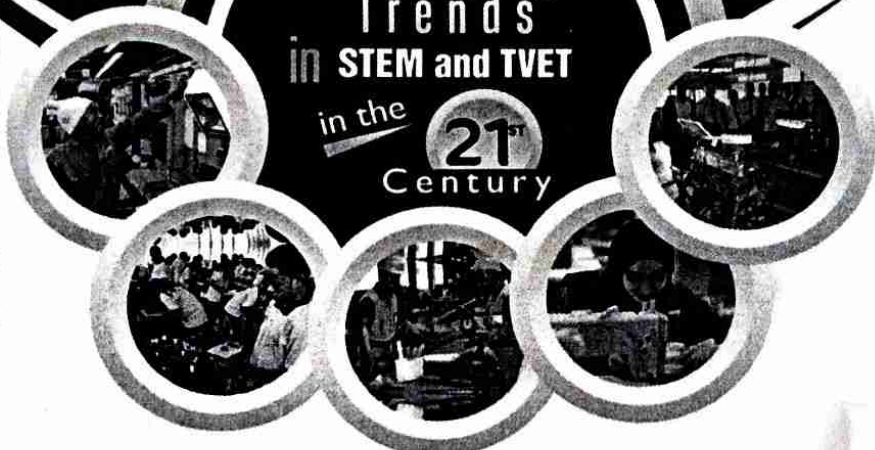




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THEME
**Emerging
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in STEM and TVET
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Technology-Based Learning Platform for Instructions among Pre-service Teachers in Nigerian Colleges of Education: The way forward.

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Abstracts

This paper focuses on technology-based learning (TBL) platform for instructions among pre-service teachers in Nigerian Colleges of Education. Technology-based learning in the early 21st century is transforming the way people learn at a time when two powerful trends converge. The first trend is the rapid acceleration of technological change and the demand that this change places on education and workforce training during their professional live. It is transforming training and education by providing new technological opportunities to address new learning needs. The paper also summarises the concept and nature of technology-based learning, how TBL addresses a number of challenges, different instructional modes, sectors of application, benefits and challenges of technology-based learning. It was recommended in the paper that National Commission for Colleges of Education (NCCE) and the Colleges of Education stakeholders should provide enabling environment for the pre-service teachers to effectively utilise technology-based learning platforms for learning. Periodic orientations, symposia, conferences, seminars and workshops should be organised for the pre-service teachers so as to keep them up-to-date with the emerging technological trends. Government, Non-governmental organisations (NGOs), National Educational Research Development Agency (NERDA) and other research institutes should fund and encourage more researches in the field of technology integration in education as more gaps are yet to be filled.

Keywords: Technology-Based Learning Platform, Technology Acceptance Model, Instruction, Pre-service Teachers, Colleges of Education.

Introduction

The world is becoming more sophisticated technologically. The industrial age gave way to information age; an info-tech era which is as vital as the water we drink because it has brought positive changes to the society, businesses, and other facets of human life. In fact, the educational sector is not exempted from the benefit of participating in an information rich computer age society. To keep to date with the emerging technological changes at the national, regional and global environments, our present educational system is continuously upgrading its resources through the modernisation of the various elements of the system (Danjuma 2015). Teaching and learning may be influenced by diverse factors, one of which is employing modern technologies to create conducive learning environments. Modern technologies and Information and Communication Technology (ICT) provide extraordinary infrastructure to deliver the knowledge in numerous ways, in different regions with different learners (Mellati & Khademi, 2018). The integration of information and communication technology (ICT) into teaching and learning has been the focus of 21st century education. Specifically, the application of computer technology in classroom environment continues to play a vital role in enhancing teaching and enriching learning (Falode, 2018). Technology integration includes educational software, computers, simulation, and

other resources that enhance learning. One of the potential benefits of modern technology was the advent of Technology-Based Learning (TBL). The importance of technology-based learning (TBL) include; accessibility for all students, learning matched to learners' need, timely update, immediate feedback, captivate learners' attention during learning, maximizes interactivity among students, keep students focused for longer periods of time, encourage critical thinking and creativity, streamlined and effective delivery among others.

