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ENHANCING THE DIGITAL LITERACY OF STEAM TEACHER EDUCATORS IN NIGERIA

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Abstract
Digital literacy is now required by teacher educators to effectively function in the world of work. In Nigeria, students are becoming more technologically inclined; therefore, Science, Technology, Engineering, Arts and Mathematics Teacher Educators in Nigeria must leverage on the new technologies both for their individual use and for pedagogy. Since Teacher education in Nigeria is to provide the intellectual and professional background that will be adequate for teachers' assignments, it becomes imperative for STEAM Teacher Educators to comprehend fully, the concept of literacy, and the need to become digital literate in today's modern world. This paper examines the requirements, skills and competencies necessary to enhance STEAM teacher educators' digital literacy, so that the benefits which ICT offers the field of education would be fully maximized, and the teaching learning process in Nigeria would become effective and beneficial to all and sundry as obtained in today's globalized and ICT compliant society. This is possible when government and stakeholders provide ICT facilities, trainings and re-trainings for STEAM Teacher Educators who also master the art of collaborating with others, sharing professional information, contributing to germane online discussions and adapting to the ever dynamic digital world.
Keywords: ICT, Digital Literacy, Teacher Education, Educator and STEAM

Introduction

For so many years, the ability to read and write was sufficient for one to be termed 'literate'. A Teacher Educator who could perform those basic functions would have no problem functioning, both professionally and personally. However, in the modern context, it is no longer so. To be considered literate, a lot of other interrelated skills and competencies are required by individuals, including teacher educators. In the modern context, literacy involves the ability to use and communicate in a diverse range of technologies. Due to this diversity, the fundamental economic, civic and social functions of literacy, which are traditionally performed through verbal language as the primary and fundamental semiotic system, have extended to other mediums/media and modes as well as other semiotic systems in digital age (Lawal, 2016).

Furthermore, as it stands today in the world that is technologically driven, the concept of literacy for individuals and professionals have changed radically, and thus it has a lot of functions which are very important. The International Literacy Association (2017) stated that the ability to read, write, and communicate enables people to connect to one another and empowers them to achieve things they never thought possible. This is because communication and connection are the bases of who we are, and how we live together and interact with the world (International Literacy Association, 2017). Literacy therefore, in its updated and multifaceted form, is no longer an option; it is a must if anyone would successfully navigate the terrain in an ICT compliant society. This definitely is without exception to the teacher educator in Science, Technology, Engineering, Arts and Mathematics (STEAM), who now require a new set of literacy skills and competencies to function effectively and efficiently in the world of work, and to get the best from their career. Without mincing words, the acquisition of the skills is essential for teachers, either at the pre-service or in-service levels, as highlighted by experts in the field of Teacher Education. The United Nation Educational Scientific Cultural Organisation (2004) noted that Teacher Education generally includes four elements which are improving the general educational background of trainee teachers; increasing their knowledge and understanding of the subjects they are to teach; pedagogy and understanding of children and learning; and the development of practical skills and competences.

Also, according to the Nigeria National Policy on Education (National Policy on Education, 2013), the goal of teacher education in Nigeria includes, among others, 'the encouragement of the spirit of enquiry and creativity in teachers, and providing them with the intellectual and professional background that will be adequate for their assignments and also make them adaptable to changing situations' (National Policy on Education, 2004). Again, enhancing the skills of teachers in the use of new technologies is part of the goals which the NPE provides details for, under Higher Education in general and Teacher Education in

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particular. Despite all the above, it appears that Teacher Educators are not properly adapting to the new changes in a globalised world, where digital literacy is a sine-qua-non to be effective and efficient as teachers. Osokoya (2012) noted this by identifying as a challenge, the inadequate knowledge and use of ICT in a globalising world by Teacher Educators in Nigeria. He further noted that a lot of schools in Nigeria continue to operate with little or no adaptation to ICT.

