is the act of developing the intellect, critical thinking abilities, social and cultural understanding, and understanding of one's own self. What are we expected to do with these skills? To continually develop self and our immediate and distant community. These knowledges, skills, values can be imparted or acquired through teaching and learning, especially in schools or institutions.

A kind or form of education is science education. Science education has its root in Science before its education comes to fore. Hence, it's important to briefly look at what science is as there is no science education without science.

Science has been presented both as a body of knowledge and process. The body of knowledge represents the current understanding of natural systems and the process whereby that body of knowledge has been established and is being continually extended, refined, and revised (National Academic Press, 2007). National Research Council (2007) claims that both elements, that is, science as a body of knowledge and a process, are essential as one cannot make progress in science without an understanding of both. Science is a systematic enterprise that builds and organizes knowledge in the form of testable explanations and predictions about the universe. It is inferable from the writings of South-Eastern Behavior Analysis Center, SEBAC (2002), that science is hinged on facts which are known to be true; empirical; reliable and operationally or functionally described. The goals of science are 3: research to understand (pure research), research to solve a particular problem (Applied research) and dispensing of solutions (SEBAC, 2002). The understanding of science is evident in the ability of an individual to describe, predict, control, synthesize and explain phenomena accordingly or as expected. These skills are expected from any learner in the 21st century even when they are not learning science to become scientists or technologists. Students in science need to be able to understand what leads to natural phenomena such as earth quake, land slide, global warming among others in order to be an informed and updated citizen of the 21st century. Science as a body of knowledge and process are taught to students in schools. These students may be those that may end up being scientists or not. The process of teaching science is referred to as science education.

Science education deals with sharing of science contents and process with individuals who are not primarily considered to be member of the scientific community in order for them to understand science and utilize such knowledge for self and others benefit. Generally, members not part of scientific community consists of individuals who could be students, farmers, market women or a whole community. However, science education as conceived in the context of this paper has to do with students undergoing training in sciences, be it in secondary or tertiary institutions of learning. Science education could be viewed as a process of teaching or training especially, within the school system to improve one's knowledge about the environment and to develop one's skill of systematic enquiry as well as natural attitudinal characteristics. According to University of Texas, Arlington UTA (2017), science education is one of the most important subjects in school due to its relevance to students' lives and the universally applicable problem-solving and critical thinking skills it uses and develops.

The aim of science education may not be to educate future technologists or scientists alone but to also share scientific contents to generality of individuals that may not be scientist (Trefil, 2008). Teaching technological literacy, critical thinking and problem solving through science education gives students the skills and knowledge they need to succeed in school and beyond. Science education could be recognized worldwide as a pre-requisite to technological advancement and involves the study of an in-depth science and in addition, educational knowledge and concepts (Pember & Humbe, 2009). Aina (2013) sees science education in Nigeria as an endeavour that

concentrates on the teaching of science concepts, method of teaching and addressing misconceptions held by learners regarding science concepts. This is not different from what it is beyond the shores of Nigeria. Science Education is an important area which shapes and molds the character of modern societies.

In spite of the importance of science education to enhancing the awareness of individuals and progress the technological advancement of any nation, it continues to be faced with rather complicated challenges not only in Nigeria but globally. Kubilay and Ozden (2012) present challenges to be surmounted to have a sustainable science education.

These challenges are as listed below:
   a) inadequate teacher compensation and professional development to attract, prepare and retain high-quality teachers,
   b) insufficient number of science and technology teachers' taking active role in the preparation of the programs,
   c) the insufficient in-service training of the science teacher in the transition state of a new program,
   d) compartmentalized subjects taught by teachers isolated within and across departments,
   e) students generally lack motivation and have low self confidence in learning,
   f) persistent achievement gaps in science and math among many student subgroups,
   g) demographic changes,
   h) the huge numbers of the students in the class,
   i) the informational education orienting students towards only exam achievement,
   j) the broken link with other lessons,
   k) insufficient physical conditions of schools (less laboratory opportunities),
   l) the intensive curriculum but insufficient time allocation for science education and
   m) the instruction of lesson in an information level and students in passive position (only listening and writing), teachers in active position (writing on the board and teaching in a classical way)

Others not explicitly mentioned in the list include: lack of appropriate monitoring of staff, corrupt tendencies of all stakeholders amongst others. Also, Badmus and Omosewo (2018) highlight the challenges of science education to include students' poor performance, poor funding and low budget allocation to education and claiming that all these challenges are attributed to the faults of the government, students and teachers. Educational leaders such as school or institutions heads, faculty heads, heads of departments etc. are not left out as contributors to these problems. Since science education, as a subset of general education is faced with all these challenges, is it not a pointer to the fact that our educational system is generally faced with issues? That our educational system in Nigeria is facing challenges and needs overhauling is obvious when a state of emergency was declared in the sector in the year 2018 by Prof. Yemi