Technology-based learning is a type of learning that takes place partially or entirely via electronic technology. This includes online and Web-based education, Intranet sites, audio- and video-conferencing, Internet chat rooms, simulations, electronic gaming, CD-ROMs, and a variety of mobile options (Carruth & Carruth 2013). Ghavifekr and Rosdy(2015) deduced that, technology-based learning (TBL) is the way of learning using the electronic technology such as internet, intranet, audio and video conferencing, webcasts to mention but a few. Technology-based teaching and learning can make many changes in school that requires for proper planning and policy making. Researchers and policymakers must both have the same insight about the future plan. With the development of learning technologies in the late 20th century, education system has changed rapidly. This is due to the capability of technology to provide a proactive, easy access and comprehensive teaching and learning environment. Ejoh, (2020) declares that, in developing countries such as Nigeria, skill development for students requires teaching and learning initiatives to be evaluated to identify a model that will be the best fit for schools.

However, several models have been brought forth to address users' responses to the use of new technologies for learning, one of such is Technology Acceptance Model (TAM). According to Buminet *al.* (2019), the widespread usage of every new technology necessitates acceptance of the technology and adoption. The TAM proposed by Davis (1989), has two constructs of beliefs that determine attitude to use technology, that is, perceived usefulness (PU) and perceived ease of use (PEOU). Davis (1989) defines perceived usefulness as the prospective user's subjective probability that using a specific application system will enhance his or her job or life performance. Whereas, Perceived ease of use (PEOU) can be defined as the degree to which the prospective user expects the target system to be free of effort. According to TAM, ease of use and perceived usefulness are the most important determinants of actual system use. Hence, the researcher seeks to adopt Technology Acceptance Model (TAM) as a framework to guide the study.

Overview of Technology-Based Learning

Technology-based learning in the early 21st century is transforming the way people learn at a time when two powerful trends converge. The first trend is the rapid acceleration of technological change and the demand that this change places on education and workforce training during their professional live. The education, secondary and tertiary cycles uses more often the technology in the educational processes, on one side. This is very important because it brings a new trend in the educational field and can be applied at all the levels. On the other side, while successful economies have always depended on a skilled and knowledgeable workforce, today's rate of change in production processes and workplace tools requires much more training and retraining of individuals on the job than it did in the past. As more workers become knowledge workers, the demand for frequent retraining and specialisation is further accelerated with each technological shift. Industry has to be able to retrain its workforce much more quickly, and the development cycles of training programs have to be shortened if companies want to stay competitive. Given that

updating workers' skills rapidly and as the need arises is so critical in today's economy, the efficiency with which companies do so can thus be critical in helping them maintain a competitive edge (Gudanescu, 2010).

According to Gudanescu (2010), Technology based learning is the way of learning using the electronic technology such as internet, intranet, audio and video conferencing, webcasts etc. Technology based learning is transforming training and education by providing new technological opportunities to address new learning needs. TBL programs come in different delivery modes and forms. They can include online tools, such as discussion boards and e-mail, and real time events, through videoconferencing and web conferencing. They can be self-paced, and have a varying focus of instruction. Technology-based learning uses a series of delivery methods and hardware and software tools to manage and deliver learning content and manage and track learner progress, as well as learner-to-learner and learner-to-instructor communication. TBL is learning that takes place partially or entirely via electronic technology. This includes online and Web-based education, Intranet sites, audio- and video-conferencing, Internet chat rooms, simulations, electronic gaming, CD-ROMs, and a variety of mobile options (Carruth&Carruth 2013).

TBL, as stated by Ganet *al.* (2014), broadly encompasses interventions that rely on advanced electronic or communication technologies to supplement or replace classroom-based instruction. Over the past decades, the rapid evolution and increasing adoption of TBL has dramatically altered the landscape for workforce training and education. One notable turning point was the introduction of personal computing and the Internet, which allowed for standardisation and increasingly widespread access to training and education. As noted above, a new "generation" of TBL is dramatically altering its reach, adaptability, and the user experience. Due to both the diversity of technologies and breadth of applications, TBL does not have a single definitive characterisation or definition. Rather, it is a continuum of interventions shaped primarily by how integral the technology is to the learning process. TBL models may rely entirely on technology for learning; may balance the use of technology and classroom learning (hybrid or blended models); or may incorporate some lesser use of technology into a predominantly classroom-based setting.

TBL holds considerable potential for addressing challenges associated with workforce training and education. When considering implementation of a TBL resource, it is useful to consider how TBL addresses a number of challenges, including: monitoring and assessing engagement and learning, adapting learning to individual's needs, promoting motivation and interpersonal interaction, using resources cost-effectively, ensuring individuals have the appropriate supports for learning, and assuring that the skills imparted are responsive to business and industry needs.

