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Academic ICTs training in South Africa, Cameroon, and Nigeria. Strategies for ICT training course design

Maria Assunta Cappelli[1] · **Abdeljalil Akkari**[2]

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Abstract
This study examines the effectiveness of ICT training programmes for academics at selected universities in Africa, specifically in Cameroon, Nigeria, and South Africa. Using a qualitative approach, we conducted semi-structured interviews with five ICT trainers and three trainees to better understand their experiences. The findings highlight both the challenges and the strengths that could be used to improve ICT training and make it more effective and relevant to the participants. Four key themes emerge from our analysis: course objectives and content, teaching strategies, implementation challenges, and expectations/impact of the courses. The objectives of the courses vary considerably—some focus on the practical application of ICT, while others aim to improve the participants' understanding of ICT systems. Teaching methods also differ, ranging from more traditional teaching approaches to collaborative, project-oriented methods. However, we identify significant challenges, particularly poor internet connectivity and a lack of sufficient technological resources, which affect the learning process. In addition, there is often a divergence between trainer expectations and trainee perceptions of the impact of these courses on their professional development. This study aims to contribute to the definition of strategies to improve the effectiveness of ICT training, in the African context, including Cameroon, Nigeria and South Africa.

Keywords ICT in African Higher Education · Access to African Education · ICT Training for Academics · ICT Use by Academics · ICT Courses in Cameroon · ICT Courses in Nigeria · ICT Courses in South Africa

✉ Maria Assunta Cappelli
maria.cappelli@unige.ch

Abdeljalil Akkari
abdeljalil.akkari@unige.ch

[1] Centre Universitaire d'Informatique (CUI), University of Geneva, Geneva, Switzerland

[2] Faculté de Psychologie et Sciences de l'Éducation (FPSE), University of Geneva, Geneva, Switzerland

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1 Introduction

Education helps people and communities grow and is the key to improving society and the economy. However, the educational landscape in Africa is complex and influenced by several factors, including access to education, teacher quality, and community participation (Bashir et al., 2018; UNESCO, 2016). Phenomena such as "massification", or the excessive increase of students in higher education institutions beyond their capacity, undermine the quality of education (Mohamedbhai, 2011). Furthermore, significant inequalities based on gender, social class, geographical location, and minority status further restrict access to higher education (Kipchumba, 2019; UNESCO Office Dakar and Regional Bureau for Education in Africa, 2023). To address these challenges, international organisations are proposing innovative solutions such as improving educational infrastructure, training teachers, inclusive policies, and the use of ICT (Hanemann & Scarpino, 2016; UNESCO, 2020; World Bank, 2015).

In the literature, the integration of ICT into the teaching process has been discussed extensively (Maina & Kuria, 2024; Mncwango et al., 2024; Okanda & Andugo, 2023). However, the specific training of academics has not been adequately explored. There is a significant gap with regard to the training of academic staff in the use of ICT.

Furthermore, the COVID-19 pandemic has highlighted the urgent need for adequate training to enable academics to use ICT effectively. In this context, Adu et al. (2020) evaluated the challenges faced in South Africa, particularly in disadvantaged areas, in using ICT for online education. The study identified several issues, including the lack of an appropriate online learning environment, limited access to data, Wi-Fi, and the Internet, as well as a lack of equipment, and poor network connectivity. In addition, attitudes towards technology were another barrier. Similarly, Muftahu (2020) highlighted the lack of technological resources and personal academic support as issues faced by African universities. In addition, the researcher noted resistance to distance learning from both academics and students. Azionya and Nhedzi (2021) analysed tweets from the pandemic lockdown and found that many South African students had difficulty accessing online education due to limited ICT resources, exacerbating existing educational inequalities. Olatunde Aiyedun et al. (2021) examined the impact of the pandemic on academic performance in Nigerian public universities, focusing on virtual learning. Their analysis revealed that virtual learning positively affected academic performance. However, they also identified challenges related to students' access to ICT and their ability to adapt to virtual learning.

