# EMERGING ISSUES IN SCIENCE, TECHNOLOGY AND MATHEMATICS EDUCATION (STEM) INTERNSHIP [TEACHING PRACTICE (TP) AND SIWES]: CHALLENGES & PROSPECTS

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## Introduction

A teacher from a layman's perspective can be seen as "one who gives instructions" and from this angle, anybody who is able to speak and has acquired the vocabulary that enable him give instructions, is seen as a teacher. Probably, this might be the reason why, many take the teaching profession for granted. However the complex process of teaching and learning (events / phenomena / skills) require that anyone taking the job should be equipped with knowledge and skills to handle the emotions, feelings, cognitive development, and values of learners, to concretize the learning process, Unachuku & Chinasa (2014). Thus, from professional point of view, a teacher must acquire reasonable professional qualification and training in requisite pedagogical skills and content knowledge. These skills make the teacher to be regarded as a cultivator of knowledge, an evaluator, and a mentor (Aluaede, 2009).

The National Policy on Education NPE (2013) has the expectation that teaching in Nigeria shall attain the highest standards possible - the minimum level expected of trainees working towards qualified teacher status. It also highlighted "conditions of success" which includes; use of standards in the design of teacher education; sound grounding of teachers in both academic disciplines and pedagogy mastery; developing in teachers, the skills of team work, reflection and action research; literacy formation as an integral part of teacher preparation.

In essence, when teacher training institutions graduate students and declare that they have been found worthy in learning and character, it presupposes that the graduates possess the necessary competencies for which the institutions had awarded them the qualifications or credentials. However, evidence has shown that paper qualification does not always amount to the possession of the expected competencies. A study by the African Union (2017) of the training, living and working conditions of teachers in Africa, provided evidence that many teachers fell short of the skills, knowledge and competencies expected of them after graduating from teacher training colleges.

## Internship

Internship is a trainee status given to a College, University or post graduate student who works in an organization temporarily, sometime without pay, to gain work experience. It's in essence training for professional careers. Internship is similar but not as meticulous as apprenticeship for professions, trade and vocational jobs. Generally, an internship consists of an exchange of service for experience in a particular career. However, the lack of standardization and effective supervision makes the term "internship" open to broad interpretations, but for our purpose we will limit

the term to "Teaching Practice" and "SIWES". Internship has the advantage of serving as a trial period in the development of a career and gauging the aptitude, flexibility, enthusiasm, and commitment of the internee. http://creativecommons.org (2021).

**Teaching Practice**

The demand for highly talented manpower is imperative in contemporary development because of the technological and social complexity that characterizes modern life. Therefore, it is not an over statement to say that, there is a need for acquisition of desired teaching skills among would-be teachers. Bagulo and Mango (2007) explains the central role of teachers in the following manner, "If the child is the centre of educational systems, teachers are the hub of the educational process, for it is upon their number, their education, their training, and their competence, productivity, effectiveness and capabilities, that the entire educational system and enterprise depend upon.". Manda and Matidza (2016) assert that for teachers to be able to fulfill their professional duties, they must be adequately and properly educated and trained in the art and craft of teaching.

Teaching Practice (TP) therefore has become an important component of becoming a teacher, it grants the Student Teachers (STs) experience in an actual teaching and learning environment. As such, TP is vital in ensuring that STs are fully prepared and committed to facilitate better learning outcomes in schools.

Moreover TP is also critical in bridging the gap between knowing what to teach, and being able to teach, (Kreamer and Dendrick, 2011). The fact that TP is practical experience and not theoretical knowledge gained from lecturers and/or books enable STs to become skilled in knowing how to address the challenges faced in classroom teaching. There is no gain saying that qualitative TP is beneficial to all teacher training systems. Unprepared and/or unsupported STs can often create more disruptions. The longer and deeper exposure of STs to classroom situations, prior to the completion of their training, ensures that they are better ready to teach as soon as they graduate.

The importance of TP has been recognized within the teacher education system in Nigeria for quite some time. However, it has been severally asserted that its organization and implementation require support before and during the exercise. The National Commission for Colleges of Education (NCCE) addressed these concerns through revision of the Minimum Standards Document for the National Certificate in Education (NCE), which includes increasing the number of TP supervisions, as well as providing for mentoring during the exercise. In addition, the provision of school-support to the STs, to reflect and discuss their TP, with more experienced teachers, offers the STs further learning opportunities. The school-based mentoring services further scaffold the pedagogical skills they acquire, since it ensures that both the mentors and mentees are helped to focus on their personal and professional development.

