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EDUCATION FOR SUSTAINABLE DEVELOPMENT: A BEDROCK FOR PRE-SERVICE SCIENCE TEACHERS' 21ST CENTURY SKILLS IN NIGERIA

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Abstract

For the past decades, the challenge of sustainable development continues to be a teething problem globally and in the mind of average Nigerians particularly. When a nation attains sustainable development that means economically, socially and for environmental factors of her economy she has reached her equilibrium level. Conversely, when hunger, poverty, insecurity, inequality, poor health management, child abuse and child trafficking, dysfunctional education, corruption, among others is ravaging the country, the idea of sustainable development cannot function effectively, and this may result to complex challenges. In the context of this paper, sustainable development is the development that meets the demands of the present without jeopardizing the ability of the future generations to meet their own needs. Education for sustainable national development (ESND) aim at promoting and improving basic education for national stability, reorienting the existing educational system at all levels to address sustainable development issues, sensitizing and promoting public awareness and understanding of sustainability, training and skills development for the 21st century skills globally. Education for sustainable national development views "education" as the only tool to attain sustainability of any developing nation such as Nigeria towards the actualization of 21st century scientific skills in pr-service teachers. This paper focuses on the following topics: concept of education for sustainable national development, pre-service science teachers' 21st century skills, challenges facing the implementation of education for sustainable national development (ESND) in developed and developing countries, barriers to education for sustainable development in Nigeria, summary, conclusions and recommendations.

Keywords: education, sustainability, national development, pre-service science teachers' twenty first century skills.

Introduction

Education is the key factor that can achieve sustainable development leading to preservice science teachers 21st century skills acquisition in any nation. Education for sustainable national development (ESND) comprises integrating key sustainable development issues into teaching and learning for acquisition of learners' 21st century skills (UNESCO, 2020). Among these are instructions about climate change, disaster risk reduction, biodiversity and poverty reduction and sustainable consumption, human right education and creative skill acquisition. Additionally, ESND requires active and participatory teaching and learning strategies that motivate and empower learners to change their behaviour and take proactive actions for sustainable development. Besides, it enhances competencies like critical thinking, imagining decisions in a collaborative way and being able to proffer solutions to life problems as need be (Leicht et al., 2018).

Looking at the current educational systems of some countries globally and particularly, Nigeria it shows that ESND has not been effectively come on board due to various factors such as socio-cultural, economical, environment challenges characterizing the international communities, to mention a few. The persistence manifestations of these anti-sustainable issues call for the need to educate the entire globally communities to realize and equally understand too that their actions at any point in time can create a positive or negative impact on their lives and others. When ESND is fully integrateded into educational system of all countries globally, it will yield positive results of empowering citizens, changing of attitude and work towards achieving the goal of sustainability in education and pre-service science teachers' skills in the 21st century.

Education for Sustainable National Development (ESND)

It has been identified by UNESCO (2013) that education is an essential tool for achieving sustainable development at the United Nations 21st agenda. Similarly, the World Commission on Environment and Development (1987) reiterated that development is sustainable if it "meets the need of the present without compromising the ability of the future generations to meet their own needs" (WCED 1987). This implies that sustainable development can be referred to "equitable and balanced" development suggesting that for science education learners to acquire needed 21st educators' scientific skills that would endure the test of time, it should balance the interests of different groups of people, within them and among other disciplines and persistently doing so in three major inter-related areas – economic, social and environmental development. Education for sustainable development represents a cursor that leads to social change through education, training and public awareness on values, behaviour and lifestyles required for sustainability and and capacity