The unexpected impact of the pandemic on the academic environment has thus increased interest in the acquisition of digital skills in higher education, especially among academics. As a result, this study aims to examine in detail the ICT training programmes offered at selected African universities. Through semi-structured interviews with ICT trainers and trainees, we will analyse how these programmes are designed to address the specific challenges of the African educational context.

This research focus is justified by a notable gap in the existing literature on the training of academics in the use of ICT. The literature review highlights several critical challenges, such as limited participation in training, difficulties in technology adoption, inadequate digital skills among educators, and the need for effective training models. However, while many studies focus on the integration of ICT into teaching, few have examined the characteristics of training courses and their impact on equipping academics to use ICT effectively (more details in Section 3). In the absence of this understanding, it is difficult to determine whether current training programmes are adequately designed to meet the needs of educators and enhance their success in using ICT. Therefore, studies that specifically examine the characteristics of ICT training courses for academics have significant value. To fill this critical gap, the methodological approach consists of conducting semi-structured interviews with five ICT teacher trainers and three ICT trainees who have participated in ICT training courses at selected universities in Cameroon, South Africa, and Nigeria.

The findings of this study will improve our understanding of academic training in the use of ICT at selected African universities. Based on these findings, the study will provide several recommendations aimed at improving ICT training courses. These recommendations will deepen our understanding of academic training in ICT and explore effective strategies to enhance teaching effectiveness in African universities. In this way, the study makes a significant contribution to the existing literature on ICT integration in African higher education. It offers new perspectives and reference models for future researchers by examining the effectiveness of various pedagogical approaches and training methodologies. Additionally, it provides a theoretical framework that can guide further research in this area. On a practical level, the study proposes concrete recommendations for designing and delivering ICT training programmes that can assist educators and policy makers in improving the quality and relevance of courses. These recommendations include strategies to overcome infrastructure barriers, improve digital literacy among teachers and students, and promote more effective use of ICT in classroom practices. By implementing these strategies, higher education institutions in Africa can develop more effective and targeted courses, ultimately contributing to the overall improvement of educational quality.

1.1 Statement of the problem, research objectives and research questions

Universities are increasingly relying on ICT in response to the recent pandemic. This global pandemic has compelled institutions to use existing technological tools in innovative ways, particularly in the context of teaching. As a result, virtual learning environments have transformed from mere meeting platforms into essential teaching tools. However, the integration of ICT in higher education is a gradual process characterised by numerous challenges, including academic training in the use of ICT.

Academics have different levels of ICT skills, which reveals significant gaps in their digital preparation. These gaps include limited digital literacy, and the emergence of negative aspects associated with the use of technology. The main

challenges relate to the effective use of e-learning platforms (such as Moodle), online collaboration tools (such as Zoom and Microsoft Teams), and content authoring software. However, it remains unclear which specific technologies and integration methods represent the greatest challenges for academics and require further investigation. There is also uncertainty about the specific areas of academic preparation that are lacking and the extent to which current training addresses these gaps. The structure of initial and continuing training, workshops, and courses and their effectiveness in improving the ICT skills of academics need to be clarified. Therefore, a thorough investigation is needed to understand how academics are currently trained to use ICT in their teaching and to identify the specific areas of competence that need improvement.

The research objectives of this study aim to evaluate the effectiveness of existing training courses by analysing their content, structure, and feedback of participants to determine whether they adequately meet training needs. Furthermore, based on the results, the study suggests targeted measures to improve the integration of ICT in higher education, thereby optimising the use of technology and improving teaching and learning practices.

In this context, the present study seeks to answer the following research question.

- What are the features and effects of the ICT training provided to academics in some universities in South Africa, Cameroon, and Nigeria?

The formulation of this research question is based on Tyler (1949)'s concept of "Basic Principles of Curriculum and Instruction". In this work, he developed a model of student learning that explores various aspects, including curriculum development. He posed four key questions that guide educators in defining an educational programme, such as: "(a) What educational purposes should the school seek to attain? (b) What educational experiences can be provided that are likely to attain these purposes?, (c) How can these experiences be effectively organised? (d) How can we determine whether these purposes are being achieved?" (Taylor et al., 2015). According to Stone (1990), these questions outline the goals that educators should follow when developing an educational programme. This process involves defining learning objectives, determining the educational actions needed to achieve those objectives, organising those actions, specifying evaluation methods to verify the achievement of learning objectives, and finally interpreting the results.

