

# A Systematic Review of Adaptable ICT Teaching Strategies on Teaching Process in Primary Teachers' Colleges in Africa

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## Abstract

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**Background:** The use of adaptable ICTs in teaching and learning is the most critical factor that boosts the learners' interest. The use of ICTs in pedagogy in Africa is still low in primary teachers' colleges. Therefore, the study explored the extent to which adaptable ICT teaching strategies and learning activities influence teaching process in primary teachers' colleges in Africa.

**Methods:** Electronic databases, mainly Google Scholar and African Journals Online, were searched for relevant literature on mixed methodological studies that had been done on the use of adaptable ICTs in primary teachers' colleges in Africa. These had been published from 2014 to 2021. This period was considered with reference to when several governments in Africa emphasised provision of support in terms of ICTs. This focus was on infrastructure, equipment, and capacity building. The search strategy involved adherence to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines for systematic reviews with focus on keywords and the general objective of the study. A total of 2,880 results was found when, 'use of adaptable ICTs in teaching and learning in Primary Teachers' Colleges in Africa from 2014 to 2021' was used to search. Of these, only 304 titles were relevant, while 92 abstracts were closely related to the study objectives. However, 51 were duplicates in the two databases; hence,

only 41 studies relevant by topic and date were exported into Mendeley; an online bibliographic management programme and were systematically reviewed for inclusion in the study. This is summarised in the PRISMA flow chart as will be indicated in the full paper.

**Results:** Integrating ICTs in teaching and learning process may cause powerful **learning** situations and promotes acquisition of knowledge, skills, and enables learners to be more constructive and self-directed. These include: shorthand computers, networks, satellite, software, and related systems that facilitate teaching and learning. However, their use is dependent on the perceived usefulness, ease to use, and attitude of both the teacher and learner. ICTs are critical in enabling individual learner to build new knowledge, especially when there is a challenge within the context. Equal access to ICT is not for all countries and this technological gap has consequences among the two categories of people: the rich and poor which is always referred to as the digital divide. If this divide continues in today's economy, individuals and families in some developing countries, such as those in Africa will remain at a disadvantage.

**Conclusions:** The effective technology use in teaching and learning is different from country to country because of the educational needs that have different variables. This calls for use of the available technologies in a way that will eventually transform the creation of knowledge and pedagogy towards producing a transformed citizen.

**Keywords:** Active teaching and learning, Adoptable ICTs, teacher education, technology

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## Background

The use of adaptable ICTs in teaching and learning is the most critical factor that boosts the learners' interest as revealed by 83.7% of the respondents in a study by Al-Shara (2015). The use of ICTs in pedagogy in Africa is still low in primary teachers' colleges. Currently, teacher educators in Africa have limited Information Communication Technology (ICT) skills, a situation that is likely to influence the use of Active Teaching and Learning (ATL) which largely requires one to use technology (Behar-Horenstein & Seabert, 2012). Active Teaching and Learning is a process of acquiring knowledge, skills, values and attitudes by any educational strategy that engages students in activities, such as debates, role plays, projects, and problem-based learning, instead of just putting them in the position of passively listening to the information given by the teacher (Mendes, 2019). Most Sub-Saharan African (SSA) countries have not fully developed their national ICT policies and these policies provide the foundation upon which ICT, both at the national level and at the educational sector level is set (Anderson & Kanuka, 1999). For those who have ICT facilities in place, many schools are struggling with their effective use, and government-led initiatives seem to mainly emphasise

capacity building for teachers both in initial and in-service teacher education pertaining to ICT use, (Hennessy & Onguko, 2010).

The integration of ICT is high on the educational reforms worldwide and in developing countries in particular. Education reforms in Ghana were launched in 2007 where computer literacy was introduced as a new subject and a tool to enhance teaching and learning. Despite the education reforms in education in Ghana, there is still a number of challenges that hinder quality teaching and learning. These challenges include inadequate ICT skills as well as infrastructure and human resource. In addition, teacher educators are resistant to change from traditional to modern methods of teaching (Agyei, 2014).

