# ENHANCING TECHNICAL AND VOCATIONAL EDUCATION AND TRAINING (TVET) USING SECURE CLOUD INFRASTRUCTURE

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**Abstract**

*Over the last two decades, African countries actualize exponential economic growth due to foreign intervention in technological skills. Technical and Vocational Education and Training (TVET) has the potential to improve the employability, productivity, and livelihoods of young workers in a country. TVET faces a number of challenges in African countries that includes Low Societal Recognition due to its traditional allied which leads to Low Enrolment and a Shortage of Skilled Workforce as well as sufficient Instructional Facility. Due to the emergence of this technology the learning processes have been enriched through collaborative learning in a remote access pattern which is obtainable in could computing technology. Cloud computing technology is a new paradigm that allows users to access software applications, hardware, storage, and computing processes directly from the web. This paper discusses some of the cloud computing techniques and their applicability in the area of technical and vocational education and training (TVET). The purpose of this study was to determine whether cloud computing might be applied to technical and vocational education and training (TVET) as well as the benefits provided by cloud computing in the development of learning systems.*

**Keywords:** Cloud computing, Collaborative teaching, Vocational Education and Training (VET)

## Introduction

Vocational Education and Training (VET), as enshrined in the Nigerian national policy on education, is 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. In Nigeria, the training of technical personnel has witnessed many challenges ranging from policies which have no beaming with our problems, curriculum that has little or no relationship with workplace and social needs, embezzlement of fund meant for education development purposes, lack of teacher motivation, inadequate facilities, inadequate funding, brain drain, poor staff training, bribery and corruption. With emergence of Cloud computing technology which enriched the learning processes of the students through collaborative learning platform, the avenue could be used to share references, to hold virtual discussions, to manage number of course work with a minimal cost. Cloud computing technologies evolve with independent technologies such as hardware virtualization, distributed processing, utility computing, network system, web services, platform as a service, and software as a service. In this paper we proposed a cloud computing model for both teaching and learning processes in vocational education and training (TVET) by using a client-server based Learning Management System (Mekawie and Yehia 2021).

## Cloud Computing Overview

The term Cloud refers to a Network or Internet. In other words, it could be say that Cloud is something, which is present at remote location. Cloud can provide services over public and private networks, i.e., WAN, LAN or VPN. Cloud Computing refers to manipulating, configuring, and accessing the hardware and software resources remotely. It offers online data storage, infrastructure, and application.