Following Tyler's rationale, we divided the main research question into four sub-questions.

1. What are the objectives, content, and structure of the ICT training course?
2. What teaching strategies are used in the ICT training course?
3. What are the main challenges that could be an impediment to effective implementation of the ICT training course?
4. What are the expectations and outcomes of the ICT training course?

Specifically, research question no. 1 draws inspiration from Tyler's questions (a) and (b). It aims to examine whether course objectives, the ICT concepts taught, and the overall structure are clearly defined, as well as whether there is a modular plan in place to achieve these objectives. Research question no. 2 is based on Tyler's questions (c) and (d), and it seeks to understand which teaching strategies and assessment techniques are employed in ICT training. Research question no. 3 arises from the findings of the literature review, which identified significant challenges in implementing ICT training courses. Finally, research question no. 4 emerges from an investigative interest in understanding the perspectives of the two interview participant profiles, namely ICT trainers and ICT course participants. The objective is to identify the expectations of both respondents and to assess the impact of the course on the academic training. Specifically, the aim is to determine whether the expectations of the trainers align with the actual impact of the course on the trainees.

This paper describes the contemporary developments and practices in African higher education, focusing on the influence of global trends and the integration of ICT to improve educational outcomes and academic training across the continent (Section 2), a review of the literature (Section 3), an analysis of the methodology adopted in this study (Section 4), a detailed description of the results (Section 5), and a discussion of the outcomes (Section 6). Finally, Section 7 is dedicated to outlining strategies for designing an ICT course and proposing recommendations.

2 Enhancing African higher education: global trends and ICT

The international community recognises the importance of access to education, as evidenced by various normative provisions and official documents. Article 26(1) of the Universal Declaration of Human Rights (United Nations General Assembly, 1948), along with Articles 13 and 28(1)(c) of the International Covenant on Economic, Social, and Cultural Rights, and the Education 2030 Incheon Declaration and Framework for Action (UNESCO, 2016)—which identifies higher education as a key driver to achieve the Sustainable Development Goal (SDG) 4)—form a comprehensive normative framework. This framework is instrumental in ensuring inclusive, equitable, and quality education worldwide.

In Africa, several states are working to improve access to education, as highlighted in key official documents, including "The Africa We Want" and the Continental Education Strategies of the African Union (AU) for Africa (CESA 16–25). "The Africa We Want", part of the AU's Agenda 2063, outlines a long-term vision for the development of Africa. Education is identified as a fundamental factor in the progress and development of the region (African Union Commission, 2015). CESA 16–25 focuses on technical and vocational education, higher education, and lifelong learning, reflecting the AU's commitment to advancing educational opportunities across Africa. These initiatives demonstrate a tangible effort by African nations to expand educational access and contribute to the continent's sustainable development (African Union, 2015).

However, ensuring equitable and universal access to education goes beyond merely providing opportunities; it also involves ensuring that education is both

relevant and of high quality. The internationalisation of higher education can help improve the quality and relevance of education in Africa. Knight (2003) defines the internationalisation of higher education as "the process of integrating an international, intercultural, or global dimension into the purposes, functions, or delivery of post-secondary education" (p. 2). This includes curriculum changes, students and lecturers' exchanges based on the principles of education in various countries, training promoting intercultural and linguistic understanding, collaborative initiative on research between higher education institutions in various countries, and so on (Akkari et al., 2023).

According to some scholars, such as Kasenene (2011), internationalisation in Africa, particularly in Uganda, faces significant barriers, including under-funding, lack of government and donor support, staff shortages and administrative rigidity. In addition, Moshtari and Safarpour (2023) identifies similar barriers in East Africa, grouping twelve key challenges into four categories: lack of explicit policy, inefficiencies in organisational structure, inadequate funding and limited human resources. Alongside these concerns, other factors hindering internationalisation include financial constraints, infrastructure deficiencies, gaps in scientific and language skills, cultural differences, non-reciprocal partnerships and the risk of brain drain. Furthermore, Wan and Geo-JaJa (2013) notes that internationalisation can sometimes neglect local knowledge, which risks downplaying its importance.