Monitoring and Assessing Learner Engagement Remotely

The biggest challenge for TBL is related to delivering the quality and effectiveness of instruction and the related challenge of maintaining the necessary level of learner engagement. The literature consistently finds evidence of low learner engagement in TBL. Learner drop-out, low effort, or "social loafing"; cheating; as well as learner isolation are real and common concerns for TBL (Carruth&Carruth 2013). Thus the use of technology may present challenges to, as well as facilitate, learner engagement, and ultimately, the instructional effectiveness of TBL.

Adapting Learning to Individuals' Needs

A related challenge to instructional effectiveness posed by TBL can be the consistency and lack of individualisation. On one hand, prerecording lessons provides a greater level of control over what content is being delivered; thus, a higher level of consistency (and potentially quality and efficiency) exists across multiple instructors involved in the content delivery (McDonald & Smith 2013). However, the uniformity of this content-centric TBL may also raise challenges in delivering material to a diverse group of learners. Whereas a traditional classroom allows for feedback from responsive instructors, content-centric TBL is limited to delivering pre-recorded or programmed material. Not only can these forms of TBL not monitor learner engagement, they also may not be able to monitor and respond to learner questions or their variable levels of comprehension, interest, or needs. On the other hand, technology may also offer the unprecedented opportunity to contextualize and individualise instruction and learning content (Ganet *al.* 2013; Maxwell 2012). In technology environments, each learner can:

- i. repeatedly access and reflect upon content they find challenging,
- ii. receive content in a variety of formats to fit their needs, including text, audio, and video,
- iii. interact with and even create learning material (for example, through discussion forums, Wikis, and other Web 2.0 technologies) and
- iv. Receive individualized assistance based on emerging “digital tutors” that are incorporated into some learning systems.

Promoting Interpersonal Interaction

Particularly in asynchronous TBL models, program designers and instructors may find it challenging to incorporate adequate substitutions for learner-to-learner and instructor-to-learner interactions and collaboration (Ke&Kwak 2013; Maxwell 2012). Research suggests this is a crucial part of the learning process, especially for adults (LeNouet *al.*, 2011). For instructors, it may be more difficult to develop rapport with learners or gauge whether they were able to understand course lectures (Dunham *et al.*, 2011). In some instances, the use of technology may result in learners' feeling isolated, disconnected, and unsupported. However, technology may also increase interpersonal interaction. Blended models may represent useful options because they offer opportunities for synchronous interaction. Alternatively, some TBL programs are incorporating technologies that can themselves facilitate or at least allow for effective communication and interpersonal interaction within both blended and technology-only courses. For example, Web 2.0 technologies, online and video discussion forums, virtual technologies, and other tools can provide a platform to develop and promote interaction and collaborative learning communities (Dunham *et al.* 2011; Ke & Kwak 2013; Maxwell *et al.* 2013; McKay & Izard 2012). Instructors can scaffold or support interactions via asynchronous feedback or synchronous video-conferencing with multiple participants (Dunham *et al.* 2011; Ke & Kwak 2013). In the workplace, Intranet and chat forums can facilitate the distribution of ideas and practices across an organization.

Saving Costs and Resources

The associated time and resource costs are major considerations for adopting and implementing TBL. These costs may be associated with such things as developing content, integrating technology and content, programming, training instructors, and supporting implementation of the necessary technology, personnel, and infrastructure. For the workforce system in particular, Ganet *al.* (2013) finds that one of the biggest barriers to implementing TBL is the cost. This cost become more burdensome the more TBL seeks not just to broadcast and archive content and materials

delivered in traditional classes (e.g., a pre-recorded Webinar that can be accessed asynchronously), but to engage learners more actively. In these instances, instructors often need more time, training, and support to use technology effectively and to keep their learners engaged (Bowen & Ithaka 2012; Maxwell 2012). Related cost concerns are those associated with hosting or accessing content. Technology requires infrastructure (example include, computer labs, broadband access). In the workplace setting, employers may incur additional costs in establishing the technological infrastructure for networking and collaborative workspaces (McKay & Izard 2012). Similarly, the workforce system may bear the costs of adopting and maintaining the infrastructure necessary to support effective TBL.

