The Roles of STEAM Teacher Education in the Emerging E-Society and Sustainable Development Goals

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Abstract: The ever increasing applications and widespread use of digital Information and Communication Technologies (ICT) in every aspect of human interactions has become a dominant culture in the current post-modern society. Consequently, it is almost impossible for individuals who are e-illiterate to survive in the emerging smart cities and e-societies, in general. Sustainable development in any nation now rests largely on the level of mastery and use of ICT, as well as, the degree to which citizens are e-literate. The task of developing human potentials needed to power sustainable socioeconomic development as well as producing e-literate citizens, is a core function of the education industry. Here in lies the significance of education, especially teacher education in the achievement of sustainable development goals. This paper therefore, addresses the role of STEAM teacher education in the emerging smart cities, e-societies, and sustainable development goals. The concepts of smart cities, e-societies, Sustainable Development Goals (SDGs) and STEAM teacher education were discussed in the paper. The role of STEAM teacher education in the attainment of SDGs, was critically examined, and the paper calls for the restructuring of the Nigerian education system in line with the basic tenets of STEAM education as parts of measures to attain the SDGs in Nigeria.

Keywords: *Smart city, e-society, STEAM teacher education, sustainable development goals, e-literate.*

Introduction

Traditionally education is often considered as a process of enculturation. However, the emergence of schooling few centuries ago propelled education beyond mere cultural transmission to become dominant agent of evolution of human cultures. The gradual evolution of the knowledge-based societies is closely interwoven with the evolutionary role of education, in the society. Ion, Rodica and Ioana, (2009) opined that knowledge creation and its propagation, through education, its dissemination through Information and Communication Technologies (ICT) as well as technological innovations are essential to the development of knowledge-based society. Indeed modern digital ICT permeates every aspects of knowledge-based society to the extent that as a necessity; citizens are increasingly becoming e-literate. This partly account for why the society is also termed e-society. In knowledge –based societies, the focus is on critical thinking leading to knowledge creation and applications rather than on things, virtual world instead of the real one, while keeping abreast with the quantity, complexity and pace of generation of new knowledge requires enormous mental effort (Csilla, 2005).

There is no doubt that the role of education in knowledge creation and propagation in the emerging knowledge-based societies rest on teachers and by extension on teacher education. In the view of Ion, Rodica and Ioana, (2009) education deepens the interrelationships between individual and society, and develops the individual's potentials to survival as a member of the society and contributes meaningfully to the society. Indeed the United Nations Educational, Scientific and Cultural Organization (UNESCO, 2015) highlighted strong connection between personal

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income and the education level possessed by an individual. Sustainable development at individual and society level hinges. The paper discussed the concept of STEAM teacher education, the idea of e-society and smart cities, the history and concepts of sustainable development goals, aspect of sustainable development goal that play role in STEAM teacher education

The Concept of STEAM Teacher Education

The acronym STEAM stands for Science Technology Engineering Arts and Mathematics. It is a concept that emphasizes the need to integrate various disciplines of human endeavors. It could be referred to as innovative strategies that described the need to include Arts with STEM for blends of disciplines. STEAM entails integration of subjects and people from different fields of learning for cross fertilization of opinion and better result. STEAM Education Program Description (2015) defines STEAM as Science and Technology interpreted through Engineering and Arts all based in Mathematics element. There is the need to incorporate STEAM into all levels of education in order to encourage globalization, cooperation and collaboration among different fields.

Teacher education is one of the tertiary educations specifically designed for training all levels of professional teachers. It is being undergone in Faculty of Education in a University, University of Education, Colleges of Education and National Teachers Institute. One of the mandates of teacher education in National Policy on Education is to produce quality education at all levels through appropriate plan and development. One of such plan is the integration of STEAM into the program and strict compliance of its implementation across all levels of education. It is through strict compliance by teacher education program that the inculcation of the STEAM could easily be achieved. This is because teachers are parts of the stakeholders that play prominent roles in spreading information. Going by this goal, the onus then lies on teacher education to integrate arts into their plan and action for optimum results.