The integration of ICT in higher education can help to overcome some of these challenges.

2.1 The role of the ICT in African higher education

ICTs can improve access to educational resources for students from less privileged backgrounds, by offering high-quality study materials, courses and content through online platforms, overcoming the limitations of physical infrastructure and local resources (UNESCO, 2020). Moreover, ICTs facilitate international communication and collaboration between students and teachers, enabling continuous dialogue and global cooperation through tools such as videoconferencing and online forums (UNESCO, 2023). They also play a key role in the continuous professional development of teachers and the updating of academic programmes to better meet the needs of the global labour market through e-learning and online courses (World Bank, 2015). Finally, ICTs promote more inclusive education by allowing students with disabilities or those in remote areas to participate in courses and educational activities via digital learning solutions and assistive technologies, thus contributing to reducing inequalities in the education system (Hanemann & Scarpino, 2016).

African international and intergovernmental organisations have expressed confidence in the potential of ICTs to improve education, as evidenced by various initiatives and programmes. For example, the AU Digital Transformation Strategy for Africa 2020–2030 (African Union, 2020), launched in 2019, outlines strategies and recommendations to promote the use of ICTs in both formal and informal education. Similarly, CESA 16–25 (African Union, 2015), presented by the AU Commission and AU Heads of State and Government and adopted in January 2016, recognises the

role of ICTs in improving the quality and relevance of higher education in Africa. To support these efforts, AVU, an intergovernmental organisation, has launched projects aimed at using ICTs to improve access to quality education and training across Africa. The AVU offers degrees, diplomas and certificates via ICT, manages a digital library, develops African educational materials in multiple languages, and trains academics in ICT and e-learning methodologies (Fomunyam, 2019). In addition, the African Higher Education Centres of Excellence (ACEs) initiative (Inter-University Council of East Africa, n.d.) demonstrates a strong commitment to improving the quality of higher education in Africa through ICT-based solutions.

However, despite these positive initiatives, some scholars highlight the potential negative effects of ICTs, such as the risk of digital exclusion and the growing access gap between urban and rural areas (Agyei & Agyei, 2021; Van De Werfhorst et al., 2022). Furthermore, other researchers underscore that technology alone cannot solve all educational challenges and argue that local contexts and cultural differences need to be taken into account for effective ICT integration (Eltahir, 2019; Kyem, 2012; Mboa Nkoudou, 2020). Finally, some researchers acknowledge that the successful realisation of ICT benefits depends largely on its effective implementation and integration (Hew & Cheung, 2013; Isaacs, 2007; Ivongbe et al., 2010; Mathende & Beach, 2022). Therefore, training academics to integrate ICT into their daily practice is a major challenge that can be addressed through the implementation of targeted initiatives as outlined in Sub-section 2.1.1.

2.1.1 Initiatives to train educators in the use of ICT in Africa

Many international and intergovernmental organisations have launched initiatives to improve the digital skills of academics across Africa. These initiatives provide valuable insights into the strategies adopted and their impact on digital literacy training and development. Among these initiatives, the International Institute for Capacity-Building in Africa (IICBA) (UNESCO, 2023) seeks to improve the quality of education in Africa through online and distance learning courses, as well as the Open and Distance Learning (ODL) project for teachers in the Economic Community of West African States (ECOWAS) countries. The ODL project includes a virtual campus, an online platform where teachers can access courses and educational resources through a personal computer connected to the Internet. This approach can reach a large number of teachers and educators at the same time. The quality of the training courses and educational resources available on the virtual campus will improve teachers' pedagogical skills, thereby improving the overall quality of education for students in Africa (UNESCO-IICBA, n.d.). Similarly, the UNESCO Global Teacher Campus (GTC) initiative (UNESCO, n.d.) provides courses that offer professional development opportunities for teachers and educators to adapt to challenges and improve the quality of education for students. These courses encompass training in ICT, digital technologies, and other forms of distance and hybrid education. In addition, the Association for the Development of Education in Africa (ADEA), the African Union/Continental Education Strategy for Africa Flagship (AU/CIEFFA), and the African Population and Health Research Centre (APHRC) developed an ICT training programme as part of the report titled "Teacher Training and Support