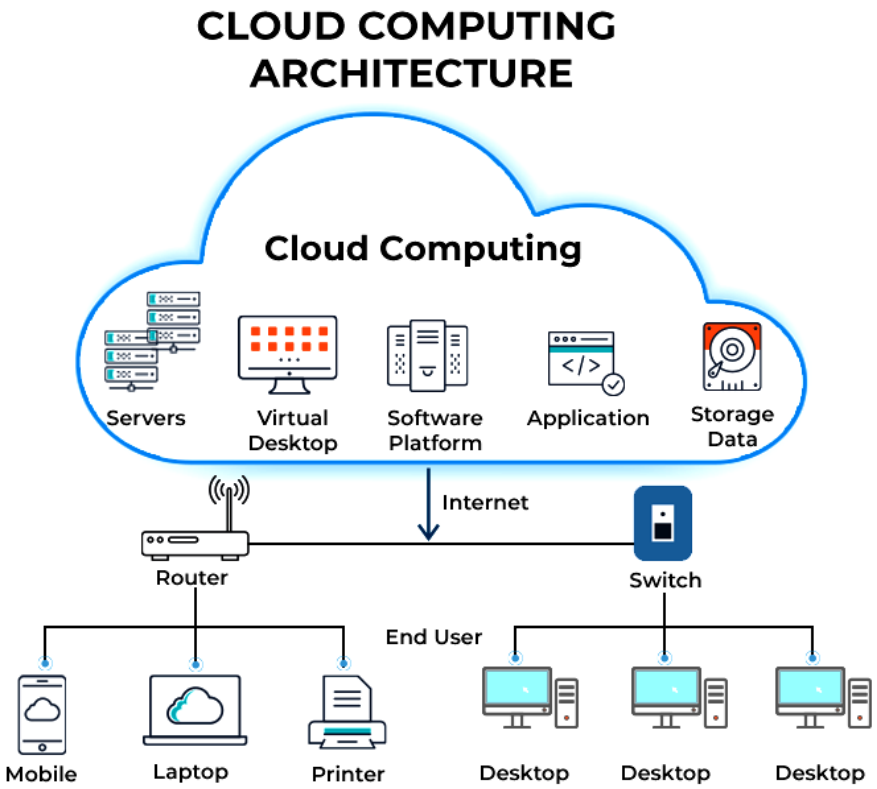



Figure 2.1 Cloud Computing Architecture
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Cloud computing offers platform independency, as the software is not required to be installed locally on the PC. Hence, the Cloud Computing is making our business applications mobile and collaborative(Gupta et al. 2021). There are certain services and models that makes cloud computing feasible and accessible to end users these are:

1. Deployment Models
2. Service Models

**Deployment Models**

According to (Mekawie and Yehia 2021) Deployment models defines type of access to the cloud service that is to say how and where cloud located. There are upto four types of access model in cloud computing viz: ***Public, Private, Hybrid, and Community.***

**Public Cloud**: The public cloud allows systems and services to be easily accessible to the general public. Public cloud may be less secure because of its openness(Zheng et al. 2020).

**Private Cloud**: The private cloud allows systems and services to be accessible within an organization. It is more secured because of its private nature.

**Community Cloud**: The community cloud allows systems and services to be accessible by a group of organizations.

**Hybrid Cloud**: The hybrid cloud is a mixture of public and private cloud, in which the critical activities are performed using private cloud while the non-critical activities are performed using public cloud.

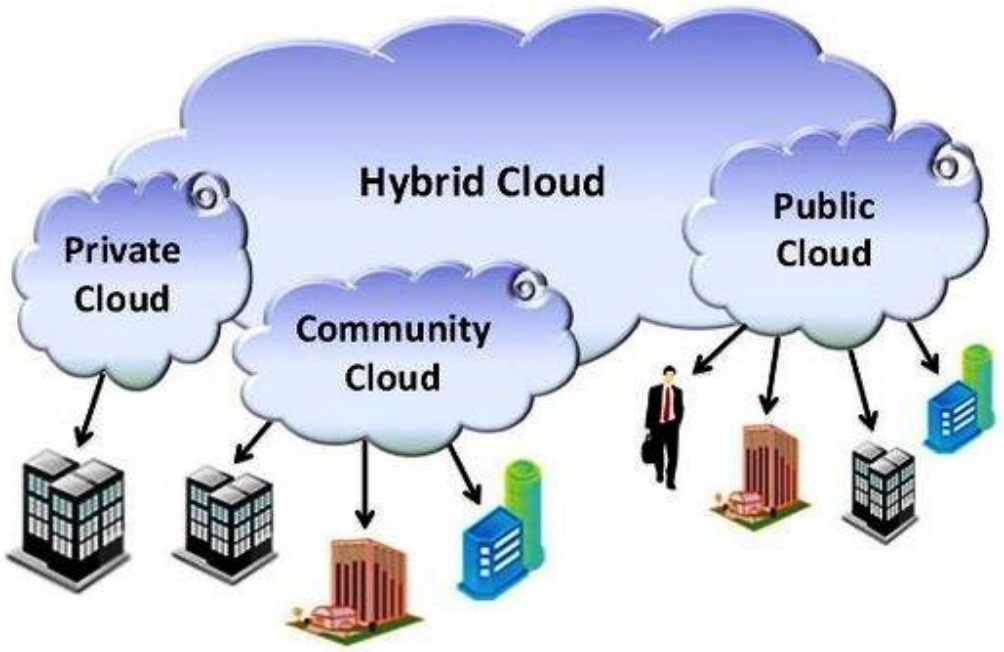



Figure 2.2: Cloud Computing Deployment Models. Source:https://www.researchgate.net/profile/Mervat-Bamiah/publication/275036700/figure/fig2/AS:669016616087575@1536517399779/Cloud-Computing-Deployment-Models-Mell-and-Grance-2011_W640.jpg

