Importance of Instructional Materials for Teaching and Learning of Technical and Vocational Education and Training in Nigerian Technical Schools and Colleges.

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Abstract
Instructional materials refer to the human and non-human materials and facilities that can be used to ease, encourage, stimulate, and promote teaching and and learning. It is the key to success of every technical oriented subjects. The purpose of Technical and Vocational Education and Training (TVET) is to acquaint people with the technical and professional skills needed for socio-economic and industrial development of a nation. This paper highlights the importance of instructional materials on the teaching and learning of TVET in our schools in promoting technology to meet the labour market needs. The importance of TVET in nation building cannot be overemphasized as the need for artisans and technicians is a fundamental element in the development equation because it allows individuals and society the potentials to unlock the horizons and adapt changes. TVET holds different kind of significance. It is counted as one of the most important strategies to solve the problem of unemployment and unskilled workforce hence the need of adequate instructional materials for its effective teaching and learning.

Key words: *Instructional materials, learner-centred, technical education, user-centred, vocational education, workforce education.*

INTRODUCTION

Learning is a natural ongoing process that occurs in organized situations as well as in everyday activities. As such, the history of learning is coincident with the history of human beings. Teaching also has a long history that is roughly coincident with the history of human families and tribes. Various tools and techniques have been used to support teaching and learning throughout the ages, so one can also conclude that Technical, Vocational and Education and Training (TVET) has a very long history (Spector & Ren, 2015). It is common to divide human history into broad periods or epochs such as the primitive period, the agricultural period, the industrial period, the information age, and the emerging era of the

intelligent society. Early in human history, it is likely that actual objects were used to support learning. For example, an elder teaching a young child to hunt might use an actual spear to support helping the child learn to aim and throw, perhaps initially at a tree rather than at an animal. The abacus was an early calculating device used to keep track of inventories, and its use had to be trained as responsibility shifted from one person to another.

What can be concluded based on this brief history? It is obvious that technologies change. Technologies are changing at an ever-increasing rate. Will this rapid rate of change continue? If so, what are the implications for technology and vocational education technology in the remainder of the twenty-first century?

Technologies change what people can do. As new technologies emerged, it became possible to represent information and knowledge in many forms, including pictures, graphics, animations, and movies. Multiple modes of representation have emerged. In addition, multiple forms of communication have also emerged. In addition to one-to-one and one-to-many face-to-face communication modalities, there are multiple forms of digital communication, including Internet chat rooms, video-conferencing, discussion forums, social networks, and more.

Technical and vocational Education and Training is used as a comprehensive term in the educational process involving, in addition to general education, the study of technologies and related sciences and acquisition of practical skills, attitudes, understanding and knowledge relating to occupations in various sectors of economic and social life (FGN, 2004). The Nigerian national policy on education, concerned with qualitative technological human resources development directed towards a national pool of skilled and self-reliant craftsmen, technicians and technologists in technical and vocational education fields.

TVET as a body knowledge is derived from observation and experiment. All vocational, and technical courses are practical in nature and their content and concepts could not be taught effectively by teacher to student without the use of laboratories. Laboratories when utilized skilfully and adequately facilitates understanding and makes teaching and learning quite meaningful. Teaching in this modern period is increasing and becoming more complex and technical in nature to be actualized with just traditional tools (Bondell, 2014). The development of modern technology has made available a vast species of laboratory materials to complement the teaching-learning process.

Science, vocational, and technical education programs are insufficient without research facility work or practice. The overall idea behind the teaching and learning of courses leading to the award of TVET is to sustain understudies to design and, inexact, manage the assortment of problems being faced in the society (Barnard, & Campbell, (2005). The laboratory is a fantastic spot where teaching and learning of practicals are carried out successfully. Most vocational and technical educational carried out in the laboratories demands the systematic usage of knowledge and talent.

The term “Technical and Vocational Education and training” is said to have been used officially at the World Congress of TVET which was held in Seoul, Korea in 1999. At that congress, it was accepted that that the acronym “TVET” is generic to encompass various terms that have already been used to describe parallel elements of the field, educational and training activities which include “Vocational Education, Technical Education, Occupational Education, Workplace Education, Career and Technical Education (CTE), Apprenticeship Training, Workforce Education, etc.” (FRN, 2013). It is believed that the focal role of Technical and Vocational Education and Training (TVET) which include entrepreneurship, agricultural science, home economics, hospitality and tourism-related courses for social reproduction and the transformation of vocational practices is the development of

professional skills in students; master them in basic knowledge and scientific principles so that they can prepare them for work (Akor, 2010).