in Africa during the COVID-19 Pandemic" (ADEA, AU/CIEFFA, APHRC, 2022). This programme aims to provide recommendations for improving teacher training in ICTs, including: (1) "investing more resources in teacher training to enhance their education" (Recommendation I, pp. 26–27); (2) "exploring public–private sector partnerships with digital service providers to offer low-cost or free access to internet packages" (Recommendation II, pp. 26–27); and (3) "identifying effective mechanisms and approaches for training teachers to assess and provide feedback and guidance to students during emergencies using distance teaching tools" (Recommendation III, pp. 26–27).

As part of its intergovernmental initiatives, the Agence Universitaire de la Francophonie (AUF) promotes certified training programmes and the professionalisation of teachers through hands-on workshops and online courses. These programmes focus on the diversity of digital strategies and services available to students and teachers, taking into account national and regional specificities. One notable example is the "Transfer project", which was implemented in seventeen French-speaking African countries between 2005 and 2011. Another AUF initiative is Open and Distance Learning (FOAD), which uses pedagogical and technical tools to provide international training to participants in different countries. The AUF provides technical, pedagogical, logistical and financial support to facilitate the creation and implementation of FOAD (Institut de la Formation à Distance de la Francophonie, n.d.). In addition, AUF promotes the accredited UTICEF Master's Degree, which aims to provide professional training and to train experts capable of developing distance education in the countries of the South. This Master's degree is characterised by the use of innovative approaches, both in pedagogical planning and in the use of IT tools (Peraya et al., 2013). Another continental programme, the African Virtual University (AVU) (Diallo et al., 2012), aims to increase the quantity and quality of teachers in Africa through training in mathematics, science and ICT. It includes the establishment of teacher learning centres and training modules in biology, chemistry, physics, mathematics and ICT. These modules enable teachers to integrate ICT into teaching and learning, thereby improving the quality and effectiveness of education.

Most initiatives primarily focus on in-service training for current teachers; however, some, such as those offered by the AUF, also incorporate elements of pre-service training. The initiatives discussed are summarised in Table 1, which includes the promoting entity, the name of the initiative, and its scope of application.

2.1.2 Impact of ICT training initiatives for academics in African higher education

The analysis of these initiatives provides valuable insights into the goals and strategies for training academics in the use of ICT. The primary aim of these programmes is to enhance the quality of education by integrating digital tools into teaching and learning processes. These initiatives underscore the necessity of improving educational quality by leveraging digital resources and strengthening teachers' digital skills. Such competencies enable educators to create interactive teaching materials, facilitate collaborative activities, and provide personalised

Table 1 International and intergovernmental initiatives for the ICT training in education

N	Promoting Entity	Name Programme	Application Scope
1	UNESCO IICBA	Training and professional development programmes	International
2	UNESCO's GTC	GTC	International
3	ADEA, AUCIEFFA, APHRC's	Teacher Training and Support in Africa during the COVID-19 Pandemic	International Collaborative Project
4	AUF	TRANSFER project, FOAD, UTICEF master's degree – ACCREDITED (Peraya et al., 2013)	International and Inter-governmental Initiatives
5	The AVU	The continent-wide teacher education and training programme aimed at increasing the quantity and quality of mathematics and science teachers	Inter-regional Initiative

feedback to students.However, the lack of these skills is often attributed to insufficient ICT development and inadequate connectivity infrastructure.

An analysis of these initiatives also reveals some notable findings. Firstly, there is a preference for training academics in ICT through distance learning. Secondly, while there is much discussion about techniques and strategies for quality training, specific details are often lacking. Furthermore, eLearning has emerged as the preferred ICT method. Third, virtual environments use the Technological Pedagogical Content Knowledge (TPACK) model to train and empower teachers to develop e-learning content and conduct assessments using digital tools. Fourthly, it aims to invest in academic ICT training, with a focus on attracting private investment to improve infrastructure, particularly in rural areas. Furthermore, methodologies are being defined to assess students through e-learning and provide feedback. Incentives for academic staff to support students in virtual education are also being considered. In addition, Open Educational Resources (OERs) are receiving attention for their potential to improve teaching effectiveness and student learning. Finally, the framework for teacher competencies encompasses a range of skills and knowledge, including pedagogical expertise, ICT skills, classroom management and student assessment (Cappelli, 2024).