A study done in South Africa in 2017 indicated that even school administrators, as mediators of learning, do not use modern tools of technology in teaching and learning process probably because they have inadequate skills to use them. It was also noted that schools did not have adequate ICT infrastructure which denied learners an opportunity to employ modern means for information search (Tshelane, 2018). A study that was carried out in Malawi, Tanzania, Kenya, Rwanda, and Ethiopia highlighted teachers as critical drivers in the preparation of learners for a digitally-enhanced society. This is not only through transformation of the education system but also changing the teachers' role. In this process, the teaching profession is learner-centred and more interactive. For teachers to enhance active teaching and learning, there is a need for continuous professional development (CPD) for them to effectively manage digital tools and other resources (GIZ, 2021).

The role of ICTs in enhancing communication, critical thinking, job creation, and innovation largely depend on how the teachers manage to deliver quality education. In order to achieve this, Đurek, V., Ređep, N. B., & eTransform

AFRicA (2016) recommend the following areas of intervention: teacher professional development, digital learning resources, and affordable technologies by respective governments. This will create an environment for Active Teaching and Learning which implies an active role of the learner in the process of achieving new knowledge or skills. This is usually associated with the term learning by doing. Pupils who actively engage with the materials are more likely to recall information later and be able to use that information in different contexts.

While available literature talks about evidence of the effectiveness of using technology in teaching, there is a knowledge gap about how ICT tools can be adapted to enhance active teaching and learning instructional strategy especially in primary teachers' college in Africa.

The integration of ICTs provides a variety of opportunities in the teaching process where the teacher has the capacity to incorporate, strengthen and interact with each learner even at wide geographical distance to achieve the desired learning outcome. ICTs enable access to learning, extension of knowledge and its transformation. Accordingly, learners share ideas in a multi-modal communication design. It supports the learner to share learning materials and spaces; promotes learner-centred approach; enhances critical thinking; and increases problem-solving skills and creativity (Ottestad, G., Mostert, M., Quinn, L., Ilomäki,

L., Noor-Ul-Amin, S., Shum, I. P., Kong, C. H., Fox, R., Majumdar, S., Cox, M., Abbott, C., Blakeley, B., Beauchamp, T., Rhodes, V., Length, F., Hennessy, S., Ruthven, K., Deaney, R., Wong, E. M. L., Hughes, J., 2008). Mastery of ICT skills by the teacher is not good enough, but also utilising these skills while teaching is vital to improve teaching and learning. However, studies done in various African countries indicate gaps in digital literacy and usage among teacher educators.

This study, therefore, explored the extent to which adaptable ICT teaching strategies and learning activities influence the teaching process in primary teacher training colleges in Africa. This is important in ensuring improved teaching in colleges; provides guidance on the best practices that may be adopted to improve the quality of teaching and learning in their respective colleges in Africa. The study was guided by a research question: To what extent can adaptable ICT teaching strategies and learning activities influence the teaching process in primary teacher training colleges in Africa?

## Method

Electronic databases mainly Google Scholar and African Journals Online were searched for relevant literature on qualitative, quantitative and mixed methodological studies that had been done on the use of adaptable ICTs in primary teacher training colleges in Africa. These had been published from 2014 to 2021. This period was considered with reference to when the government of the Republic of Uganda emphasised provision of support in terms of ICTs. This focus was on infrastructure, equipment and capacity building. The search strategy involved adherence to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines for systematic reviews with focus on keywords and the general objective of the study in the first step. A total of 2,280 results was found in Google Scholar and 18 in African Journals Online when, 'use of adaptable ICTs in teaching and learning in Primary Teacher Training Colleges in Africa from 2014 to 2021', was used to search. In second step, abstracts of these papers were analysed to determine their relevance to this study. Out of the 2,280 results analysed through Google Scholar, 15 were duplicates with 2,265 none duplicates. The 18 titles analysed through African Journals Online had 3 titles none duplicate and 15 papers were duplicated in both Google Scholar and African Journal Online. From Google Scholar and African Journals Online, there were 2,298 total titles read. From these studies, 304 were found to be relevant, whereas 2,282 were irrelevant; hence, discarded. From the 304 studies, only 92 abstracts were closely related to the keywords. Hence, they were critically analysed for inclusion in the study. However, 24 of them could not answer the study objective, hence, excluded. Finally, only 17 full studies were critically read, analysed and included in the study as indicated in Figure 1.