**Service Models**

Cloud computing is based on service models categorized into :

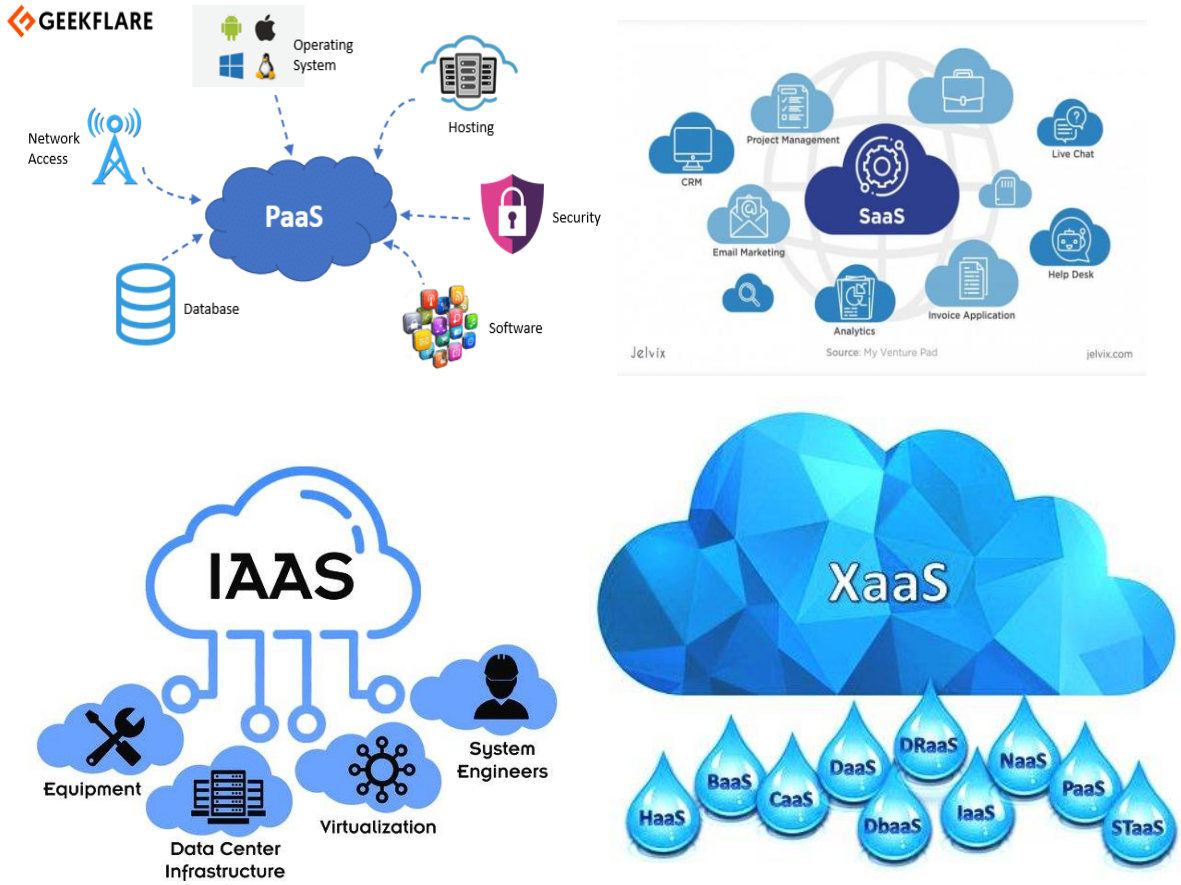
- Infrastructure-as–a-Service (IaaS)
- Platform-as-a-Service (PaaS)
- Software-as-a-Service (SaaS)
- Anything-as-a-Service (XaaS)

**Infrastructure-as-a-Service (IaaS):** IaaS provides access to fundamental resources such as physical machines, virtual machines, virtual storage, etc.