While advocating for the reinvigoration of the education process in Nigeria, Obanya (2004) among other things, calls for a paradigm shift from narrow specializations to broad-based knowledge and from specific to generic skills which facilitate adaption to the changing demands of teaching and make continuous, on-the-job learning easier. These generic skills constitute what are considered as "new concepts and constructs"

in "education as an end in itself". These include analytical power, team-spirit, problem-solving skills, creativity, lifelong learning skills, information technology assets, communication power and versatility. The merits and assets of these generic skills cannot be over emphasized in the task of creating ideal teacher.

**Analytical Power**

This refers to an advanced capacity for logical reasoning on the part of the STs. The skill is centered on the ability of STs to establish meaningful relationship between a variety of "knowledge forms and structures", "societal issues and concern", "life situations", "social aspirations" and "problem situations" etc. analytical power demands that the STs should not only be preoccupied with knowledge of these structures but also need to be aware of the process by which the subject matter and content of these structures are interconnected and interrelated. The STs have to be efficient in employing a variety of tools including "appropriate verbal and symbolic utterances", "quantitative measures", "graphical presentations" and "illustrations" to establish relationship among highly diversified phenomena and knowledge structures.

**Team-Spirit**

Team-spirit demand from ST practical display of a number of social skills such as ability to cooperate harmoniously with others in small or large groups; ability to contribute meaningfully to group activities in a wide variety of forms; ability to demonstrate leadership when and if necessary and appropriately; ability to relate to others and to get out of one's shell while remaining oneself. Team-spirit also enables members of the team or group to know and understand one another better, because they constantly share ideas and information. It further allows the pooling of ideas, encourages constructive professional criticism among members, permits team members to specialize in the task they know best, provides new members the opportunity to observe and learn from experienced members and profit from their advice and counseling.

**Problem Solving Skills**

This is designed to engage STs in "reflective thinking" which leads to conceptualization of ideas for visualizing perception, which is key to intelligent action. Reflective thinking is the scientific method applied in approaching all human problems, ranging from simple to complex and abstract. It is considered that, there are essentially 5 sequential phases in any act of thought involving problem solving skills: 1 - Defining the problem; 2 - noting the background condition including theoretical principles surrounding the problem; 3 - raising questions and formulating hypothesis for deriving positive solutions; 4 - elaborating the probable value of various questions and hypothesis; 5 - actively considering the questions and testing the hypothesis to see which idea offer the best solution.

**Creativity**

Creativity requires that the ST display an ability to go beyond the well-trodden path in thinking as well as action. It calls for a display of ingenuity in both inquiry and problem solving including zeal to learn. Creativity includes traits such as insight, initiative,

cooperation, originality, persistence, emotional stability, perseverance, judgment, communication skills and reflective thinking.

**Lifelong Learning Skills**

This is the internalization of variety of skills on the part of the STs. which include: skills required to enable him / her have working experience of other fields of knowledge, other than the one he/she specializes in,; skills required to enable him / her come in contact with variety of learning experiences; skills required to help him / her control his / her own learning; skills required to help him / her determine the overriding purpose in his / her life; skills required to help him / her differentiate between work and play; skills required to enable him / her realize his / her potentials. Lifelong learning skills leads to the development of social, scientific, environmental, health, and civic awareness as well as manipulative tendencies.

**Communication Power**

This is the ability to use both verbal and non-verbal forms of communication. Communication skills play a major role in facilitating inter-personal exchange of ideas and information and in pursuits of habits of team playing. It also includes manipulation of instructional materials or tools to enhance the achievement of teaching goals.

**Versatility**

This requires STs to broaden their horizons and frontiers of knowledge and experiences. An individual ST should endeavor to be meaningfully exposed to different fields of learning and take advantage of their connectedness. Obanya, (2004) opines that, for those who have learnt correctly, the discipline embodied in school subject will always remain as an integral part of their being.