building of the society at large (UNESCO, 2018). In 2015, the United Nations General Assembly set 17 Sustainable Development Goals (SDGs) aimed at empowering people to respond and adapt to present and future opportunities; that is, to live sustainable lives (OECD, 2017). The role of education as a major tool for linking the environment with responsible development is reflected in all 17 SDGs, particularly SDG 4.7, which aims to "ensure that all learners acquire the knowledge and skills needed to promote sustainable development" (Leicht et al., 2018). This means that education for sustainable development involves learning how to make decisions that balance and integrate the long-term future of the economy, the natural environment and the wellbeing of all communities near and far, now and in the future. It empowers learners to take informed decisions and responsible actions for environmental integrity, economic viability and a just society, for present and future generations, while respecting cultural diversity. It is about lifelong learning, which is an integral part of quality education. Education for sustainable national development is a holistic and transformational education which addresses learning content and outcomes (Ferguson, et al., 2022). Elaborately, ESD as learning content, moving toward integrating significant issues, such as climate change, biodiversity, disaster risk reduction (DRR), and sustainable consumption and product (SCP) into the curriculum (Hoga & Tormey, 2008). Regarding to pedagogy and learning environment, it helps designing instructions and learning in an active, interactive, learner-centered manner to enable exploratory, action-oriented and transformative learning, rethinking learning environments for both physical as well as virtual and online to motivate learners to act for sustainability. Education for sustainable national development enhances learning outcomes stimulating learning and promoting core competencies such as critical and systematic thinking, collaborative decision-making and taking responsibility for present and future generations to achieve the goal (ESDC, 2011). Education for sustainable national development encourages societal transformation by empowering learners to transform themselves and the society they live in by enabling a transition to better economics and societies. UNESCO, 2013 identifies the capability of ESD as equipping learners with skills for profitable jobs, motivating people to adopt sustainable lifestyles, empowering people to be global citizens who engage and assume active roles, both locally and globally, to face and resolve global challenges and ultimately to become proactive contributors in the creation of a more just, peaceful, tolerant, inclusive, secure and sustainable world. Since education for sustainable national development encourages participatory critical thinking and skills establishment, there is need to discuss some of the 21st century pre-service science teachers' skills required for effectiveness and productivity

21st Century Skills

Generally, 21" century skills are diverse of skills and capabilities which are required for successful participation in daily endeavour such as learning, business, work and other societal responsibilities.

Educators have identified diverse skills that are necessary to cope with modern age, but for the purpose of this paper, Crockett (2016) skills classification will be adopted because it seems to take care of the skills holistically. They include problem-solving, creativity, analytic thinking, collaboration, communication, ethics, action, and accountability.

Problem-solving

Diverse challenges crop up daily that require man to find solutions. In science education, these skills are very significant for science teachers to possess to be effective. Scientists right from the history and development of science have been employing these skills. Among the examples of scientists with high problemsolving skills are Wernher von Braun and Stephen Hawking. Werner von Braun was one of the leading experts in rocket development in the 20th century in USA who and his team were instrumental to the design and development of Jupiter ballistic missiles, Jupiter C, Jun II, and Saturn I launch vehicles respectively. He was team leader of the group that provided the Saturn V launch and later the Apollo II mission which enabled Americans to land on the Moon in 1969.

Creativity

The term creativity is said to be the capacity to break with status quo and generate meaningful new ideas, innovations, forms, methods, and interpretations (Akpan, 2018). Individuals that are creative turn new and imaginative ideas into reality; they perceive the world in new ways; recognise and trace hidden patterns especially among phenomena that appear unrelated. Among the creative scientists are Charles Darwin, Thomas Edison, Marie Curie and Isaac Newton. Isaac Newton a mathematician, physicist and scientist was very creative, and he cannot be forgotten as a result of creativeness. He developed new laws in the areas of mechanics, gravity and motion.

Analytical Thinking

This is the ability of an individual to separate abstract whole into components parts in order to examine and study the different parts and the relations among the parts. The skills comprise abstract thought, deductive reasoning, logical thinking, among others. The importance of this skills in science and every aspect of human endeavour cannot be overemphasized as they have the capability of information gathering and articulation in solving problems. This skill helps in making reliable predictions from evidence available. Albert Eintein is a typical example. He was known in his work that described that light behaved like wave and a stream of particles known as quanta or photons which behave like wave likeparticle duality that formed the foundation for quantum mechanics and advances in television, lasers and semi-conductors, among other discoveries.

Collaboration

Collaboration is the working together with another person or in a group to achieve something of positive value. This type of skill requires putting ideas and experiences together to arrive at valuable result. Examples of those who work in group to achieve valuable goals in science abound. A team of more than 30 surgeons in India in November 2007 who performed a

tasking and challenging 24-hour operation on Lakshmi Tatma, a two-year old girl who was born joined at the pelvis to a 'parasitic twin' that stopped developing in the mother's womb. The surviving foetus absorbed the limbs, kidneys and some body parts of the undeveloped foetus. She had four arms and four legs. The doctors worked through the night to remove the extra limbs and organs. A team of neurologists separated the fused spines while orthopaedic surgeons removed most of the 'parasite', carefully identifying which organs and internal structures belonged to the girl. The operation included transplanting a good kidney into Lakshmi from the twin.