**Platform-as-a-Service (PaaS):** PaaS provides the runtime environment for applications, development and deployment tools, etc.

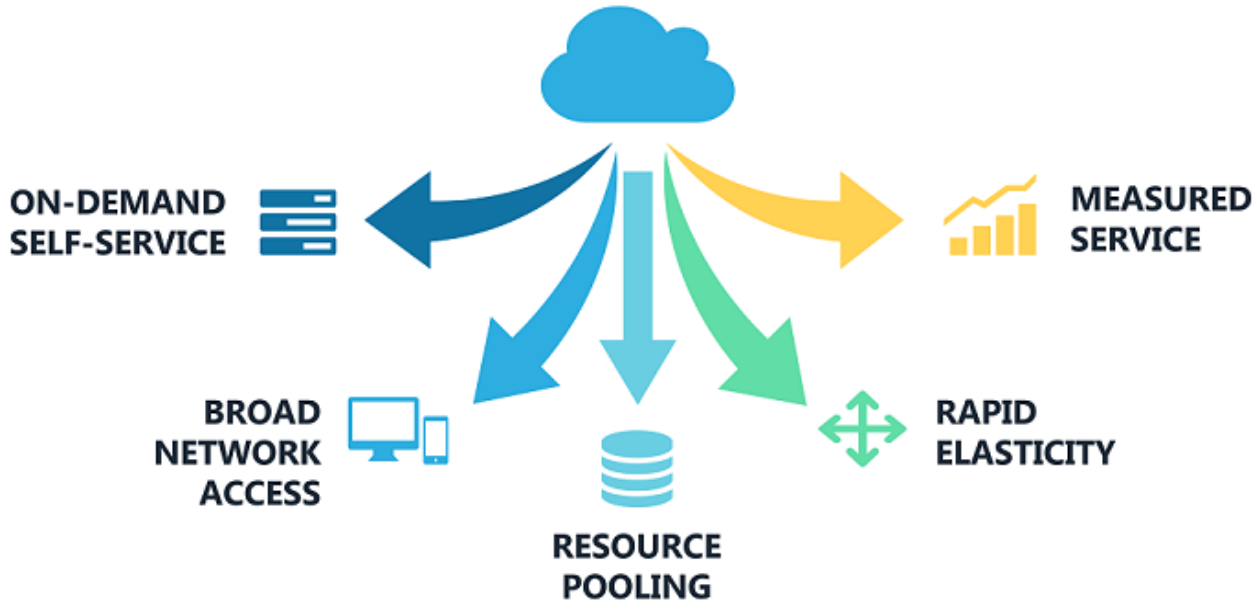
**Software-as-a-Service (SaaS):** SaaS model allows to use software applications as a service to end-users.

**Anything-as-a-Service (XaaS)** is yet another service model, which includes Network-as-a-Service, Business-as-a-Service, Identity-as-a-Service, Database-as-a-Service or Strategy-as-a-Service.




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**Essential Characteristics of cloud computing**




**On Demand Self Service:** Cloud Computing allows the users to use web services and resources on demand. One can logon to a website at any time and use them.

**Broad Network Access:** Since cloud computing is completely web based, it can be accessed from anywhere and at any time.

**Resource Pooling:** Cloud computing allows multiple tenants to share a pool of resources. One can share single physical instance of hardware, database and basic infrastructure.

**Rapid Elasticity:** It is very easy to scale the resources vertically or horizontally at any time. Scaling of resources means the ability of resources to deal with increasing or decreasing demand. The resources being used by customers at any given point of time are automatically monitored.

**Measured Service:** In this service cloud provider controls and monitors all the aspects of cloud service. Resource optimization, billing, and capacity planning etc. depend on it(Alhomdy et al. 2021).