However, Ikeotuonye, (2011) in his assessment of teachers and the challenges to the Nigeria vision 20:20:20 lamented that the vision may not be achieved because the preparation of teachers still remains a herculean task. Thus, the quality of teacher education at present is still less than satisfactory in structure, content and mode of delivery, to cope with the societal demand for "qualified teachers" for the ever expanding basic education sector in Nigeria. Teachers in Nigeria lack 3 essential skills needed in an effective teacher: pedagogical skills (how to teach) subject content knowledge (what to teach) and the values and attitudes to support the development of young learners. This prevents them from keeping abreast with new developments in their area of specialization. It adversely affects the quality of teaching and learning in the Teacher Training Institutions (TTI) and ultimately STs Learning outcomes which in turn affects the learning outcomes in pupils, (TDP, 2018).

**The NCCE Reforms**

Over the last decade, the discourse around teacher education in Nigeria has intensified. This has been demonstrated by reforms introduced to address the poor learning outcomes of children in schools. The reform of the pre – service training has become an area of deep concern for policy makers, teacher training institutions and indeed the general public. It is generally felt that, achieving the goal and objectives of National Policy on Education (NPE) and National Teacher Education Policy (NTEP) requires

well trained and motivated teachers. Similarly, the unsatisfactory levels of pupils' learning outcomes (mean score in English, Mathematics and Sciences are less than 45 percent and in some cases as low as 25 – 30 percent) can be attributed to low teacher quality and performance.

The NTEP was developed by the Federal Ministry of Education (FME) between 2011 and 2014 and presented in 2016 as part of the Ministerial Strategic Plan (MSP) for education. One of the key challenges identified by the MSP is the poor organization and implementation of TP and therefore recommends the integration of micro – teaching and TP as central components of teacher education. It is in this context that the NCCE articulated a set of reforms aimed at enhancing the quality and effectiveness of the pre – service teacher training. One of the most important aspects of the reforms is the improvements in the TP, which is perhaps is the most important component of pre – service teacher training program. It is the STs first direct experience of classroom teaching and a milestone in their professional training.

**Major Achievements of the Reform**

The Colleges of Education (CoEs) in the five north western States (Jigawa, Katsina, Zamfara, Kano and Kaduna) witnessed a high level implementation of the NCCE reform agenda. This was achieved through partnership between the NCCE and Teacher Development Program (TDP) of the DFID/UKAid. The TDP was a 6-years (2013 – 2019) technology-enabled intervention that worked with relevant federal and state actors to improve teacher effectiveness in the targeted states. Within the intervention period, TDP was able to train 102,362 in-service teachers, 1,041 teacher educators (TEs), 20,895 STs and reached over 5.4m children.

The NCCE and all the 12 CoEs in the five states have already developed the following sustainability plans for continuing the reforms:

a. Re-structuring of the Colleges in line with the NCE curriculum making graduates more relevant to basic education;
b. Longer, immersive duration of TP with a minimum of 18 weeks in the 3rd year of the NCE training;
c. Provision of a TP toolkit to enable Teacher Educators (TE) provide effective supervision;
d. Mandatory school visit so that STs can observe and interact with qualified teachers to familiarize themselves with their future work environment;
e. Developed functional TP system which includes at least 6 supervision visits per ST, trained mentors in schools, better quality support by trained supervisors.
f. School based mentoring to foster strong guidance and promote better relationships between STs and teachers;
g. Training of TEs to design, develop and adopt a school based mentoring
h. Activity-based pedagogy training of STs aimed at enhancing their mastery of content in the teaching of Mathematics, English and Science;
i. Incentive Award Scheme (IAS), which seeks to enhance the quality of TP through the provision of incentives to both the TEs, school based mentors and STs;

j. About 1,051 TEs enrolled and completed CPDC course, 76 percent of which deliver effective lectures and used students-centered pedagogies in their lessons compared to the baseline of 44 percent prior to the course;
k. Colleges in partnership with TDP trained 41,047 STs before TP on pedagogy out of which 64 percent were found to have improved in lesson delivery compared to 48 percent those not trained;
l. CoEs have embraced the introduction of Management Information System (MIS) in area of TP assessment and data collection.
m. CoEs have integrated the Continuous Professional Development Course (CPDC) as part of their mainstream professional development structure. (Curled from http://www.tdpnigeria.org March 2021).