Communication

Communication refers to way in which people express thoughts and ideas effectively making use of oral, written, or nonverbal methods. Multimedia means including video and imagery in different forms can be employed. One of the aspects of effective communication is the ability to listen carefully in order to give meanings, values, attitudes and intentions. In science education and other areas of life communication is used to inform, instruct, motivate, and persuade people. The ICT skills acquisition for everybody particularly 21st century pre-service science teachers globally is highly required.

Ethics, action, and accountability

This skill among others includes global awareness, tolerance, environmental awareness, adaptability, personal accountability and fiscal responsibility (Crochett, 2016). Every citizen in the society is demanded to practice personal, global, and online responsibilities activities that focus on how to make the world a better place for everyone and worth living. In 21st century, there is need to create humane, selfless and caring persons who respect other cultures and their beliefs. Such people make concerted efforts to be diligent in their daily chores and desire to be honest and up and doing in their interactions with people.

E-learning teaching and learning in schools, colleges and universities should therefore intentionally emphasize on internet safety and the habit of having empathy for others without harming anyone. Ethics identifies a set of standards of behaviour which makes it easy to take a decision on how we should act under different situations (Brown University, 2017).

Education for Sustainable National Development Goal

The significance of ESD that promotes perservice science teachers' skills in the 21st century cannot be underestimated. For the fact that education being viewed as a tool for change if effectively utilized globally can enhance effectiveness and productiveness of science teachers in the entire world. With a world population of over 10 billion people with limited natural resources, we need to learn to live sustainably in all areas. We need to consciously involve in action understanding the fact that what we do today can have implication on the lives of other people and the future generations. The implication of this is that ESND empowers people to change the way they think and work towards a sustainable future. UNESCO aims to improve access

to quality education on sustainable development at all levels and in all social contexts, to transform society by reorienting education and helping people develop knowledge, skills, values and behaviour needed for sustainable development (UNESCO, 2017). The current emerging international recognition of ESND as an integral element of quality education and a key enabler for sustainable development that will enhance 21st skills acquisition among learners for relevance soon. The goals of SD are well and clearly stated and to be adopted by the global community for the next 15 years as contained in the target 4.7 of SDG goals. Target 4.7 of SDG 4 on education addresses ESD and related approaches such as Global Citizenship Education.

Sustainable Development Goals comprise the following:

- End poverty in all nations everywhere.
- End hunger, achieve food security and improved nutrition and promote sustainable agriculture.
- Ensure healthy lives and promote wellbeing for all ages.
- Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.
- Achieve gender equality and empower all women and girls
- Ensure availability and sustainable management of water and sanitation for all.
- Ensure access to affordable, reliable, sustainable and modern energy for all.
- Promote sustained, inclusive and sustainable economic growth. Full and productive employment and decent work for all.
- Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.
- Reduce inequality within and among countries.
- Make cities and human settlements inclusive, safe, resilient and sustainable.
- Ensure sustainable consumption and production patterns.
- Take urgent action to combat climate change and its impacts.
- Conserve and sustainably use the oceans, seas and marine resources for sustainable development. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forest, combat desertification, halt and reserve land degradation and halt biodiversity loss.
- Promote peaceful and inclusive societies for sustainable development; provide access to justice for all and build effective accountable and inclusive institution at all levels.
- Strengthen the means of implementation and revitalize the global partnership for sustainable development (UNESCO, 2017).

However, the goals and objectives of education for sustainable national development it is still far from being achieved as result of inherent various factors or challenges.

Challenges Confronting ESND for Science Students Education Skills' Acquisition in the 21st Century

No doubt many countries in the world have imbibed and bought the need for education to achieve sustainability, few significant achievements have been recorded at any stage. Reasons for this abound from many areas. One of such is lack of vision or awareness. Funding policy is another challenge, among others. Hopkins (2012) identified twelve major issues impeding progress of education for ESD during the 1990s and 21st century. He recommended that starting from the planning stage the problems can be tackled, government at various levels should prevent or reduce delays of implementation of ESD efforts for the attainment of sustainability. Besides, governments as a matter of fact must address and redress the challenges that are peculiar to local conditions such as the relationship quality between the school managements and the lecturers' union.