From the foregoing, it then becomes clear that for STEAM Teacher Educators in Nigeria to perform their functions effectively and efficiently in their field, they must become digitally literate, which includes mastering the new technologies and methodologies of the modern times. If STEAM Teacher Educators would profit from ICT and enhance their professional development, there is a need to continually acquire digital literacy skills and develop the competencies so required. In recent years, the use, role and influence of ICT in education have been the subject of discussion among researchers including Cuban (2011); Hennessy, Ruthven, & Brindley (2005); Livingstone(2012); Olofsson, Ola Lindberg, Fransson, & Hauge(2011). However, one thing that appears clear is that Teacher Education, as a field of study, is being positively influenced by digital literacy in several ways. Thus, studies exploring the use of digital technologies in education have shifted their focus to the increased roles of ICT in the knowledge-based society, its roles in learners' personal lives, and in the development of appropriate knowledge, skills, competencies, and attitudes for lifelong learning (Bennett, Maton, & Kervin, 2008; Erstad, 2010; Lankshear & Knobel, 2006; Ng, 2012; Voogt, Erstad, Dede, & Mishra, 2013).

Concept of Digital Literacy

Since its introduction by Paul Gilster, the term 'digital literacy' has gone through various modifications. As a matter of fact, it keeps expanding and accommodating new skills and competencies as the times require. Bawden (2008) noted that the origin of 'digital literacy' can be traced to two terms which are computer literacy and information literacy. Computer literacy was supposed to indicate a person's ability to use computer software proficiently, while information literacy included other skills such as evaluation and appreciation of information. Today, after interacting with digital technologies for several years, researchers and educators can now view digital literacy from various lenses and angles. In their own perspective, Fieldhouse and Nicholas (2008) noted that digital literacy requires individuals to have critical thinking skills which would help them determine how credible information is. It would also help them to contextualise, analyse, and synthesise any information found online. In a similar view, digital literacy has to be conceived as an entitlement which supports an individual's full participation in a society, in which social, cultural, political and financial dimensions of life are increasingly being mediated by digital technologies (California Technology Assistance Project, 2009).

According to Spires, Bartlett, Quick and Garry (2012), digital literacy refers to a wide-range set of practices which ultimately allow students to create, share and understand meaning and knowledge in an increasingly digital age. Still considering the concept of digital literacy, the United States Department of Education (2015) defined it as a set of skills associated with the use of technology to enable users find, evaluate, organise, create and communicate information and the ability to use those skills to solve problems in technology-rich environments Leu, Kinzer, Coiro, Castek, & Henry (2013). Terry (2021) considered it as the ability to interpret and design nuanced communication across fluid digital forms. A proper consideration of all the above submissions makes it clear that digital literacy refers to a set of competencies and skills which are required to effectively and efficiently function in the 21st century society. The competencies and skills would enable a Teacher Educator access, create and utilise content in the most appropriate manner. It also remains sacrosanct to understand that the concept of literacy is always changing. Thus, it is necessary to allow for some ambiguity in terms and definitions, as new technologies afford new digital spaces for literacy learning, which will continually be new, multiple, and rapidly disseminated.

Digital Literacy and Teacher Education

Nakpodia and Urien (2011) noted that Teacher Education is the process which nurtures prospective teachers and updates qualified teachers' knowledge and skills in the form of continuous professional development. In a similar vein, Ogunyinka, Okeke and Adedoyin, (2015) submitted that Teacher Education refers to the professional education of teachers towards the attainment of attitudes, skills and knowledge considered desirable so as to make them efficient and effective in their work, in accordance with the need of a given society at any point in time. It includes training and/education occurring before

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the commencement of service (pre-service) and during the service (in-service or on-the-job). It therefore becomes clear that a digitally literate STEAM Teacher Educator would be better positioned to teach students, achieve career goals, and get the best from life and work. In discussing some of the areas where digital literacy is positively influencing teacher education, researchers have observed a lot, including collaboration, metacognition and modelling.