Osinbajo, the Vice President of Nigeria at a National Economic Council's meeting he chaired (Pulse, 2018). It is quite unfortunate that our educational system is not delivering the right leaders and followers both educationally and politically (Ijaya, 2019). The 21st century is characterized with rapid advancement in science and technology such that virtually all areas of life are influenced by technology and products of science. How well are our educational leaders ready to cope with the trend and assist both teachers and learners of science in Nigeria to achieve the aims of science education? ICT has been presented as a tool to assist educational leadership and influence innovation (Yusuf, 2019). Does science education portend the potentials to also influence educational leadership and innovation? Based on the claim that science education is very important to the development of any nation. It is therefore necessary to explore the process or methods of science education in order to understand if it has the capacity to deliver or influence individuals with capacity of leadership and innovation.

Nexus between Leadership and Educational Leadership and Innovation

If 'lead' means to guide, then leadership would mean the act of guiding. Armstrong (2012) and Grath and Bates (2013) put leadership as centering on inspiring or influencing others to willingly participate in executing a task to achieve a goal they all share. Leadership can be conceived as the ability to influence, motivate, and enable others to contribute toward organizational success (Nayar, 2013) Leadership is a social influence process in which the leader seeks the voluntary participation of subordinates in an effort to reach organization goal. Leadership is both a research area and a practical skill encompassing the ability of an individual or organization to guide other individuals, teams, or entire organizations. John Maxwell wrote 21 indispensable qualities of a leader. These qualities are: character, charisma, commitment, communication, competence, courage, discernment, focus, generousity, initiative, listening, passion, positive attitude, problem solving, relationship, responsibility, security, self-defense, servanthood, teach-ability and vision. Mullins (2004) defines a leader as a person who delegates or influences others to act so as to carry out specified objectives. As regards innovation, it is a new idea, creative thoughts, and new imaginations in form of device or method. Innovation is often also viewed as the application of better solutions that meet new requirements, unarticulated needs, or existing market needs. Innovation signifies creativity and creativity is one of the skills every learner in 21st century should possess according to 21st framework of education.

Educational leadership is the process of enlisting and guiding the talents and energies of teachers, pupils, and parents toward achieving common educational aims. It is a collaborate process of enlisting, guiding and unites the talents and forces of teachers, students and parents. The goals of educational leadership are: to improve the quality of education and the education system itself, create a vision of academic success for all students, strives to maintain a safe and receptive learning environment, delegates responsibility to others, to continually improve instructional methods and curriculum content and borrow and adapt modern management tools, processes and techniques (Armstrong, 2017). Teachers, lecturers, heads of department and institutional heads are

all educational leaders at different fronts and hierarchy. They are all to perform their leadership roles in their various areas of influence and control.

Thus, educational leadership and innovation could mean a collaborate process of enlisting, guiding and uniting the talents and forces of teachers, students and parents - such that they can generate and use new ideas and creative thoughts which shall be channeled towards the improvement of the quality of education and the education system itself. Education leadership and innovation should be initiated by school leaders who will in turn motivate and influence other stakeholders to play their part in ensuring the aims or goals of education in the system and lives of learners are achieved.

Nexus between Science Education and Educational Leadership and Innovation

If the universe is the earth along with the human race and the totality of human experience (Encarta, 2009) and systematic enterprise is the readiness to undertake new ventures or activities that are considered often risky but in a methodical way, then science has a say in leadership and innovation because they are part of human experiences. It will not be out of context if the union and intersection of the processes and procedures of science education and that of educational leadership and innovations is considered. Practicing science requires following certain procedures. To verify or confirm certain laws or theories or to understand the 'why' of a phenomenon, one needs to follow certain linear or non-linear procedures. The procedure to follow is known as scientific process or methods of investigation. These processes can be in stages of four or seven steps based on authors.

The scientific method is a procedure consisting of a series of steps with the goal of problem-solving and information-gathering. Jakubik (2017) presents scientific method as following certain steps which include recognition of a problem and a clear elaboration or description of the problem itself; process of experimentation and data collection; formulation and testing of a hypothesis or potential solution and conclusion. Jakubik (2017) beliefs that with a little consideration and observation, any problem encountered in daily life is a potential possibility to use the scientific method.