Hence, Hopkins summarized the challenges and suggestions as:

- There is need for more awareness for ESD: Initially, ESD programme was launched to create and develop awareness within the educational community and the society to reorient education for the achievement of sustainability.

Reorientation of education in order to address sustainable development will not be possible If government officials or school management are not aware of the significant connections between education and sustainable development. When the public are conscious of the fact that education has the capability to improve or enhance the implementation of national policies, regional land and resources management programs and local programs, among other sustainability, hence education should be oriented to achieve this objective.

- Restructuring and infusing ESD in the existing science education curriculum: Integrating ESD in the existing curriculum can be determined by each country depending on their peculiarities. Their decision may be either to integrate ESD into the existing curriculum or design an entirely new one and the modes of implementations such as sustainable development, environmental education/population education, but to mention a few. Each country needs to specify whether their teachers are to teach about sustainable development, modify or to change the goals and methods of education to achieve sustainable development.

- Connecting existing issues of science educational reforms and economic survival: The productivity and effectiveness of educational systems globally, are profoundly being discussed as regards of the societal changing and growing demands. The current general discourse for the call of educational reform may act as enzymes to promote ESD. Linking ESD to one or more priorities of science educational reforms, it might yield good results. Conversely, it will be difficult to achieve this if advocates of this idea try to add entirely new phenomenon to current overloaded.

- Addressing the complexity of sustainable development concept:

Sustainable development is an emerging, vast and complex concept. The meanings and definitions of SD vary among scholars and practitioners who made efforts trying to define it and how to implement it at different levels in the society. Since it is difficult to define and implement, hence, it might pose challenge to teach. The greatest challenge is the issue of completely reorienting an entire education system particularly science education to achieve.

• Challenge of community participation In ESD programme: Lack of clear and defined goals of reorienting the global educational system pose a serious challenge. How to educate different sectors of the economy such as the teeming teachers' population: agricultural instructors, water treatment trainers, environmental education teachers, among others. How these trainers and means of implementation pose a serious threat to the success

How to engaging traditional discipline in multi-disciplinary framework: ESD is encompassing and interdisciplinary and shares concepts and analytical tools from many disciplines. Hence, where subjects are decompactified and divided and taught in a disciplinary structure ESD could be difficult in such situations. In countries where national curriculum describes in detail the context and sequence of study in each discipline, ESD will be challenging to implement. While in other countries where there is commonality ofcontent and is described generally, ESD will be more easily implemented, but this demands the resourcefulness and creativity of the teachers who can teach across many disciplines.

• Responsibility sharing among many government parastatals: People believe that an informed society is solely the responsibility of the ministry of education. Every sector has responsibility in ESD to make it successful. For instance, ministry of health has role to take in ESD, just as they have a stake in SD. Expert experiences, resources, and funding from many ministries must be shared among them, then the possibility of building a high-quality, successful education program be promoted. Personnel capacity building: The implementation of a new education policy demands responsible, skilful, accountable personnel and expertise in both systematic educational change and sustainable development. Immediate knowledgeable and capable personnel (leaders at various categories) must be developed through effective strategies. It is unrealistic to expect nations to retrain teeming populated science teachers and thousands of administrators in either or both ESD and educational change. Strategies must be developed to employ the strengths and use existing skills models of personnel.

• Financial and material resources development: Implementing ESD will need functional basic education. The basic goals which were established at Jontiem and reaffirmed at Dakar, stated that educating more children and increasing the universal average minimum of schooling to six years. To achieve these goals require employing more teachers. They must be trained, and current teachers must be retained to reorient their curricula to address sustainability. This will gulp new

financial resources to reorientate them. The current educational programme must continue while the new curriculum is being designed and developed for ESD to successfully implemented.

- Policy development: There should be a well-defined policy to back up ESD for its integration and implementation from the state and national authorities of the government. Shortfall of this resulted to be the downfall of the 1970s global effort to integrate environmental education into the primary and secondary school curricula. The same fate could befall the ESD effort at the higher level. Policy makers froms ministries are in position to formulate the policies that will make the reform successful. While the interpreters and the implementers such as administrators, teachers and community leaders at the local levels must apply it at the local levels.