Strengthening Access and Readiness

Another set of issues is related to effectively supporting the technological access and readiness of learners. While online technologies have made basic education and training more accessible to adults, a “digital divide” mitigates this access for many people. The “digital divide” most commonly refers to a difference in access to technology (that is, those who have it and those who do not) (Gungor&Prins 2011). However, it can also refer to a difference in accessibility or the difference in technological “literacy” between those who use technology regularly (“digital natives”) and those who do not (“digital immigrants”) (Bynner *et al.* 2010). This issue exists for both learners and instructors. The impact of learners’ technological access and readiness is relevant to all forms of TBL. The impact of instructors’ access and readiness is slightly less pervasive, but impacts any TBL that requires personal interaction between the TBL and the learner. Using TBL effectively may require not just technology support, but also instructors effectively using and interacting with the TBL product or curriculum so they can guide learners through the materials and complement the TBL. Learners and instructors with low technological literacy and comfort levels often become frustrated trying to use the technology or when they encounter technical difficulties (Sitzmann *et al.* 2010). Instructors, as well as learners, frequently feel challenged without adequate training or support. To deal with these issues, some programs provide initial training support (such as orientations, assistants, courses) to familiarize instructors and learners with the technology or to impart effective technology based pedagogical practices to the instructors (Dunham *et al.* 2011; Maxwell *et al.* 2013). For learners with learning and physical disabilities, TBL programs offer a variety of assistive technology options. For example, programs may provide screen readers and closed captions for online videos (Betts, *et al.* 2013). Screen readers, such as iPhones’ Voice-Over or Android 4.0’s Talk-Back, are used by individuals who are blind or have learning disabilities (for instance, dyslexia, dysgraphia, attention deficit disorder) (Betts, *et al.* 2013).

While these challenges are faced by traditional forms of instruction as well, they are uniquely complex when learners are remotely located, face-to-face interaction may be limited, and a critical threshold of “technological literacy” is needed to thrive. While TBL may present a number of unique challenges (like the possibility of learner isolation), it also affords unique remedies (24/7 access to personalized content). Ultimately, TBL is multifaceted and evolving, with strengths and weaknesses that vary by learning population, context, and content.

Modes of Technology-Based Learning

The followings are some of the modes of Technology-based learning which include;

Computer-based training (CBT)

Computer-based training (CBT) refers to self-paced learning activities delivered on a computer or handheld device such as a tablet or Smartphone. CBT initially delivered content via CD-ROM, and typically presented content linearly, much like reading an online book or manual. For this reason, CBT is often used to teach static processes, such as using software or completing mathematical equations. Computer-based training is conceptually similar to web-based training (WBT), which is delivered via Internet using a web browser.

Flipped classroom

This is an instructional strategy in which computer-assisted teaching is integrated with classroom instruction. Students are given basic essential instruction, such as lectures, before class instead of during class. Instructional content is delivered outside of the classroom, often online. The out-of-class delivery includes streaming video, reading materials, online chats, and other resources (Hall & DuFrene, 2016).

Computers, tablets and mobile devices

Computers and tablets enable learners and educators to access websites as well as applications. Many mobile devices support m-learning (Kolpashnikova & Bartolic, 2019). Mobile devices such as clickers and Smartphone can be used for interactive audience response feedback (Tremblay, 2010).

Virtual classroom

A virtual learning environment (VLE), also known as a learning platform, simulates a virtual classroom or meetings by simultaneously mixing several communication technologies. Web conferencing software enables students and instructors to communicate with each other via webcam, microphone, and real-time chatting in a group setting. Participants can raise hands, answer polls, or take tests. Students can whiteboard and screen cast when given rights by the instructor, who sets permission levels for text notes, microphone rights, and mouse control (Farwell, 2013).

Augmented Reality

Augmented reality (AR) provides students and teachers with the opportunity to create layers of digital information, including both virtual world and real-world elements, to interact within real-time. AR technology plays an important role in the future of the classroom where human / Artificial Intelligence co-orchestration takes place seamlessly (Sharples, 2013). Students would switch between individual and collaborative learning dynamically, based on their own learning pace, while teachers, with the help of AR, monitor the classroom and provide necessary interventions in cases where computer systems are not yet designed to handle. In this vision, the technology's role is to enhance, rather than replace, human teachers' capabilities.

Learning Management System

A learning management system (LMS) is software used for delivering, tracking, and managing training and education. It tracks data about attendance, time on task, and student progress. Educators can post announcements, grade assignments, check on course activity, and participate in class discussions. Students can submit their work, read and respond to discussion questions, and take quizzes (Courts & Tucker, 2012).

Computer Assisted Instruction

Sharma (2017) defines Computer Assisted Instruction as an interactive instructional technique whereby a computer is used to present the instructional material and monitor the learning that takes place.

Sectors of application of Technology-based learning

Education: At different educational levels technology is used as a component of blended learning programs meant to improve traditional curriculum by providing authentic learning experiences. Instructors often implement blended learning to teach students to use technology as well as to help them apply the technology to develop math, science, and reading skills. Researchers have found that Technology based learning components promote active learning and ownership of the learning experience for students. This is because the Internet provides students with the immediate opportunity to research topics they are studying in class and build on information they acquire from traditional classroom instruction.