Following the implementation of the reform programs (NCCE/TDP) in the North West, TDP went on tracer study and investigated the impact the reform had on graduates of the CoEs that benefitted from the intervention. Graduates of 2014-2018 were traced and the performance of some of them who are teaching in the basic school system was assessed. The study revealed that the CoEs altogether graduated 71,265 students during the period under study, out of which 20,183 or 28 percent of the graduates were employed and teaching in the basic school system. In all the five states, the NCE graduates were rated as "good" during lesson observations and "excellent" when assessed by the head teachers during interviews and by a questionnaire. The areas which were rated the lowest across board were "entrepreneurial skills, creativity and innovation" as well as "computer skills and the use of education technology." http://tdpnigeria.orgApril2021.

**Table 1:**
TDP-Supported Colleges of Education graduates, 2014-2018

| S / N | College of Education | Number of Graduates | | |
|---|---|---|---|---|
| | | Male | Female | Total |
| 1 | FCE, Zaria | 7,036 | 4,843 | 11,879 |
| 2 | SRCOE, Kumbotso | 9,666 | 1,882 | 11,548 |
| 3 | KSCOE, Gidanwaya | 5,175 | 4,806 | 9,981 |
| 4 | FCE, Kano | 5,296 | 2,307 | 7,603 |
| 5 | FCET, Bichi | 5,469 | 1,556 | 7,025 |
| 6 | ZSCOE, Maru | 4,896 | 1,790 | 6,687 |
| 7 | AKCILS, Kano | 3,265 | 2,577 | 5,842 |
| 8 | JSCOE, Gumel | 2,868 | 518 | 3,386 |
| 9 | FCET, Gusau | 0 | 2,521 | 2,521 |
| 10 | IKCOE, Dutsinma | 1,892 | 557 | 2,449 |
| 11 | FCE, Katsina | 1,342 | 614 | 1,956 |
| 12 | JSCILS, Ringim | 252 | 136 | 388 |
| | **TOTAL** | **47,158** | **24,107** | **71,265** |

Source: http://tdpnigeria.orgApril 2021

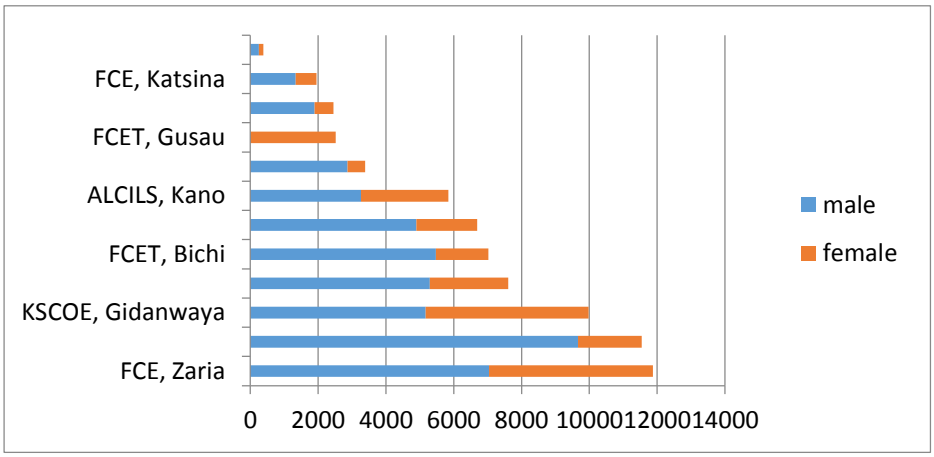


**Figure 1:** TDP-Supported Colleges number of graduates, 2014-2018.Source: http://tdpnigeria.org April 2021

The training received by these graduates in the study was adjudged to be adequate, because assessment during the tracer study revealed that average of the mean scores of the Colleges was 3.80, (see table 2 below for details).