Fig. 1 Scientific method
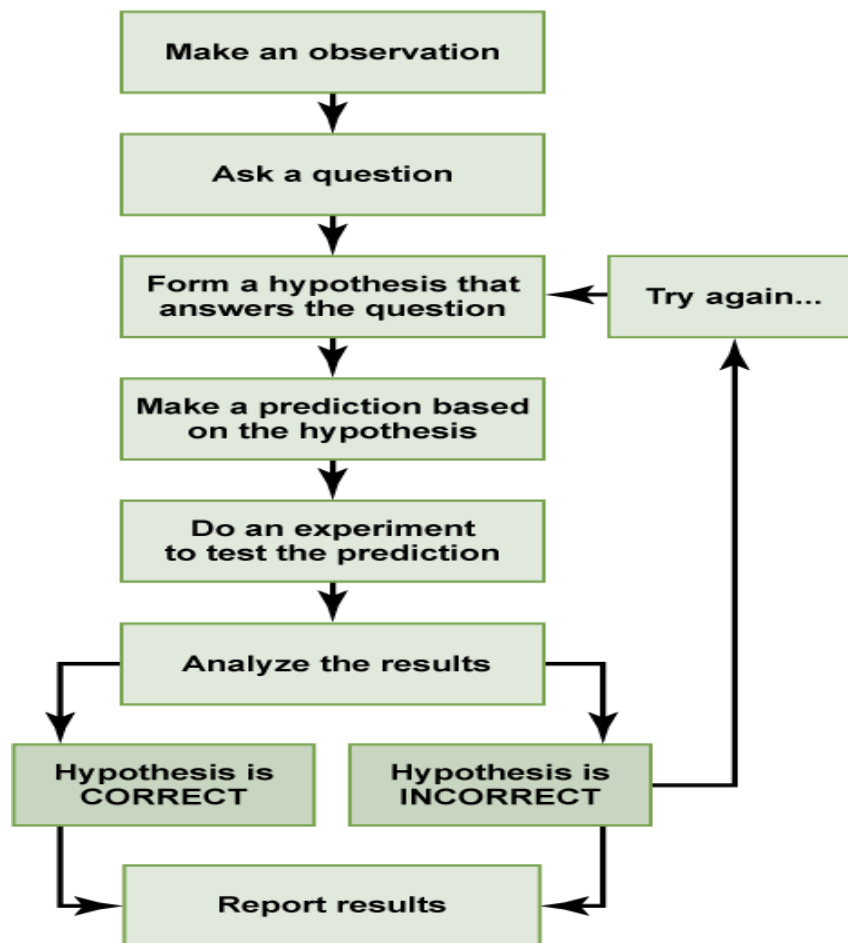
Source: lumen learning (2017)

It is good to note that education in this contemporary era does not only focus on the acquisition of knowledge in the specific subject area, but also the overall development of skills, abilities, and learning dispositions needed for success in the 21st century. Based on this, Applied Educational System (AES) 2019, there are 12 abilities that today's learners need in order to succeed in their careers during this information age. Four fundamental skills out of these have been identified as the 4Cs: creativity, critical thinking, communication and collaboration. Others include, information literacy, media literacy, technology literacy, flexibility, leadership, initiative, productivity and social skills. The Partnership for 21st Century Learning (P21) 2009, identified these 4c's as themes to be overlaid across all curriculum mapping and strategic planning as part of every lesson, just like literacy and numeracy. From the science process and the P21(2009) framework presented above, one can establish a connection and a relationship. To succeed in one's scientific pursuit and understanding of phenomena, critical thinking; collaboration with experienced individuals; and creativity cannot be relegated. It also follows that teachers who teach following the processes of science

inquiry or science methods will succeed in raising individuals who will utilize these methods to observe, guess, verify and analyze information and take accurate decisions. Carrying out findings by adopting the scientific process develops one's critical thinking skill amongst others.

Regarding educational leadership, the leaders in educational setting such as teachers, heads of departments, faculties etc. need to have or cultivate certain traits, characteristics, qualities or potentials that will make them actualize the organization goals. John Maxwell wrote 21 indispensable qualities of a leader which are: character, charisma, commitment, communication, competence, courage, discernment, focus, generousity, initiative, listening, passion, positive attitude, problem solving, relationship, responsibility, security, self-defense, servanthood, teach-ability and vision. It is logical to assume that whoever learns and follows the scientific processes in answering or unraveling phenomena in the laboratory or universe will eventually end up possessing greater percentage of these indispensable qualities highlighted even without siting to learn them in a classroom setting. One example out of numerous issues showing how leaders use or can use scientific methods to solve on-job issue or challenges, whether deliberately or not, can be illustrated below:

Case Study

Problem: Phebe is a 300level student in a tertiary institution. Dr. Xac is the Head of Department (HOD) and Phebe is his cousin. Phebe hinted the HOD about what he perceived to be an injustice between a lecturer and Yac. Yac is Phebe's course mate. Phebe narrated how the lecturer failed Yac because both had a contrary opinion on a particular matter which led to a kind of heated argument. The HOD remembered that the lecturer had once made mention of the unruly behaviour his course mate exhibits. In order to avoid irrational conclusion which will lead to faulty judgement, the HOD needs to apply 'wisdom' to unravel the truth behind the whole stories so as to avoid conflict and misconception that may not only affect the personalities involved but the department and by extension the institution. Scientific method can be adopted to unravel this scenario. How?

a) The problem: Phebe had a heated argument with the lecturer. The lecturer failed phebe. Course mates perceived Yac's failure has been deliberately orchestrated by the lecturer. The issue can degenerate to faculty or institutional matter if not quickly curtailed.

b) Questions to unravel: are these claims true or not?

c) Background research: ask Phebe further questions relating to the students' personality type, disposition to lectures, attendance and others. Ask about his and other students' perception of the lecturer as well.

d) Hypothesize: perhaps the lecturer failed him because of what transpired between them. Perhaps the student truly did not pass his exam. Perhaps the student did not do well in continuous assessment too.

e) Test your hypothesis by doing an experiment, for example, invite the student in question. Invite the lecturer. Finding out from the lecturer his own side of the story and thereafter requesting for the student's attendance and script as applicable. Invite other trusted member of the class offering that course specially to have an insight about the duo.

f) Analyze your data and draw conclusions

g) Communicate your findings to the duo, for example telling the student he failed (if he did fail) the test and exam, showing him script, ask him to apologize to the lecturer and redeem the lecturer's image with other students and after that the HOD can appeal to the lecturer on his behalf. Also, telling the lecturer he is at fault if found guilty, asking him not to shy away from the issue by maturely addressing it with the students who have got that notion and also telling him to re-grade the candidate if the opportunity still exist.

Lumenlearning (2017) puts forward the major precepts of scientific methods such as verifiability, predictability, falsifiability and fairness which are satisfied by the above steps. The concern that if the above steps or similar ones are followed may generate a departmental rift amongst lecturers may hinder the leader from following the procedures as expected. However, it cannot be ruled out that it will restore justice, trust and orderliness if followed with unbiasedness. These procedures are not different from the methodologies involved in carrying out academic researches. This does not mean that scientists are automatically leaders but it only means scientist by virtue of their training and the requirement will develop certain qualities of leaders. A scientist or students of science needs discernment, passion, and commitment etc. in order to break barriers. Also, it does not mean a leader will also be a scientist but it means true leaders to will be able to observe, do an informed guessing, experiment and communicate. Summarily, both have certain intersections that cannot be ignored.

CONCLUSION

Both Science education and educational leadership and innovation have complementing relationship. Science education possesses certain procedures that inculcate certain qualities of leaders in the leaners of science. No doubt, good educational leaders will deploy all tactics, ideas, skills, knowledge and resources to ensuring science education achieve its aims both in the lives of the learners and that of the society as a whole. However, from the challenges ravaging education and science education as highlighted by authors (Aina, 2013; Badmus & Omosewo, 2018; Ijaya, 2019; Kubilay & Ozden, 2012.) it is clear that science education and educational leaders, their leadership and innovations need urgent attention.

RECOMMENDATIONS

It is against this background that the under listed suggestions shall be made for teachers and other school leaders to be innovative educational leaders to students. They should:

1. Emphasize the understanding of the underlining processes of science, design practical ways for these principles, theories to be verified and motivate learners through guided inquiry and other strategies to carry out the discovery and verification processes

2. Consistently have dialogue with the school leadership (HODS, Deans) on issues, activities that will enhance the quality of science education be ready to shift from the teacher-centered approach (pure lecturing method) of science teaching to the integration of both students and teachers centered within the framework of inquiry

3. Develop content knowledge such that will be appealing to the learning pace of the students and have the knowledge of all constituting units, departments or faculties in the institution

4. Set aside meeting days and call for consistent report, at interval, from all units of the institution, they should determine to take swift and appropriate actions that will influence the quality of education in their institution

5. Acquire and allocate resources, including money, time and people, to supports school based instructional initiatives. Also, authorize the selection or the creation of new curricula and instructional programmes.

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