Post-Secondary Education: Technology-based learning has provided the students with opportunities to access the best programs offered by a variety of educational institutions and offer working adults more access to education and professional specialization through distance learning. The use of technology based learning in post-secondary institutions is continuously growing. Other delivery systems include networks and affiliations of colleges that join together to offer learners the best of each institution's courses. Students work with their own college degree or certificate program and receive credit for courses they complete through other institutions belonging to the network or affiliation. Another growing trend in delivery systems is the public-private technology-based learning partnerships. Certainly, post-secondary institutions in the world have fostered significant innovation in technology-based learning strategies, with one of the most common being the online university.

Economy: Private corporations have made great efforts to capitalize on the benefits of technology-based learning. The web and computer-based models are especially valuable to companies in competitive markets and those with a large and widely dispersed employee base. More and more private companies realize the importance of investing in a quality workforce while maximizing profits through cost-effective technology-based learning programs. Although overall training budgets fell considerably in 2009 due to the global economic crisis, many companies are choosing to spend money on e-learning due to the efficiency of the solutions offered. Employees take advantage of these opportunities through integrated on-the-job training as well as off-site professional development programs.

Public sector: Government at state and local level has turned its attention to technology-based learning as a cost-effective strategy to provide training and professional development for the workforce; up-to-date, on-demand training for military personnel and other government workers. Current issues of importance to governments in every country include funding for accessibility, intellectual property, and the standardization of management systems throughout learning environments. Reports from these bodies point to technology based learning, is related to the capacity to produce a stronger, better qualified workforce if advances are made in these areas (Gudanescu, 2010).

Benefits of Technology-based learning

There are numerous advantages to technology based learning in comparison to face-to-face learning. Some of the primary benefits, as itemized by Gudanescu (2010) are the following:

- i. Accessibility for learners who intend to follow any type of courses,
- ii. Learning matched to learners' need,
- iii. Scalability: well-designed technology based training programs can also accommodate larger volumes of customers at little extra cost.
- iv. Timely Update;
- v. Streamlined and Effective Learning Delivery.

Challenges

The introduction of technology based learning at all educational levels is not without challenges. They include:

- i. Digital Divide: The digital divide directly affects technology based learning implementation since a significant portion of the population still does not have access to computers or to the Internet. Internet use is lowest for low income people, those who are over 50 years old, the unemployed, and individuals who have never attended college.
- ii. Social Loafing: technology based learning is also more likely to produce "social loafing," in which learners reduce their level of effort when they perceive that doing so will not have negative social effects.
- iii. Accommodation for Individuals with Disabilities: Access to technology based learning courses for individuals with disabilities can also pose a challenge. While technology based learning generally offers access options for those disabilities, accommodations must be made in order for technology based learning to be accessible.
- iv. Compatibility: Another challenge for technology based learning is the need for compatible technology.
- v. Development Costs: Another disadvantage of technology-based learning is high upfront development costs, which can require significant programs, because they spent so many hours developing the materials and so few students enrolled in the course.
- vi. Lack of Credibility: Lastly, technology based learning degree programs still lack the level of credibility of traditional degree programs (Gudanescu, 2010).

Conclusion

In conclusion, the very first stage of technology integration must be effective to make sure that, pre-service teachers are able to make the best use of it. Thus, preparations of a technology-based learning begin with proper implementation and supports by the school management. If the implementation process of technology integration in schools take place appropriately from the very early stage and the continuous maintenance are adequately provided, it will result in a huge success and benefits for the pre-service teachers. The use of technology in teaching and learning is more about practicality as compared to theories and that is why teachers must be given time to learn and explore it, face the "trial-and error" phase before they are completely comfortable with its usage and able to make use of it for teaching and learning. Technology based learning components promote active learning and ownership of the learning experience for students. This is because the Internet provides students with the immediate opportunity to research topics they are studying in class and build on information they acquire from traditional classroom instruction. It has provided

the students with opportunities to access the best programs offered by a variety of educational institutions.

Recommendations

National Commission for Colleges of Education (NCCE) and the Colleges of Education stakeholders should provide enabling environment for the pre-service teachers to effectively utilize technology-based learning platforms for learning. Periodic orientations, symposia, conferences, seminars and workshops should be organized for the pre-service teachers so as to keep them up-to-date with the emerging technological trends. Government, Non-governmental organizations (NGOs), National Educational Research Development Agency (NERDA) and other research institutes should fund and encourage more researches in the field of technology integration in education as more gaps are yet to be filled.

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