Collaboration refers to technology training situations involving two or more student teachers, who "work together to maximise their own and each other's learning" Goodyear, Jones & Thompson (2014: 440). Brodahl, Hadjerrouit, & Hansen, (2011) used Google Docs and EtherPad to appraise whether ICT would be effective in a group setting and whether it could support collaborative writing. They found that through collaborative writing, where the pre-service teachers had to write a reflective essay, they (pre-service teachers) got acquainted with collaborative tools, and developed the skills and competencies required in implementing educational tasks. With metacognition, teachers analyse and document their thoughts, reactions, and/or consequences of their actions surrounding a situation involving ICT. Some research findings showed that pre-service teachers were allowed to think and talk about how to integrate ICT into their teaching, and it was found that forums, blogs, online bulletin-boards and discussion groups were highlighted by the students as media of learning through ICT (e.g., Doering& Beach, 2002; Shoffner, 2009).

Modelling involves teacher educators, in-service teachers, mentors, and peers, usingICT to "intentionally display certain teaching behaviour", which could play an important role in shaping "student teachers' professional learning" (Lunenberg, Korthagen, & Swennen, 2007:589). Barton and Haydn (2006) had tutors model technology integration and meaningful learning activities with ICT for two cohorts of student teachers in history and science during their field experience. This involved demonstrating how to use PowerPoint, the Internet, creating a webpage using html code, and the use of data logging tools. However, it becomes clear through the studies that modelling needs to involve student teachers so that they can get hands-on experience with the technologies that they will be using in their future classrooms.

Enhancing the Digital Literacy of STEAM Teacher Educators in Nigeria

If one would be an active and successful Teacher Educator in this 21st century society, it is imperative to develop proficiency in the tools of technology and build intentional cross-cultural connections and relationships with others. Such a practice would enable the teachers to solve problems collaboratively and strengthen their independent thoughts. It is important to note that STEAM teachers have an exciting opportunity to shape the future of innovation in the field of education by blending the disciplines of Science, Technology, Engineering, and Mathematics together in classes to solve problems collaboratively. STEAM teachers' focus more on helping learners develop competency in group work and creative problem-solving, using what students have learned in math, physics, or engineering courses.

Since digital literacy involves dealing with multimodal texts in many different communicative situations, a STEAM teacher educator is expected to develop competencies in a range of communicative resources such as images, colours, videos, sounds and graphics. It also involves communicating in a humble way with people from different cultures and those with different lifestyles. To be regarded as being digitally literate, STEAM Teacher Educators are expected to be efficient and effective in so many areas, including the following, as highlighted by (Duodeney, Hockly and Pegrum, 2013). These indices are helpful in identifying a digitally literate STEAM Teacher Educator in Nigeria, and they are listed and explained below.

Texting literacy: refers to knowledge about the conventions of texting language or 'txtspk' (text speak, that is, the use of abbreviations, acronyms, symbols, etc.), and of knowing in what contexts to use or not use it. According to Crystal (2008; 2011), research has shown that, far from having a detrimental effect on language standards and literacy, text speak can in fact aid literacy. So, a digitally literate STEAM Teacher Educator should be aware of and adept in txtspk.

Hypertext literacy: STEAM Teacher Educators need an understanding of how hyperlinks in online text work, and should be able to produce texts with an effective use of hyperlinking. This means that Teacher Educators should know why a hyperlink is necessary, how many hyperlinks to include in a text, what to link to and understanding the effects of over- (or under-) linking in a text, and so on.

Visual, Media and Multimedia literacy: a STEAM Teacher Educator needs to understand how images and multimedia (audio, video) can be used to supplement, enhance, subvert, or even replace text

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communication. In this digital era, Teacher Educators need to know how to produce multimodal messages without external assistance and this includes the ability to share photos on Facebook and create videos for YouTube.

Mobile and Technological literacy: for a STEAM Teacher Educator in Nigeria, it is important to have a clear understanding of how mobile technology is changing the way things are done and how HTML coding can help.

Search literacy: refers to one's capacity to look for information effectively online. A STEAM Teacher Educator in Nigeria should therefore be aware of other search engines beyond Google such as safesearch, edugoogle, googlescholar, Mojeek, Baidu, Ecosia, Bing etc .

Information literacy: refers to the capacity to not only search for accurate information, but also be able to sieve information and assess online sources of the information for authenticity and reliability.