STEAM teacher education is also expected to point out the connectivity among several disciplines that seem on related and looked into how such could benefit the populace within their immediate environment, society and economy at large. However this interaction should in no way affect the present and future inhabitants but is expected to encourage peaceful coexistence between organisms and ecosystem. Being able to do this therefore calls for teachers' enquiry and creativity, which another goal of the teacher education as found in the National Policy on Education (Federal Republic of Nigeria, 2013).Teachers enquiry and creativity if properly implemented will go a long way in assisting STEAM teacher education in bridging the gap between theoretical knowledge and practical application. This is the manipulative skill which is one of the emphases of STEAM.

The Concepts of e-Society and Smart Cities

The two concepts are interrelated with one subsuming the other. E- society is a subset of smart city consisting of one or more e- communities. E- society is characterized with digitalized government and economy and usually driven by Information Technology. It is often accompanied with participatory

Smart City is one of the innovative programs that have been gaining popularity since the end of 20th century. Garge, Mittal and Sharma (2017) were of the view that evolution of smart city could be traced to 2008. Smart city could be variously defined depending on the perspectives at which one examines it. A city is described as being smart when fully furnished with information communication technologies and providing e-services to a population. Smart city according to Eremia, Toma and Sanduleac (2017) is that which utilizes Information Communication Technology (ICT) and data driven to integrate planning, participatory approach and financing

Smart city is often described as a community that is technologically developed and those provides a better and improved quality of life and create more opportunities for the harmonious life and development of its citizens. Smart cities according to Garg, Mittal, and Sharma (2016) are cities associated with easy access to information as well as information dissemination from source to destination. These definitions reveal the significance of ICT to smart city. This is why Garg et al. (2017) often submitted that Information Technology is the backbone of smart city that is highly useful in promoting easy access to information anytime, anywhere, and by everybody at their convenience.

This city is often characterized with effective networkable business climate, smart professions and smart professionals who participate in decision making, urban life and development (Ishkineeva, Ishkineeva & Akhmetova, 2015). Eremia, Toma and Sanduleac (2017) ascribed sustainable economy, innovative ideas, inclusive education, resources efficient, dynamic economy and climate friendly environment to smart cities. This is to say that smart cities are also expected to imbibe the concept of sustainability with the spirit of not harming the inhabitants of today's and future's generations. Smart city is often characterized with harmonious co-existence among citizens, businesses and governors this is in line with the assertion of Garg et al (2017) that the three main pillars of smart cities which are citizens, governors and enterprise need to be collaborated for optimum results.

The degree of smartness of a city depends to a large extent on the technological readiness of such city and the extent of spread of the e-services. E- services exert a very great influence on virtually all fields of human endeavors, ranging from educational, health, banking, businesses , building and governing sectors .This implies that existence of e- services

or e-society reduces stress of face to face transactions encourages easy transition to smart city in educational and health industries among others .

History and Concept of Sustainable Development Goals

Sustainable Developments Goals (SDGs) was proposed by committee of nations to fill the gaps noticed in the Millennium Development Goals. Carruthers (2018) stated that SDGs which was adopted in 2015 and created by the United Nations with the intention of creating common set of developmental goals for all communities in every nation for 2030 agenda of sustainable development. Sustainable development unlike the Millennium Development Goals (MDGs) has 17 goals and included aspects that deal with the economic and environmental dimensions in addition to the social dimension which was the primary focus of the MDGs (Catholic Agency For Overseas Development [CAFOD], 2015). United Nation Development Program (2018) asserted that SDGs is expected to finish the job of MDGs and as such will tackle the root causes of poverty and the universal need for development that works for every person irrespective of gender, race or ethnicity.