**Table 2:**
On the Job ratings of 1,115 NCE graduates from 12 CoEs in Northwestern Nigeria

| S/N | Indicator | State / Mean Score | | | | | Total Mean | Std Dev |
|---|---|---|---|---|---|---|---|---|
| | | Jig | Kad | Kan | Kat | Zam | | |
| 1 | Preparation of lesson plan and lesson notes | 4.57 | 4.02 | 4.15 | 3.88 | 3.90 | 4.11 | 1.16 |
| 2 | Meaning and implication of professionalization of teaching | 4.58 | 3.97 | 4.10 | 3.65 | 3.67 | 3.99 | 1.13 |
| 3 | Areas of specialization/teaching subject | 4.36 | 3.93 | 3.97 | 3.83 | 3.69 | 3.96 | 1.27 |
| 4 | Lesson delivery, questioning techniques and class management | 4.39 | 4.00 | 3.08 | 3.72 | 3.70 | 3.95 | 1.21 |
| 5 | Variety of strategies to evaluate students' performance | 4.36 | 3.98 | 3.93 | 3.69 | 3.72 | 3.93 | 1.19 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 6 | Variety of teaching methods | 4.22 | 3.98 | 4.00 | 3.61 | 3.71 | 3.91 | 1.32 |
| 7 | Strategies for self development | 4.13 | 3.98 | 3.90 | 3.46 | 3.62 | 3.82 | 1.29 |
| 8 | Improvisation and application of instructional resources | 4.05 | 3.83 | 3.81 | 3.62 | 3.63 | 3.78 | 1.19 |
| 9 | Life skills and adaptation to environment | 4.26 | 3.82 | 3.85 | 3.47 | 3.51 | 3.78 | 1.23 |
| 10 | Entrepreneurial skills, creativity and innovation | 3.73 | 3.53 | 3.27 | 3.28 | 3.24 | 3.39 | 1.34 |
| 11 | Computer skills and use of educational technology | 3.26 | 3.39 | 3.17 | 3.15 | 3.25 | 3.24 | 1.36 |
| | Overall mean score | 4.17 | 3.85 | 3.83 | 3.57 | 3.60 | | |
| | **Grand mean** | | | | **3.80** | | | |

Sample size: A total of 1115 NCE graduates filled the questionnaire; Rating scale: 1-5; Source: http://tdpnigeria.orgApril 2021

**SIWES**

Students' Industrial Work-experience Scheme (SIWES) is one of the Industrial Training Fund (ITF) programmes which were introduced in 1974 due to the inability of engineering, technology and vocational Students in Nigerian higher institutions to meet the practical needs of their training by matching their theoretical school knowledge with the practical aspect of the training in industry. SIWES is therefore an educational as well as a skill development programme designed to prepare students in institutions of higher learning to work and gain experience while attending school. This work experience gives students the opportunity to be part of an actual work situation outside the classroom. SIWES is a tripartite cooperative industrial internship programme that involves the institutions, industries, and the government. Students that participate in this work experience program include those studying, engineering, vocational, and technology related courses. The programme forms part of the approved minimum academic standards in these institutions and a core academic requirement carrying specified credit units.

The explicit policy of SIWES was summarized by the federal government in its Gazette of April, 1978 as follows: To provide an avenue for students in institutions of higher learning to acquire industrial skills and experiences in their course of study; To provide students with an opportunity to apply their knowledge in real work and actual practice; To make the transition from school to the world of work easier and to enhance students' links / networks for later job placement. It is obvious that the reasons that led to the

inception of the programme some decades ago are today even more relevant due to rapid technological development. (Chijioke, Ugwanyi, and Ezema, 2010).
Tarfa, (2016) citing the work of Ekpenyong (2011), identified the principles underlying any industrial work experience scheme for students in institutions of higher learning as the desire to marry the practical with the theoretical learning that characterizes conventional classroom situations, with a view to striking a balance between theory and practice, as a well as equipping the students with the needed skills to function in the world of work.

**Brief history of SIWES**

In recognition of the need for acquisition of "Relevant Production Skills" (RPSs), the ITF (which was itself established in 1971 by decree 47) initiated SIWES in 1974. The scheme was designed to expose students to the industrial environment and enable them develop occupational competencies so that they can readily contribute their quota to national economic and technological development after graduation. Consequently, SIWES is a planned and structured programme based on stated and specific career objectives, which are geared towards developing the occupational competencies of participants.
In spite of some challenges in the four decades of its existence, the Scheme has not only raised consciousness and increased awareness about the need for training but has also helped in the formation of skilled and competent indigenous manpower which has been managing the technological resources and industrial sectors of the economy. Participation in SIWES has become a necessary condition for the award of relevant certificates in the Universities, Polytechnics and Colleges of Education.