- Supportive and safety climate development: Climate safety and support are needed in order to bring about the major changes required by ESD. Reformations, changes, experiments and risks taken are required by policy makers, administrators and teachers to make and accomplish new educational and sustainable goals. Therefore, authority and educational community support are needed to change the status quo. In case if parents or vested interest groups in the community question or criticize teachers' initiatives they must feel the administrators' support for their efforts. Administrators and teacher at all levels must be given the right through policy development to introduce new or controversial topics and pedagogical strategies. However, there must be checks and balances within professional guidelines and cultural context should also be in place through effective quality control.

- Making sustainability to be generally popular culture: Despite the clamour for ESD globally, the themes of sustainability are not in the top gear in popular cultures or governmental policies. One principle of sustainable development is that the rates of use of renewable resources should not exceed their rates of regeneration, for instance but many societies have developed or are developing a "disposable culture". We use discard disposable beverage containers, food wrappers, plates, and eating utensils daily. The truth is that this disposable culture is using these resources as trees and fossil fuels more rapidly than they can be replaced. This is because the principles of sustainable development are not currently integrated into daily life and governmental policy, the emergence and infusion of ESD could become an important motivator and anchor of community-based sustainable development. Therefore, ESD could modify, shape and encourage behaviour, values and ethics that support an informed knowledgeable individual in the society that has the political will to achieve a sustainable life.

Besides. UNEP (2011) identified challenges confronting educational for sustainable development (ESD), thus:

To integrate sustainable science and education.

To strengthen co-ordination and collaboration between different levels of education for sustainable development; and

To mitigate information and knowledge gaps between different parts of the world.

Additionally, there is the challenge tailoring all educational policies, taxonomy and programs towards sustainable development.

Difficulties of integrating ESD in Nigeria

The challenges of ESD as regards of sustainability for development and preservice science teachers' 21st century skills abound particularly Nigeria which seems to have the highest number of out-of-school children. (GPE, 2012). These barriers were highlighted as follows:

• Poor funding of education: Global financial support for education is decreasing drastically despite the concerted efforts of Global Partnership for Education
(GPE) in helping many developing countries to increase their annual budget for education. Financial grants have dropped significantly for basic education for the past few years (GPE 2009 and GPE 2012) hence, resulting to inability of countries to get children into schools for learning. All the 59 developing countries that receive aids from GPE including Nigeria face the challenge of funding shortfall of $ 34 billion for few years to come for primary and secondary education.

. □ Shortage of trained and qualified teachers: This is a serious challenge confronting integration of ESD Nigerai. A good number of teachers that are currently teaching are untrained and qualified resulting to children inability to learn the basic science subjects right from elementary schools even to higher levels. Even the numbers of teachers in post to schools are not adequate throughout the world. The UN for example, estimates that about 1.9 million additional new teachers are required to achieve universal primary education by 2015, and 6.3 million more are needed to achieve universal lower secondary education by 2030. Most of the teachers in post to teach in Nigeria do not meet international standard.

• Shortage of classroom and science laboratories:

Shortage of classrooms and science laboratories pose great challenge to any educational programme. In sub-Sahara African countries including Nigeria, learners are found learning in overcrowded classrooms, even some under the trees without classrooms at all, talk less of adequate science laboratories. There are average of over 100 found learning in a class in primary and secondary schools in Nigeria for instance especially in the rural areas of the country. Other physical facilities are grossly in short fall such libraries, workshops, running water, toilets, among other facilities in the universities. In other African neigbouring countries like Chad, only one in ten schools has healthy potable water and many without toilet.

• Lack of instructional and learning resources: In a country where there are no current textbooks and learning resources no educational programme can be successful. In the United Republic of Tanzania, for instance, only 4% of all grades 6 pupils had a reading textbook to themselves. Similarly in Cameroon, there are 15 primary school students that share a

reading textbook and 16 for every Mathematics textbook in Grade 2. In secondary schools and tertiary institutions science facilities and other materials are grossly short in supply. Adequate and appropriate instructional resources are required for effective teaching. Without these resources being adequately supplied to schools to promote sustainable development and pre-service science teachers' acquisition of 21st century skills for effectiveness cannot be achieved.