The milestone for the promulgation of the SDGs began as far back as 1993 with the creation of the Committee for sustainable development by the United Nations. This was followed with the review and renewed commitment for the implementation of the Agenda 21 at the Earth Summit +5 in 1997, and in the year 2000 at the Millennium summit in New York comes the birth of the Millennium Development Goals otherwise known as the MDGs with eight goals. Sachs (2012) opined that the MDGs mark a historic and effective method of global mobilization to achieve a set of social priorities worldwide. The main objectives of which include but is not limited to promoting global awareness, political accountability and public pressures to fighting against poverty for the years 2000 to 2015. In the year 2002 there came an increase renewed interest and commitment by committee of nations to the pursuit of the sustainable development with the Johannesburg Plan of Implementation otherwise referred to as JPOI. JPOI and the Agenda 21 were built upon at the Rio +20 in 2012 emerges the concept of SDGs.

The term sustainable development is based on the premise that nations can meet the needs of the present without actually compromising the ability of the future generations to meet their own needs. Sachs (2012) submitted that because of the growing urgency of sustainable development for the entire world emerged the idea for the concept of Sustainable Development Goals (SDGs). SDGs also known as global goals are universal action call to end poverty, protect the planet and ensure that there is global peace and prosperity with poverty eradication being at the heart of the 2030 agenda (United Nations Development Programme [UNDP], n.d.). The major cardinal goals of the SDGs as highlighted by the United Nations include but not limited to: ending poverty and hunger, bringing about improved good health and well-being, qualitative education, gender equality, provision of good clean water and sanitation, ensuring there is affordable and clean energy, sustainable cities and communities. Sustainable cities and communities which is the 11th goal requires that governments should make the cities and human settlements inclusive, resilient, safe and sustainable (UNESCO, 2017).

Aspect of Sustainable Development Goals that Play a Role in STEAM Teacher Education

Goals one, two, four, nine, ten and eleven of Sustainable Development Goals are to eradicate poverty; zero hunger; quality education; industry, innovation and infrastructure; reduced inequalities; and sustainable cities and communities respectively are very germane to the actualization of the goals STEAM teacher education with respect to the concept of STEAM . Teacher education as one of the tertiary education is expected to promote and encourage scholarship, entrepreneurship and community services (FRN, 2013).This is to say that the goal encourages the program to be employers of labour through its entrepreneurship program. Part of the awareness sensitization effort towards this is the introduction of bio-entrepreneurship opportunities to undergraduate education students through their method course ,i.e., EDU 313.

Bio-entrepreneurship skills calls for teachers' creativity and commitment to duties through establishment of their own trade without necessarily looking for a white collar job. This goes a long way in eradicating poverty through employment generating and wealth creation. Hence, a very good means of sourcing for livelihood, self-sustenance and zero hunger. This translates to actualization of goals one and two of SDGs.

Emphasizing quality education at all level with respect to educational plans and development also constituted the goal of teacher education. Coincidentally this corresponds to goal four of SDGs. which is quality education. Quality in the area of contents, pedagogy and personalities of the teacher contribute tremendously to the success of the teacher education and SDGs. Teachers are also expected to provide career counseling services to learners and are supposed to be a lifelong learner. Professional growth of teachers should be intensifying because teachers are supposed to be life learners. This is because it is through learning that quality and worth of teachers could be sustained.

Industry, innovation and infrastructure reflects goal 9 of SDGs. This goal corroborated one of the purposes of teacher education that it is desirable to take cognizance of the changes in the methodology and in the curriculum and that teachers should be exposed to these innovations. One of such innovation is the integration of Information Technology

(IT) in to training of teachers. The effectiveness of IT into teacher education depend greatly on infrastructural facilities like electricity and this consequently resulted to industrialization in such location. This implies that the 2013 edition of national policy had cater for the needs of present generation and next generation with respect to actualization of the SDGs. Teachers as the implementer of the policy are implored to be committed and motivated in discharge of their duties.