**Aim of SIWES**

The primary objective for the establishment of SIWES is the enlisting and strengthening employers' involvement in the entire education process that prepares students in Nigerian tertiary institutions with the practical aspect of their field of study by exposing them to machines, equipment, professional work ethics, methods and ways of safeguarding the work areas and workers in industries and other organizations.

**Objectives / Benefits of SIWES**

1) Provides an avenue for students in institutions of higher learning to acquire industrial skills and experience during their course of study.
2) Expose Students to work methods and techniques in handling equipment and machinery that may not be available in their institutions.
3) Make the transition from school to the world of work easier and enhance students' contact for later job placements and a chance to evaluate companies for which they might wish to work.
4) Provides students with an opportunity to apply their knowledge in real work and industrial situations, there by bridging the gap between theory and practice.
5) Teaches the students how to interact effectively with other workers and supervisors under various conditions in the organization.

6) Provide students with opportunity to test their interest in a particular career before permanent commitments are made.
7) Help students to develop skills in the application of theory to practical work situation and techniques directly applicable to their career.
8) Develops and enhance students' personal attributes; such as critical thinking, creativity, initiative, resourcefulness, leadership, time management, and presentation skills etc.

**Internship in Science, Technology and Mathematics (STEM) Education**

The need for, and importance of internship in STEM education as basis for personal and national development cannot be overemphasized. This is because the STEM philosophy integrates disciplines and offers instructions in real – world (as opposed to purely academic) application of teaching methods, (http://pearsonaccelerate.com11may 2019). Zakari (2017) citing UNESCO and ILO (2002) see STEM as a comprehensive term referring to those aspects of educational process involving in addition to general education, the study of technologies and related sciences, and the acquisition of practical skills, attitudes, understanding and knowledge in various sectors of economic and social life. It is therefore not surprising that interest in the learning of STEM is increasing in all countries of the world. Every country is striving towards producing more and better trained scientists. The Nigeria Policy on Education stresses the importance of STEM and spelt it out in its objectives for all levels of education. For instance, the objectives for basic education are:

1. Laying a sound foundation for scientific and reflective thinking
2. Developing in the child, the ability to adapt to his/her changing environment
3. Giving the child opportunities to develop manipulative skills that will enable him/her to function effectively in the society.

These objectives suggest the adoption of inquiry and activity oriented approaches in the teaching and learning of STEM. Thus, STEM is a blended learning environment that exposes students to know that scientific methods can be applied to everyday life. It teaches students scientific thinking skills with a focus on real world applications and problem solving. Thus STEM education focuses on the following goals:

a. STEM literate society;
b. A general workforce with 21st century competencies;
c. Research and development focus on innovation;
d. Knowledge, aptitude and skills to identify questions and problems in real life situations;
e. Explain the natural world and design technologies that simplify tasks

Umar and Deba(2017) view STEM as a tool for equipping students with necessary skills needed for the enhancement of productivity towards wealth generation and sustainable economic development.

**Challenges**

One of the major challenges facing internship in Nigeria as outlined by Yusuff and Soyemi (2012) is a mismatch between training and labour-market skills demand (curriculum Vs societal needs, COEs Vs Basic Education). Moreover, training

institutions operates with poor funding, dilapidated infrastructure and furniture, overcrowded classrooms / halls insufficient equipment / materials and poor students support services. The duration period for internship is short as such little time is devoted for mentorship. Furthermore the number of trainee per center / supervisor per contact period is larger than expected.

Alkali et al. (2017) citing the work of Okorie (2000), pointed out that some lecturers while teaching, are unable to perform skills of diversified nature because they are themselves not adequately trained to maintain, repair, or at least operate machines they are supposed to be working with. This poses a great challenge for students on internship when they want to apply the knowledge supposedly learned. The Nigeria's Economics Recovery and Growth Plan (ERGP, 2017 – 2020) pointed out that inadequate facilities, lack of STEM structures and quality programmes, insufficient number of skilled teachers are challenges that continue to bedevil our urge for development (Zakari, 2017).