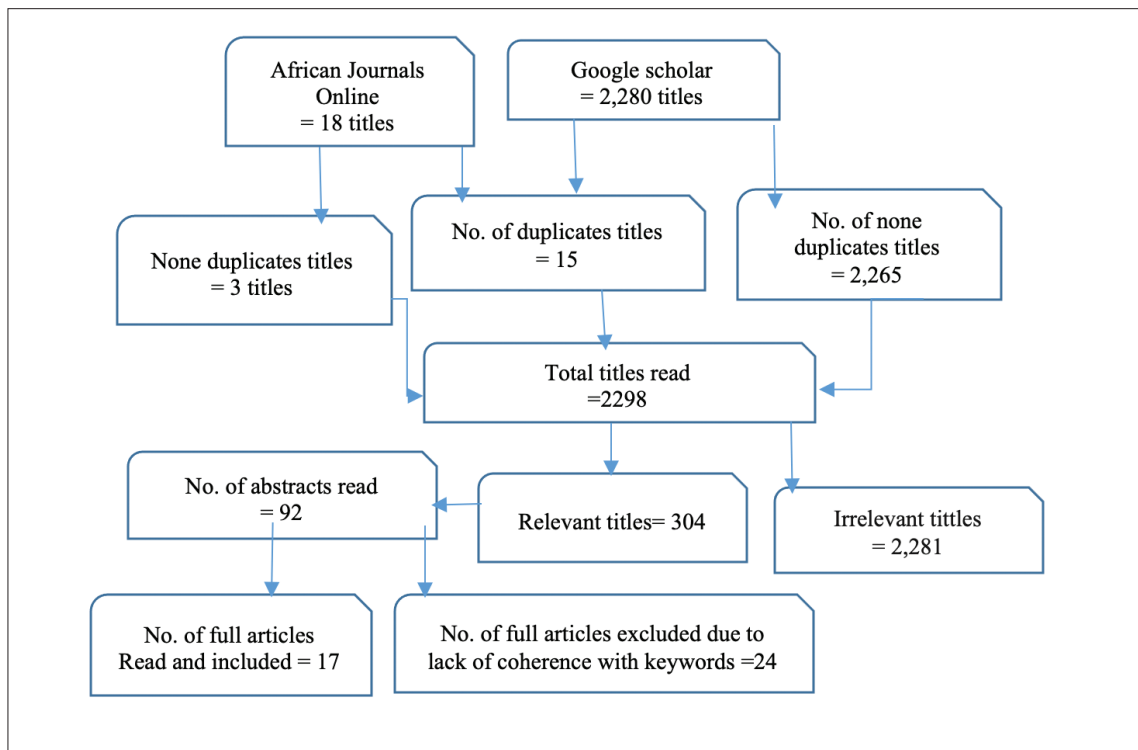


Figure 1: PRISMA flow chart

## Results

Over the last decades, the integration of ICTs in the teaching and learning process has gained a solid attention in low and middle income countries. Its significant role in Teacher Training Institutions (TTIs) and in education generally cannot be downplayed. It is beneficial to both teachers and learners because it eventually produces citizens with 21st century skills who are digitally literate and adaptable to all life situations (Adarkwah, 2021).

In low and middle income countries (LMICs) specifically those in Sub-Saharan Africa, active teaching and learning suffer a number of challenges, including: inadequate number of teachers to meeting learning needs, and inadequate training and systems for continuous professional development. Given the above hindrances, several innovations have been done to address the challenges at hand. For example, Computer Assisted Instruction (CAI) tools were developed to guide the teaching and learning process in low and middle income countries (Kaye & Ehren, 2021). CAI refers to a software that can help the teacher to deliver a personalised lesson that is more interactive, enhances learning experiences to learners both online and offline in academia and other practices. The model indicated that operating environment, stakeholder engagement, infrastructure technological trust, CAI tool design, content curation/creation, student engagement, classroom integration, teacher and student capacity, data collection, and innovative changes promote continuous use of ICTs (Kaye & Ehren, 2021).

A meta-data analytical study by Agyei (2014) in Ghana provides a situational analysis of the pedagogical issues associated with ICT use in teacher education in Ghana. This is facilitated by investing in connectivity, Internet use, Liquid Crystal Display (LCD) projectors, specialised computer software, CPD for teachers, curriculum, pedagogical integration, and availability of ICT facilities in TTIs. These strategies are intended to skill teachers, enable access to ICT facilities, promote public-private partnership, innovations and improve the overall quality of the teaching and learning process.