Federal Republic of Nigeria (2013) stressed the need to ensure equality quality education for all at every level. The idea in this goal reflects the need to understand the strength of students and make provision for the development of their needs. This is why one of the goal of teacher education had it that teacher education should be extended at NCE and degree level to cater for technical, vocational, business and special education. This is one of the ways by which inequality could be reduced the actualization of goal 10 which could be interpreted as every child count.

Having a sustainable cities and community is goal number 11 which could be correlated with several roles of teacher education. Such goals are assisting teachers to fit into social life of community the society at large and enhance their commitment to national goals; and providing teachers with intellectual and professional background that will assist them to cope with the changing words. This correlates to having peaceful coexistence between living and ecosystem and might be very helpful in conflict resolution. Depending on the perspective of the arguments, the goals of SDGs and teacher education are connected to one another, and should be considered as such for the success of 2030 agenda of SDGs.

Conclusion

This paper simplified the concept of e-society and smart cities as well as that of STEAM teacher education. Attempts were also made to the history and concepts of SDGs, alongside with the aspects of SDGs that is expected to be achieved through teacher education. The article was concluded by suggesting useful recommendations on how smart cities could be realized in developing country like Nigeria.

Recommendations

- Curriculum developers should set up monitory team that will ensure strict compliance of the implementation of the goals.
- Teacher training institution should emphasize the need to integrate and utilized ICT to all levels of education.
- Programs seminars and workshop should be organized to keep teachers abreast of the innovation in their profession as well as update the knowledge of the in-service teachers.
- Awareness sensitization should be intensifying by professional bodies like SAN, STAN, MAN, BOSON among others.
- Textbooks authors should design their textual materials to meet the emerging trends in the society.
- Government should make available basic amenities that will facilitate transition of normal cities to smart ones.
- Students should be encouraged to develop positive attitude towards embracing smart cities.

References

Carruthers, J. (2018). *What are the sustainable development goals?* Retrieved from citiscope.org/habitatIII/explainer/2015/03/what-are-sustainable –development-goals

Catholic Agency For Overseas Development. (2015). *Sustainable development goals.* Retrieved from https://cafod.org.uk/About-us/Policy-and-research/SDGs-policy-reports

Csilla, S. (2005). Knowledge-based society? *European Integration Studies, Miskolc, 4*(2), 87-94.

Eremia, M., Toma, L., & Sanduleac, M. (2017). The smart city concept in the 21st Century. *Procedia Engineering, 181*, 12-19.

Federal Republic of Nigeria (2013). *National Policy on Education* Federal Ministry of Education. Science curriculum for senior secondary schools, 1- 56.

Garg, S., Mittal, S. K., & Sharma, S. (2017). Role of e- training in building smart cities. *Procedia Computer Science, 111*, 24-30.

Ion, P., Rodica, G., & Ioana, D. (2009). The role of education in the knowledge-based society during the economic crisis. *Annales Universitatis Apulensis Series Oeconomica, 11*(2), *645-651.*

Ishkineeva, G., Ishkineeva, F., & Akhmetova, S. (2016). Major approaches towards understanding smart cities concept. *Asian Social Science, 11*(5), 70-73.

Sachs, J. (2012). *From millennium development goals to sustainable development goals.* Retrieved from https://www.thelancet.com/journals/lancet/article/PIIIS0140-6736%252812%252960685-0abstract

United Nations Development Programme. (n. d.). *What are the sustainable development goals?* Retrieved from www.undp.org/content/undp/en/home/suatainable-development-goals.html

United Nations Development Programme. (2018). *What is the 2030 agenda for sustainable development?* Retrieved from www.ng.undp.org/content/nigeria/en/home/post-2015sdg-overview.html

United Nations Educational, Scientific and Cultural Organization. (2015). *Education for All 2000-2015: Achievements and Challenges - EFA Global Monitoring Report 2015.* Paris: UNESCO

United Nations Educational, Scientific and Cultural Organization. (2017). *Education for sustainable development goals learning objectives.* Retrieved from http://unesco.unesco.org/images/0024/002474/247444e.pdf