FRN (2013) stated that, the goals of Technical and Vocational Education (TVE) shall be:- (a) to provide trained manpower in the applied sciences, technology and business particularly at craft, advanced craft and technician levels; (b) to provide the technical knowledge and vocational skill necessary for agricultural, commercial and economic development; and (c) to give training and impart necessary skills to individual who shall be self-reliant economically.

TVET to a large extent has no limitations. It encompasses every environment in which nature may be observed and investigated whether in the field or within the equipped classroom and the main reason for teaching TVET as investigative or enquiry is always located in the laboratory (Akinbobola, 2015).

Technical and Vocational Education and Training is the study and ethical practice of facilitating learning and improving performance by creating, using, and managing appropriate technological processes and resources. From the perspective of technology used in education, TVET could be understood as the use of emerging and existing technologies to improve learning experiences in a variety of instructional settings, such as formal learning, informal learning, non-formal learning, lifelong learning, learning on demand, and just-in-time learning. TVET approaches have evolved from early uses of audiovisual aids to individual and networked computers, and now have evolved to include various mobile and smart technologies, as well as virtual and augmented realities, avatar-based immersive environments, cloud computing, and wearable and location-aware devices. Various terms have been used along the way to refer to educational technologies, such as learning technologies/environments and instructional technologies/systems. We have embraced a broad interpretation in this book to cover instructional design approaches, learning strategies, and hardware and software. Our view is that anything that consistently can support learning and instruction can be considered an educational technology. Some educational technologies are simple and have existed for many years; others are complex, and new ones are finding their way into educational settings every day.

TVET focuses on both the technical and pedagogical ways and means of supporting learning and instruction. It is the basis for the success of the e-learning revolution in recent years. Technology-based instruction can surpass traditional classroom-based instruction in quality by providing a wide variety of affordable and capabilities that can promote motivation and result in engaging, efficient, and effective learning.

There is a strong demand for technologists who understand learning theories and for instructional designers and educators who understand technologies and how to effectively integrate technology into learning and instruction. The field of educational technology is becoming part of major educational programs in institutions worldwide. The commercial training industry is large and still going through a period of rapid and sustained growth, based in large part on the integration of advanced digital technologies.

The needs and requirements of the various organizations, both educational and commercial, vary widely in terms of the knowledge and skills needed to implement educational technology solutions effectively. Further complexity comes from the fact that potential students of educational technology exist at different levels and in a variety of contexts; potential students come from a variety of backgrounds, ranging from education, computing, engineering, design, arts, the humanities, finance, and the natural sciences. Their interests and expectations vary as widely as their aspirations toward what kind of organizations they would like to serve after their studies. The aim of this book is to prepare students with the knowledge and skills to understand the organizational needs and requirements, and not only use and manage existing and emerging technologies effectively, to be able to apply associated

pedagogies and instructional strategies appropriately and effectively, to evaluate and manage educational technology solutions, and to foresee and prepare for future possibilities.

Leaner experience with TVET

Learner experience with TVET includes learners' perceptions, responses, and performances of the learning environment, resources, and methods. The structure and elements of user experience can reveal the connotation and extension for the definition, which could enlighten us the structure and elements of learner experience with educational technology. Morville (2004) proposed a conceptual framework called user experience honeycomb to describe the elements of user experience in designing Web sites.

In order to create a meaningful and valuable user experience, the information in a Web site should be:

(1) Useful: the content should be original and fulfil a need;
(2) Usable: the Web site should be easy to use;
(3) Desirable: image, identity, brand, and other design elements should evoke desirable emotion and appreciation;
(4) Findable: the content should be navigable and locatable onsite and offsite;
(5) Accessible: the content should be accessible to people with disabilities;
(6) Credible: users should trust and believe what they see, hear, or read; and
(7) Valuable: the Web site should deliver something valued by the user. Rubinoff (2004) also proposed that user experience was made up of four interdependent elements: branding, usability, functionality, and content. Branding includes all the aesthetic- and design-related items within a Web site. Branding refers to the site's projection of the desired organizational image and message.