**IMPLEMENTING CLOUD COMPUTING IN EDUCATION**

Cloud computing is an emerging platform for e-learning in current and future learning management system. Many e-learning cloud computing models have been proposed to support e-Learning. However using e-Learning environment for teaching computer programming requires a platform equipped with special applications such as programming workbook, program automatic marking and plagiarism detection, centralised logbook for monitoring students' work and performance, as well as online development environment(Elamir, Jailani, and Bakar 2019).

Most of educational institutions have become highly dependent on information technology to service their requirements particularly in **Technical and Vocational Education teaching.** These services are increasingly provided using Internet technologies to faculty and students and accessed from web browsers. The services are offered cheaply or freely to education, often with much higher availability than can be provided by the educational institution. Are we therefore facing a future where the majority of educational services will be hosted in the cloud and institutions no longer host their own data centers with expensive hardware, power billsparticularly in most of the government schools in Nigeria. IT plays very limited role. Most of the work is done manually from attendance to classroom teaching to examination system(Khoda Parast et al. 2022). Cloud computing technology can provide solutions for the above mentioned problems in education system. Cloud computing enables users to control and access data via the Internet. The main users of a typical higher education cloud include students, Faculty, administrative staff, Examination Branch and Admission Branch as shown in Figure 3.1. All the main users of the institution are connected to the cloud .Separate login is provided for all the users for their respective work. Teachers can upload their class Tutorials, assignments, and tests on the cloud server which students will be able to access all

the teaching material provided by the teachers via Internet using computers and other electronic devices both at home and college and 24 x 7. The education system will make it possible for teachers to identify problem areas in which students tend to make mistakes, by analyzing students' study records. In doing so, it will also allow teachers to improve teaching materials and methods.

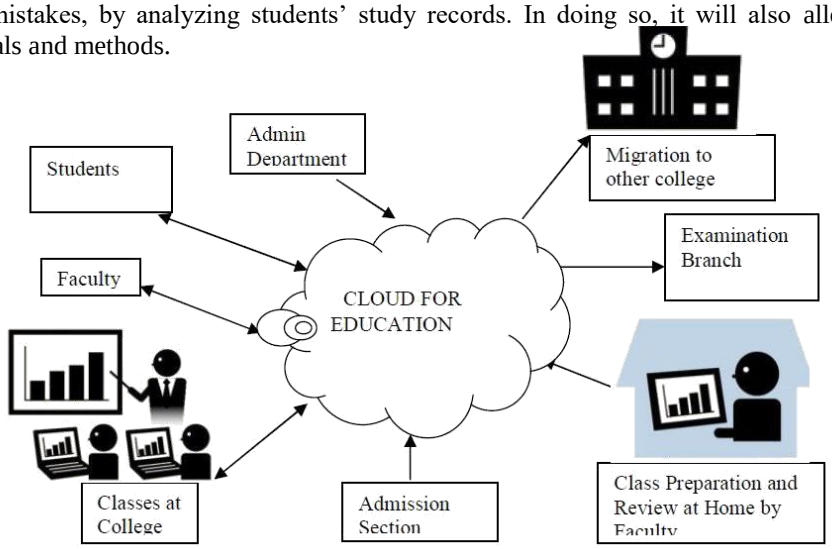



Figure3.1: Services attached to Education Cloud. Source:https://www.researchgate.net/profile/Mervat-Bamiah/publication/275036700/figure/fig3/AS:669016616103948@1536517399811/Cloud-Service-Delivery-Models-Mell-and-Grance-2011_W640.jpg

This will not only make it possible for students to use online teaching materials during class but they will also be able to access these materials at home, using them to prepare for and review lessons. Utilization of cloud computing systems will reduce the cost of operation because servers and learning materials are shared with other colleges(Ranger 2022). In the traditional deployment model, all Information Technology resources are housed and managed in-house. Many aspects of these services and tools may be migrated to the cloud and consumed directly over the Internet either as fully functional applications (SaaS), development platforms (PaaS) or raw computing resources (IaaS).Figure3.3 shows how the different categories of university users may consume cloud services(Mekawie and Yehia 2021).