**Prospects / Way forward**

STEM provides opportunities for students to learn how to apply their educational experience in STEM disciplines in reacting to situations that require them to apply the knowledge in context appropriate to their ages and stages of development. Thus STEM is more than a class-to-finish. It pulls together ideas presented in school and helps show how they benefit our society and the world as a whole. Students can see that what they are learning today is pertinent to their future and the future of the whole world.

STEM education gives people skills that make them more employable and ready to meet the current labour demand. It encompasses a whole range of experiences and skills. Each STEM component brings a valuable contribution to a well-rounded education that gives learners an in-depth understanding of the world around us.

**Conclusion**

My fervent belief is that, with the right synergy between theory and practice in STEM education, our country's potentials will be fully and effectively utilized and our objectives as a nation can be actualized. "……. Only when the human spirit is allowed to invent and create, only when individuals are given a personal stake in deciding economic / technical policies and benefitting from their success – only then can societies remain economically alive, dynamic, progressive and free…"– Ronald Reagan.

**References**

African Union, (2017).Study on teacher: training, working, and living conditions in member states. Addis Ababa: AUC.

AlkaliD. D. David A. F. & Yakubu A. P. (2017). Sound technical vocational education and training for economic recovery and national development in A.S. Bappah, F.O. N Onyeukwu,S.A. Adebayo, R. & P.S. Williams (Eds) Proceedings of 29th Annual National Conference and Annual General Meeting of Nigerian Association of Teachers of Technology (PP 27-38) Lagos: Nigerian Association of Teachers of Technology.

Aluede O. (2009). The Teacher matters: Strategies for making the teaching profession more relevant in Nigeria's education system. International Journal of Science Education 1 (1) pp 66-71

Bagulo M. & Mango U. (2007). Teacher Education Reforms: Examination of programmes and policies. Nigerian journal of Educational Philosophy, 20 (1) pp 8-14

Chojioke F. Ugwanyi O. Jonas H. & U. Ezema (2010). Challenges of SIWES in Library and Information Science in the ICT environment https://www.nou.edu.ng

Federal Republic of Nigeria, (2013). National Policy on Education accessed on 3rd April 2021 from http://educatetolead.files.wordpress.com/2016/02/natinal-education-policy-2013pdf.

Ikeotuonye, A.I. (2011). Preparing Teachers for the Challenges of Nigeria's Vision; In Nwangu, B.G. and Buseri, J.C. (eds). Human Development for Vision 20: 20: 20, Abuja: Nigeria Academic of Education.

Kraemer, K.L. and Dedrick, J. (2011). Information Technology and Productivity: Result and Implications of cross country studies. In M. Pohjola (eds), Information Technology and Economic Development. Cambridge: Oxford University Press.

Manda, M. andMatidza, I. (2016). A tracer study of 2011-2015 graduates from the LandManagement Programme at Mzuzu University. Journal of Education and Society in Southern Africa, 3(3) 45-67.https://www.academia.edu/.../a tracer study of 2011 – 2015 graduates f...

Obanya, A.D. (2004).Education for the Knowledge Economy, Ibadan: Mosuro publication.

Tarfa, B.D. (2016). STEM Education & Development: Paper presented at 14th National Conference and Exhibition. http://www.researchgate.net

Teacher Development Programme TDP (2018). Evidence of Change: info@tdpnigeria.org

Umar A. Abdullahi S. & U. Deba, (2017). Prioritizing STEM education for sustainable economic development of Nigeria in the dwindling economy, In A. S. Bappah, F.O.N Onyeukwu, S.A. Adebayo, R. & P.S. Williams (Eds) Proceedings of 29th Annual National Conference and Annual General Meeting of Nigerian Association of Teachers of Technology (PP 27-38) Lagos: Nigerian Association of Teachers of Technology.

Unchukwu, G.C. andChinasa, N.K. (2014) Teachers and the 21st century skills: A critical look at Teacher Education in Nigeria; development and Challenges, A book of readings in memory of Prof. Babs Fafunwa, Yaba Lagos.

Zakari A. (2017).Funding technical vocational education and training for sustainable economic recovery in A.S. Bappah, F.O.N Onyeukwu,S.A. Adebayo, R. & P.S. Williams (Eds) Proceedings of 29th Annual National Conference and Annual General Meeting of Nigerian Association of Teachers of Technology (PP 27-38) Lagos: Nigerian Association of Teachers of Technology.