Functionality includes all the technical and behind-the-scenes processes and applications. It entails the site's delivery of interactive services to all end users, and it is important to note that this sometimes means the public as well as administrators, instructors, and learners. Usability entails the general ease of use of all site components and features. Subtopics beneath the usability banner can include navigation and accessibility. Content refers to the actual content of the site (text, multimedia, images) as well as its structure, or information architecture. We look to see how the information and content are structured regarding defined user needs and client business requirements.

Do Learners Value TVET?

From the holistic perspective, the value of learner experience refers to the positive or negative quality that renders the changes of the classroom, such as classroom furnishings and layout changes, the use of equipment, desirable or valuable for the learners.

What drives an educational technology's value to the student? TVET features must be in alignment with learning needs. If a classroom change is designed to support learning needs, teacher and learners may consider the layout changes and equipment valuable. Learning needs encompass more than just their explicit needs—things that learner know they want, but to include learners' implicit needs—things that learners do not express as needs, which might be hidden in learning activities and be recognized by their teacher. To meet learners' unexpressed needs, educational technology should not only be easy-to-use products, such as devices and software, but also services that add much value to student learning.

Do the Learners Find TVET Equipment Easy to Use?

Usability refers to the ease of use and learn-ability of TVET, which is composed of:

(1) Learn-ability: how easy is it for teachers and students to accomplish basic tasks the first time they encounter the educational technology?

(2) Efficiency: once teachers and students have learned the design of educational technology, how quickly can they perform teaching and learning tasks?
(3) Memorability: when teachers and students return to the design after a period of not using it, how easily can they establish proficiency?
(4) Errors: how many errors do teachers and students make, how severe are these errors, and how easily can they recover from the errors?
(5) Satisfaction: does the educational technology meet the needs of learners?
The design factors of an educational technology include systems, facilities, and software which have a significant influence on usability.

Do Learners Enjoy Engaging with TVET?
Desirability refers to the attractiveness and engagement of the activities in educational technology or the pleasing perception from teachers and students. A pervasive goal in education is to engage students in learning so that they are attentive and mindful (Lavigne & Mouza, 2013). Engagement involves three dimensions (Fredricks et al., 2004):
(a) Behaviour (e.g., participation in activities such as the number of times students interact with virtual world characters, embedded tools, objects),
(b) Cognitive-motivational (e.g., putting forth the effort, the belief of competence in the content area or self-efficacy, desire to be optimally challenged),
(c) Emotions (e.g., interest, curiosity, sense of belonging, and affect). Engagement in an educational technology depends on the content presentation methods, the digital resource, software systems, and interactive design.
Vahey et al. (2013) listed four key benefits when using dynamic-representation technologies in mathematics classrooms: (a) providing rich representations for the student to understand some difficult concepts, (b) providing an opportunity for the student to focus their attention on the same point, (c) supporting the utilization of narrative as a type of representation, and (d) engaging students in the class.

Do Learners Find the Technology Personally Adaptive?
Adaptability of an educational technology deals with the diversity of students and their learning preferences which result in a need to treat learners as individually as possible. Room layout should be flexible to meet the teacher's instruction and learner's collaboration; a software system should adapt to learning styles of the learners; and physical environment factors, such as lighting, temperature, and ventilation, should be adjusted to suit learners.
Hill (2008) recognized that flexible, modern learning environments have potential to encourage students to participate in activities with peers as they acquire knowledge for themselves. About classroom layout, Lippman (2002, 2003) in studies of schools mentions that providing a variety of spaces within a single classroom may support child–adult/student–teacher interactions. Jamieson (2007) recognized that formal spaces such as lecture theaters, classrooms, and laboratories should have flexible layouts which support a diversity of teaching and learning approaches, although this is not always affordable or feasible.

Do Learners Feel Comfortable with TVET?
Comfortability with TVET focuses on providing physical and emotional well-being experience to learners when they are using educational technology, i.e., the user interface and environmental conditions consisting of various elements such as temperature, humidity, noise, thermal, air pressure, ventilation, air quality, acoustic, dust, vibration, lighting, airflows, radiation, and so on. Due to the increased use of media and technology in classrooms, the design of easy-to-use, adjustable lighting systems is more critical than ever. Lighting needs to be designed to the standards proposed by Illuminating Engineering

Societies and the National Electrical Code's current recommendations. Lighting should be designed to meet the special program requirements for each instructional space (Clabaugh, 2004).