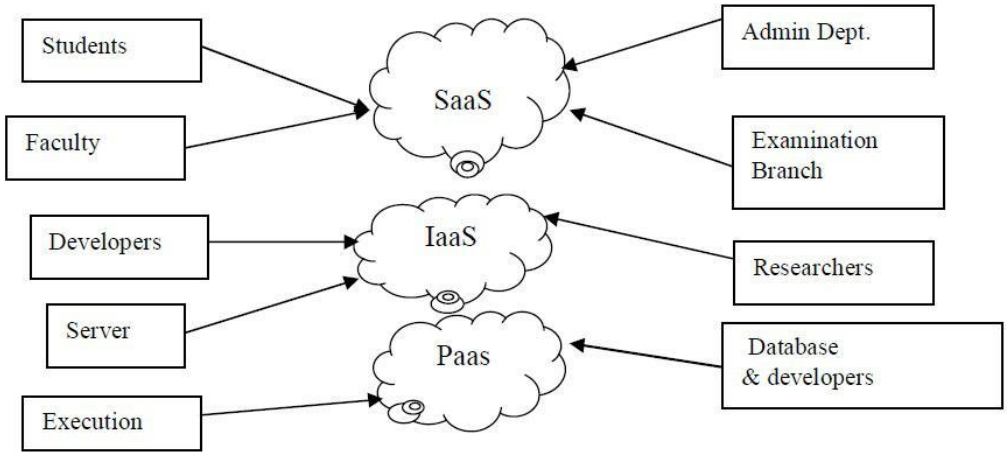



Figure3.2 Users of an Education Cloud Computing System. Source:https://www.researchgate.net/profile/Mervat-Bamiah/publication/275036700/figure/fig3/AS:669016616103948@1536517399811/Cloud-Service-Delivery-Models-Mell-and-Grance-2011_W640.jpg

**Benefits of Cloud Computing for Institutions and Students**

**Personalized Learning:** Cloud computing affords opportunities for greater student choice in learning. Using an Internet-connected device, students can access a wide array of resources and software tools that suit their learning styles and interests.

**Reduced Costs***:* Cloud-based services can help institutes reduce costs and accelerate the useof new technologies to meet evolving educational needs. Students can use office applications for free without having to purchase, install and keep these applications up to date on their computers. It also provides the facility of Pay per use for some applications.

**Accessibility***:* Availability of the services is the most important and desired by the user using the education cloud. 24 x 7 is the availability that is needed by this system without failure. From anywhere one can login and access the information.

**Improved administrative efficiency of schools and universities:** Colleges and the administrative staff can focus on the core functions of the institution instead of futile efforts on IT infrastructure and the applications set-up.

**No Extra Infrastructure***:* Colleges and governments are now free to focus on their goals that is making more research facilities available to the students and making the environment global in spite wasting time on worrying about the buildings, labs, teachers etc.

**Higher quality of education delivered anytime, anywhere:** Courses with updated content can be delivered consistently across all locations.

**Standardisation of content:** Courses delivered over cloud through a central location will lead to a standard content delivery to multiple remote virtual classrooms.

**Collaboration:** Students and Colleges can collaborate on studies, projects using collaboration solutions.

**Agility to rollout new courses:** Cloud-enabled technologies ensure rapid access to infrastructure services thereby rendering agility in rolling out newer products.

**Improved administrative efficiency of schools and universities:** Teachers and the administrative staff can focus on the core functions of the institution instead of futile efforts on IT infrastructure and the applications set-up.

**Scalability:** Scalable systems on cloud to provision big data platform for research and analysis.

**Go Green***:* Education cloud will surely reduce the carbon footprint.

**Conclusion**

The cloud allows us to access our work anywhere, anytime and share it with anyone. It frees us from needing a particular machine to access a file or an application like a word processor or spreadsheet program. In the present paper a cloud education system is introduced and how it is beneficial for students, faculty and the educational institutes for providing quality education.

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