In his participatory action research study in South Africa, Tshelane (2018) also emphasises the importance of the use of modern technology, Internet connectivity, and local digital content on enhancing active teaching and learning. These create an understanding and practice of critical leadership skills to address daily challenges in life.

In his review in Lesotho, Akkoç (2019) focuses on identification of challenges contextually-related to blended distance learning model. He encourages the use of ICTs, development of an educational policy on ICT, engagement of specialists and other stakeholders. Furthermore, in 2019, in his other review on Africa and Asia, he mentions that addressing the identified challenges requires the integration of computers, modems and CD-ROM in the teaching and learning process.

Baguma (2018) carried out a review in which he aimed at exploring how academics were integrating ICT into their teaching and learning practices at a university in Uganda. The importance of equipping TTIs with knowledge and relevant technological skills which would effectively support ICTs integration in teaching process is explained.

In 2021, GIZ carried out a digitalisation initiative review in five countries which include: Republic of Tanzania, Malawi, Rwanda, Ethiopia and Kenya in Sub-Saharan Africa. The initiative was a pilot that focused on the teaching profession and how education could be adapted to make a change on socioeconomic situations with a primary emphasis on digital skills development. The author indicates that the increasingly demand for the new competences in the workforce requires teachers to change their focus.

The importance of skills training and lifelong learning in enhancing teacher competences cannot be overstated since they are critical in the labour market. These would be facilitated by digitalisation, development of comprehensive and forward-looking policies, with good investment in digital technology, (Adarkwah, 2021). Other critical factors that impact digitalisation of education specifically on online learning are: the need for post-COVID-19 strategies for key policy makers in government that would promote e-learning education and a dependable educational reform vehicle to facilitate development. The reforms communication platform for and as a means to achieve the Sustainable Development Goal Four (SDG 4), student learning outcomes and social interaction (Adarkwah, 2021).

A review study in Ethiopia that aimed at evaluating the effectiveness of e-learning on the academic performance in mathematics, found out that online learning, blended e-learning and conventional learning strategy result in analytical skills, constructivism and generation

of new information in a teaching learning system (Tegegne, 2014). These require a strategy focusing on computers, statistical software, and visualised ICTs. In addition, there is a need to develop innovative teaching strategies for active teaching and learning to relate the data concepts with the authentic life circumstances, for instance, problem solving (Dushimimana & Uworwabayeho, 2020).

Combrinck and Mtsatse (2019) investigated ICT resources available for teaching and learning in South Africa, emphasising the use of predict paper-based literacy for Grade 4 and whether they were regular. This study also emphasises continuous professional development of teachers, and provision of ICT equipment for teaching, learning, and administrative purposes. These strategies would help to produce competent graduates in the global market, and give learners opportunities to support the communities. DVDs could also be used to blend learning, promote learner engagement, stimulate higher-order thinking and develop lifelong learning skills for future labour market ( Mlotshwa, N., Tunjera, N., & Chigona, A., 2020).

When learners have domesticated the use of ICTs, they can discover other useful areas, such as online tutorials or videos, content specific websites, where learners can possibly be assisted in a particular area, concept, or any specified task. This strategy allows learners to use their thoughts before embarking to the subsequent learning level (Mlotshwa et al., 2020). However, this is dependent on their mindset which is critical in all life circumstances. Therefore, creation of a warm, caring and multi-dimensional classrooms, integration of collaborative learning practices and setting up of projects would nurture creativity, critical thinking, problem- solving, and responsibility skills ( Rwothumio, J., Mbirithi, D. M., & Itolondo, W., 2020). Accordingly, an education framework that uses a flipped classroom model provides teachers with competency-based training to use such innovative strategies which has a bearing on learners' mindset. Hence, they are able to participate in creative activities (de Brabander & Glastra, 2021). Results are summarised in the Table 1.