Impact of Instructional Materials on students

Instructional materials help students to improve in their learning procedure (Ewudo, 2009). Skills are developed through the use of instructional materials which help students range of experiences and to achieving their learning target. They stimulate students desire to learn as well.

Ogbu (2006) stated that instructional materials develop students' ideas through the creation of events and objectives which will improve the student's continuity of thought. It equally facilitates, stimulates and assist students to actively have interest in the subject under study. It improves the emotional instincts of students by providing them with the required knowledge. It also provides students with understanding of the working models presented by the teacher. The student captures the true picture of what is taught by the teacher. In presenting subject content and real objects, learning and teaching is played efficiently by making sure that good points of the subject matter are captured (Patterson, 2009).

User Experience

As we know, educational technology systems aim at improving user's performance, and users could include students, teachers, parents, support personnel, administrators, and policy makers. Different users may have different perspectives and concerns, and thus user's perspectives play a vital role for the success of TVET systems.

In software engineering, user-centered design and development are now standard practice with an emphasis on rapid prototyping and getting input from representative users. Taking the typical models of user-centered design in software engineering as a reference and considering the research of user-centered design in educational technology, the following sections will introduce the users' perspective of educational technology. Emphasis is on user experience, user-centered design, learner-centered design, and the ARCS motivation model.

User experience is defined as "a person's perceptions and responses that result from the use or anticipated use of a product, system or service" (International Organization for Standardization, 2009). From to this definition, User experience includes all the users' attitudes, emotions, perceptions, preferences, physical/psychological responses, and behaviours that occur before, during, and after use. The IOS also lists three factors that influence user experience: system, user, and the context of use.

User Experience Honeycomb

Morville (2004) created a frequently reproduced honeycomb model to design for user experience that illustrated the facets of user experience, especially to help clients understand why they must move beyond usability.

The user experience honeycomb could be used as a guide to explain the various facets of the design of user experience. Morville (2004) believed that the user experience honeycomb would contribute to educating clients, which helps them to find a sweet spot between the various areas of a good user experience. If applied in TVET, the essential items could be explained as follows:

Useful. A TVET product or service should fulfil teachers'/ students'/parents' needs. If the product or service could not fulfil user's wants or needs, then there is no real use for the product itself.

Usable. Systems in which the product or service is delivered should be simple, familiar, easy to understand and easy to use. The learning curve that users must go through should be as short and painless as possible.
Desirable. The visual aesthetics of the educational product, service, or system should be minimal, attractive, and easy to understand. Our pursuit of efficiency must be moderated by an appreciation for the power and value of the brand, image, identity, and other elements of emotional design.
Findable. Information in the TVET systems needs to be findable and easy to navigate. If teachers/students/parents have a problem, they should be able to find a solution quickly. The navigational structure must be set up in a way that takes users' behaviours and habits into consideration to makes sense.
Accessible. The product or services should be designed so that even users with disabilities can have the same user experience as others.
Credible. The enterprises and their products or services need to be trustworthy.
Valuable. Our products or services should deliver value to sponsors. For Non-profits, the user experience must improve the mission of the enterprise. With for-profits, it should contribute to the bottom line and increase customer satisfaction.

Learner -Centred Design

Comparing with UCD, Learner-Centred Design (LCD) emphasizes the importance of supporting students' growth and their motivational needs in designing educational software. Learner-centred indicates a move from ease-of-use issues towards the development of a student's comprehension expertise. Soloway et al, (1994) suggested that special needs of the learners must be considered if we are putting them at the centre of the product design.

1. Understanding is the Goal: When designing the educational software, keep in mind that learners do not have the basic knowledge and basic skills specific work domains. For example, they will not know the accounting principles or practices when a spreadsheet is presented to them. How will they learn how to use that spreadsheet must be considered in the design process.

2. Motivation is the Basis: We cannot count on the motivation of learners. Remember that both students and professionals have a strong tendency to fitter away time or to procrastinate, when they are confronted with a task they are not familiar or unprepared for.

3. Diversity is the Norm: Learners who use a specific tool are often from a diverse set of background, with various interests, skills, abilities, learning styles etc.

4. "One-size-fits-all" will not will not satisfy the various needs of diverse learners.

5. Growth is the Challenge: Learners can be very different from day 1 to day 100. They may have learnt quite a bit about a problem domain and might have developed a set of skills and practices in that domain; however, most of the software doesn't change and grow. The individual has changed but the knowledge and the specific practices of a task in the software has not changed. Therefore, learner-centred design must follow the basic tenets.