Consideration for the physically disabled: ESD is for all, denying these group of people in the society may inhibit the successful integration of ESD for sustainability. In some of the worlds' poorest countries, up to 95% of children with physically challenged are not in the school system. Good hand of fellowship must be extended to this set of people in the society with the necessary resources to make the impact of ESD holistic.

- Gender issue: This factor still create challenge in educating the citizen globally especially in Nigeria where some uneducated parents refuse to send their female children to schools particularly for western education. Despite the efforts of government at various levels to promote girls' education, a good number of young women are still out of school it is evidence in female enrolment into science courses in the university. More than 95 million young women living in developing countries are uneducated. Poverty forces many families to choose which of their children to send to school, hence opts for early marriage. Girls often miss out due to belief that there is less value in educating a girl than a boy. This still occurs mostly in rural part of the villages in the world.

- Challenge of insurgency and insecurity: In a country where insecurity thrives, and insurgency is the order of the day no interventions of any educational programme can be successful (Adebisi, 2016). From 2011 upward, about 50% of all the worlds' out-of-school children were living in countries affected by conflict which prevents governments from functioning; teachers and students often flee their homes, and continuity of learning is generally hindered especially in insurgency affected areas in northeast of Nigeria.

- Poverty and poor standard of living: Any society that is ravaged with poverty and poor standard of living with the people underfed and poor health cares, it is very difficult to achieve significant achievement for any educational innovations especially ESD. Malnourishment of people has negative impacts on brain development which may result to poor performance in schools' activities. Around 171 million children in developing countries, Nigeria inclusive, are stunted by hunger by the time they reach age 5 (GPE 2009 – 2012). Good feedings and health care are good cursors to good academic performance and effectiveness of students.

- Cost of education: Despite the fact many countries globally have declared free basic education for her citizens projecting that poverty and lack of money should not be a stumbling block to children basic education. To this effect, Federal Republic of Nigeria, for past decades, have announced the abolition of school fees,

hence resulting to increased children enrolment in the schools. Unfortunately, in recent years past, this has been reversed as a result of economic depression consequently forcing many children out of schools' system. For many poor families, school remains too expensive, and children are forced to stay at home doing nothing or work themselves. In some developing countries like Nigeria, malfunctioning of public (government) schools leads parents to sending their children to private schools, where school fees are very high and unaffordable for the poorest families who risk making themselves destitute in their efforts to get their children better lives through education (GPE 2009 – 2012).

Summary

In Nigeria, in order to effectively implement ESD that will enhance 21st preservice science teachers' skills for effectiveness and productivity, all hands must be on deck in the country, the government, tertiary institutions, post primary and primary school heads, ministries of education, among other stakeholders must plan to address the challenges stated. These issues should be considered at every level, especially at the national level the country, to ascertain persistent implementation of ESD. Meaningful and objective deliberation, good planning and development focused on at tackling the challenges will enhance the successful integration and implementation of ESD programs and modifying the existing educational curriculum to achieve 21st pre-service science teachers skills for sustainability.

Conclusion

Without an iota of doubt, education is the factor and means for successfully achieving national sustainable development globally. Relegating education and learning for sustainable development to bare ground, the goal of 21st century pre-service science teachers' skill acquisition for effectiveness and productivity will be a forgotten one. In this paper, the writers focused on these concepts: Education for sustainable national development, ESD goals, likely challenges confronting the implementation of ESD for 21st pre-service science teachers' skills acquisition for effectiveness and productivity and difficulties of integrating ESD in Nigeria.

Recommendation

The following recommendations are made by the writers for successful implementation of ESD to promote sustainable national development for 21st century pre-service science teachers' skills acquisition for effectiveness and productivity:

- Enlightenment campaigns should be planned and organized at local and national levels for school administrators, curriculum developers, teachers and head teachers at all levels of education, especially the university. The programmes should aim at increasing the awareness and knowledge all the educational actors stated above.

- All educational stakeholders at all levels should be kept on always updating them especially at the point of implementation, since ESD is a long-term endeavour. Other government and non-governmental organizations, donor

agencies, and the mass media, among other stakeholders should be kept updated as well.

- UNESCO should find ways of integrating 21st century skills for teachers' effectiveness and productivity in science education curriculum for the institution saddled for the responsibility of training teachers as one of the core courses.

- Modern and well-equipped science laboratories should be provided in the schools to teach 21st century skills at all the educational institutions saddled with the task of training teachers at all educational levels.

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