**Table 1:** Adaptable ICTs teaching strategies and learning outcomes

Adaptable ICTs	Adaptable ICTs teaching strategies	Teaching/Learning outcome
<ul style="list-style-type: none"> <li>• Computerassisted instruction</li> <li>• Internet use</li> <li>• LCD projectors</li> <li>• Specialised computer software</li> <li>• Modern technology,</li> <li>• Internet connectivity</li> <li>• Local digital content</li> </ul>	<ul style="list-style-type: none"> <li>• Operating environment</li> <li>• Stakeholder engagement</li> <li>• Infrastructure technological trust</li> <li>• CAI tool design</li> <li>• Content curation/creation</li> <li>• Student engagement</li> <li>• Classroom integration</li> <li>• Teacher capacity</li> <li>• Student capacity</li> <li>• Data collection</li> <li>• Innovative changes</li> <li>• ICT workshops</li> <li>• ICT integration across the university curriculum</li> <li>• Investing in ICTs</li> <li>• ICT pedagogical integration in different institutions at different levels in Ghana</li> <li>• Availability of ICT facilities</li> <li>• Teacher education institutions to include ICTrelated</li> <li>• courses in their programmes</li> <li>• Blended teaching</li> </ul>	<p>Ongoing use of ICT to improve the quality of teaching and learning</p> <ul style="list-style-type: none"> <li>• Skilled personnel</li> <li>• Access to ICT facilities</li> <li>• Publicprivate partnership</li> <li>• ICTs initiatives and innovations</li> </ul>

## Discussion

The results of this review vividly highlight the important role played by adaptable ICTs not only in active teaching and learning but also in the growth and development of any country (Adarkwah, 2021; Tegegne, 2014; Dushimimana & Uworwabayeho, 2020). The need for ICT-empowered human resource, ICTs to aid the provision of quality education system, use of constructivism concept in the teaching and learning process, availability and access to resources to support training and learner attitude and mindset are emphasised.

The global experience shows that effective technology use in education is different from country to country because of the education needs that have different variables. This calls for contextualisation and use of the available technologies in a way that will eventually transform the creation of knowledge and pedagogy towards producing transformed communities. In this regard, teachers need to re-think about the capacity and skills that are required by the learners to become more active workers in a knowledge-based society (Omwenga, 2015).



The present teaching-learning approaches in most Africa countries are teacher-centred and characterised by instructional pedagogy approach. In addition, the classes are very big, which affects the learning outcome; and as a result, the learners' performances and the feedbacks are usually undesirable (Halloluwa, 2011). Whereas active teaching and learning involves students' efforts to actively construct their knowledge, active learning involves working with other students on projects during class. They are required to do tasks, such as asking questions, making a presentation or contributing to discussions. They can also participate in a community-based project as part of a course; work with other students in the classroom or outside the classroom on assignments given to them. They could also join discussions on different ideas from a course inside or outside the classroom or tutoring peers. Bonwell and Eison define such approaches that stimulate active learning as, "instructional activities involving students in doing things and thinking about what they are doing" (Brame, 2015, p. 203).

The challenges that hamper the use of ICTs in teaching and learning include: access and availability of ICT facilities, connectivity, access to online materials and equipment, and change in the way teachers teach. These require refocusing of the teaching approaches, from teacher centredness to more transactional, self-learning and independence of students. Change has been majorly around the manner of learning and its process because this type of learning prepares the learners to confront the future (Bidarian, 2011, Tondeur, 2007). However, individual teachers lack desired skills; and in respect of this, ICT integration usually focuses on teacher competences and characteristics, for instance, skills and attitude towards computer use. This focus has shifted the blame from organisation to individual teachers (Tondeur, 2007).

With regard to the current pandemic, stakeholders in education have realised that the worst scenario presented by COVID-19 was the closure of schools where learners could not have face-to-face sessions, yet there was need for learning continuity. COVID-19 proved that ICT skills are crucial in developing learner-centred activities which could have been necessary during the lockdown when learners have been physically away from the teacher. During this period, most learners have been left out due to socioeconomic differences, and so have been the teachers. Teachers need training to competently provide online sessions. There is still a need for teachers to adjust to the digital learning platforms as solution to active learning where learners practice by themselves, (Gonçalves & Capucha, 2020).

## Conclusions

Adaptable ICTs teaching strategies that encourage active learning are emphasised to develop learners' skills more than just conveying data. Learners need to be fully involved in activities that evoke critical thinking and problem-solving. The Active Teaching and Learning process is hampered by digitally incompetent teacher trainer. This demands for investment in capacity building for teacher trainers.

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