Participatory literacy: refers to being able to contribute to and participate in online networks. As a STEAM Teacher Educator, one should be able to identify online professional networks and contribute to such groups by leaving feedbacks and making comments in discussions.

Cultural and intercultural literacy: the online space allows people from various parts of the world to interact; it therefore becomes imperative to understand digital artefacts from other cultures and interact effectively and constructively with people from other cultural environments.

Remix literacy: refers to the ability to modify contents and produce something new. In this way, a teacher educator is not only a consumer but also a producer for others to learn.

A critical appraisal of the competencies and skills listed above clearly shows that Teacher Educators in Nigeria have to really put in personal effort to become digitally literate because the skills are both interrelated and different.

Factors that Hinder the Enhancement of STEAM Teacher Educators' Digital Literacy in Nigeria

ICTs and digital literacy are no doubt really helpful in achieving a lot, even in the field of education and teacher education. However, there seems to be a number of challenges Nigerian teacher educators face. These challenges are both intrinsic and extrinsic to the teacher educators. One major challenge to Teacher Education in Nigeria which hinders the enhancement of Teacher Educators' digital literacy is that of insufficient knowledge, and use of ICT in a globalising world. There is no gainsaying that the knowledge, and use of computer technology as well as the internet is a necessity for all teachers to guarantee the relevance of the system and its products in the 21st century.

Unfortunately, many teacher training institutes in Nigeria still operate the traditional education system with little or no adaptation to ICT. The fundamental question is how can teachers benefit from the ubiquity of information and facilitate communication among professional networks, if they do not pursue ICT knowledge? Another major problem is the absence of standard ICT facilities and training sessions for both in-service and pre-service teachers in teacher training institutions and even in schools. It appears that the governments at all level have not been able to continuously provide ICT training and re-training and provide an enabling environment for teachers to maximise the opportunities for becoming digitally literate. As highlighted by Input Visit Report (2010) of Education Sector Support Programme in Nigeria (ESSPIN), some of the challenges facing teacher education equally affect STEAM Teacher Educators in Nigeria from becoming digitally literate. The challenges include:

1. The Teacher training curriculum in the country does not fully acknowledge the new age environment in schools and classrooms in terms of constructivist learning, learner-centred instructions and integrating technology into the processes of teaching and learning. There is not a sufficiently strong link between the schools' curriculum and the teacher education curriculum.
2. The emphasis on content delivery, examination and certification over real learning is also a serious threat to quality. The current system of teaching and evaluation does not allow creativity, innovation and research, which are important tools for lifelong learning. Also, education is construed as an academic exercise that is divorced from the daily-life world of learners, and obtaining education qualifications at any level relies heavily, and primarily, on corruptive practices.

Conclusion

Over the past decade, both teaching and learning have changed radically and would keep changing. New information and communication technologies (ICT) are continually being developed, and would find their way into Nigeria. As a matter of fact, today's students are part of the generation referred to as digital natives and it would be impossible for an analogue teacher to effectively impact digital students. Many of

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students have a robust interaction with digital technologies for academic purposes and teacher educators cannot afford to be left behind. It therefore means that Teacher Educators in Nigeria need to have and develop a high level of digital literacy for themselves, and at the same time, master how to use a range of technologies within digital pedagogies. STEAM Teacher Educators in Nigeria need to view technology from various perspectives, including its creative capacity.

Suggestions

1. Enhancing the digital literacy of STEAM Teacher Educators in Nigeria is a task which requires the input of various stakeholders from the Teacher Educators themselves to schools and government at all levels.
2. It also requires that government and non-governmental organisations rise up to the challenge of improving the digital literacy of STEAM Teacher Educators in Nigeria by demanding for, creating and sustaining an enabling environment and ICT tools.
3. On the part of the government, the political will to back up words with actions must be taken. ICT facilities, Trainings and Re-trainings must be provided for STEAM Teacher Educators in Nigeria without further delay. This would enable them (teacher educators) gain access to ICT tools and develop their competencies.
4. Teacher Educators in Nigeria should master the art of collaborating with others, sharing professional information, contributing to germane online discussions and adapting to the ever dynamic digital world.

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