CONCLUSION

Instructional materials stimulate students desire to learn. It equally assist in the learning process by making assimilation and memorization of material easy and help in the long retention of information. It improves the students understanding on the working model taught by the teacher and also allows the learner to capture the true picture of what has been presented.
The teaching and learning of TVET in schools and colleges is expected to equip students and or learners with the basic knowledge and practical's skills for various activities. For students of TVET at technical schools and colleges to acquire knowledge and skills, instructional

resources need to be adequately available and utilized effectively in the teaching-learning process. The effect of this is mass self-employment among school leavers.

It is necessary to prepare the technical student into productive employments to accelerate the engine to economic and technological development and in doing that, the student need to be equipped with the necessary skills and knowledge which is provided by TVET.

REFERENCES

Akor, R. (2010). Students under achievement in Vocational Technical subjects at post primary schools suggested. Remedies Teacher Education Journal (TEJ), 2(1), 22-27.

Barnard, R., & Campbell, L. (2005). Socio – cultural theory and the teaching of process writing: The scaffolding of learning in a university context. [Electronic version] The Tesolanz Journal, 13, 76 – 88. Retrieved 10/10/2015 from http://researchcommons.waikato.ac.nz/handle/10289/433/content.pdf

Bondell, K.(2014). Lecture as a teaching Method. Retrieved from www.712.education.com MERLOT,(2016). Teaching Strategies. Creative common press, California.

Clabaugh, S. (2004). Classroom design manual: Guidelines for designing, constructing, and renovating instructional spaces at the University of Maryland. Retrieved from http://www.it. umd.edu/tc/UM_Classroom_Design.pdf.

Federal Republic of Nigeria (2013). National Policy on Education.(5th edition). Abuja: NERDC

Federal Republic of Nigeria (FRN, 2008). National Policy on Education. Abuja: NERDC

Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of the concept, state of the evidence. Review of Educational Research, 74(1), 59–109.

Hill, F. (2008). Patterns for small learning communities at the elementary level: The "L" shaped classroom. Retrieved from http://www.schoolfacilities.com/uploads/files/85.pdf.

Huang,R., Spector,J.M., & Yang, J. (2019)Educational Technology:A Primer to the 21st Century. Springer Nature Singapore Pte Ltd.

Jamieson, P. (2007). Rethinking the university classroom: designing 'places' for learning. Paper presented at the Next Generation Learning Space Conference.

Lavigne, N. C., & Mouza, C. (2013). Epilogue: Designing and integrating emerging technologies for learning, collaboration, reflflection, and creativity. In Emerging Technologies for the Classroom (pp. 269–288). New York: Springer.

Lippman, P. C. (2002, October). Understanding activity settings in relationship to the design of learning environments. CAE Quarterly Newsletter. AIA Committee on Architecture for Education.

Lippman, P. C. (2003). September). AIA Committee on Architecture for Education: Advancing concepts about activity settings within learning environments. CAE Quarterly Newsletter.

Morville, P. (2004, September 28), User experience design [Web log message]. Retrieved from http://semanticstudios.com/publications/semantics/000029.php.

Ogbu, A. J. (2006),Using Learning Styles Instruments to Enhance Students Learning. Decision Sciences Journal of Innovative Education (5), pp. 1-20.

Rubinoff, R. (2004, September 28). How to quantify the user experience. Retrieved from http:// www.sitepoint.com/quantify-user-experience/.

Soloway, E., Gusdial, M., & Hay, K. E. (1994). Learner-Centred Design: The Challenge for HCI in the 21st Century. Interactions, 1 (2), 36-48. http://dx.doi.org/10.1145/174809.174813.

Spector, J. M., & Ren, Y. (2015). History of educational technology. In J. M. Spector (Ed.), The SAGE Encyclopedia of educational technology. Thousand Oaks, CA: Sage.

Vahey, P., Knudsen, J., Rafanan, K., & Lara-Meloy, T. (2013). Curricular activity systems supporting the use of dynamic representations to foster students' deep understanding of mathematics. In C. Mouza & N. Lavigne (Eds.), Emerging technologies for the classroom: Explorations in the learning sciences, instructional systems and performance technologies (pp. 15–30). New York: Springer.