In summary, the analysis of the different approaches and strategies adopted by international and intergovernmental organisations to train academics in ICT clearly demonstrates the need to use digital tools to improve the quality of education. These initiatives, which include online training programmes and collaborative projects, reflect a concerted effort to equip educators with essential digital skills and resources. However, challenges such as inadequate infrastructure and connectivity continue to constrain the extensive implementation of these initiatives.

3 Literature review

The integration of ICT in higher education plays a fundamental role in shaping the learning approach. The use of ICT can transform how individuals access knowledge, interact with learning materials, and engage in learning activities. However, this integration remains a gradual process in Africa, accompanied by numerous complexities and challenges. Scholars have explored the preparation of academics for the use of ICT (Sub-section 3.1) as well as the characteristics of the current ICT training courses (Sub-section 3.2).

3.1 Academics' competence in using ICT

Some scholars have investigated digital competency among academics in Africa. Hussein (2014) noted that there is limited participation of academics in ICT training. He discussed the importance of providing ICT training to academics for the successful development of staff in higher education in Uganda. Indeed, the findings suggest that the university has allocated resources for training academics in ICT. However, it appears that "little attention has been given to the issue of engaging academics in ICT training" (p. 39). Hussein identified one of three barriers to the effective use of ICTs described by Balanskat (2006). This barrier is termed the teacher-level barrier, which is defined as a micro-level obstacle related to the teachers themselves. The other two barriers include mid-level (school) and system-level barriers. Specifically, teacher-level barriers encompass weak motivation, low digital proficiency, and a lack of trust in new technologies. Balanskat argued that "the readiness for ICT development should start by considering how well prepared the academics in higher education are for these changes before implementing any ICT programs" (p. 42). Oyelaran-Oyeyinka and Adeya (2004) emphasised that "mere exposure to technology does not guarantee usage; the existence of information in society does not assure the use and concomitant acquisition of knowledge" (p. 68). In other words, Ojo (2005) explained that although "ICTs are available, people are unable to use them for their collective benefit due to constraints such as a lack of expertise and infrastructure to support the application of these technologies" (p. 95). The scholar points out the importance of not only having access to digital technologies but also possessing the skills and resources to use them to their full potential for the benefit of the community. Thus, these studies highlight that it is not enough to provide resources and training programmes; it is also essential to ensure that academics are actively involved and participate in ICT training programs in order to maximise the benefits of the ICT staff development process.

Furthermore, Ferede et al. (2022b) aligned with this perspective, noting that a qualitative analysis conducted on twenty-one active instructors in three public universities in Ethiopia revealed that the potential of technologies is not fully exploited. The instructors do not employ technologies in a "transformative manner." This is evidenced by the fact that they do not integrate ICTs in a way that alters traditional teaching approaches, which are typically teacher-centred. Consequently, the study

emphasises the necessity of developing academic skills in ICT that enable educators to effectively integrate technologies to promote active, student-centred learning. In addition, as part of this study, Ferede et al. (2022a) identified the determinants of teachers' ICT use, which included institutional, individual and infrastructural factors. The researchers also highlighted the need to include aspects of management support, course-related factors, students' ICT skills, and access to ICT infrastructure as new determinants influencing ICT use. The analysis of these factors leads them to believe that it is crucial for universities to organise training courses, allocate adequate budgets and provide ICT infrastructure such as computers and Internet access. The scholars understand that the use of ICT varies between academic disciplines, particularly noting that arts and humanities disciplines face more barriers to ICT integration, which can lead to low usage. Finally, the researchers highlight the importance of considering the students' perspectives for effective ICT integration. Students need skills, positive attitudes, support and adequate access to ICT infrastructures. This concept is further developed in Mpungose (2020)'s study, which examined the challenges faced by South African universities in adopting the Moodle platform, which was introduced as a mandatory requirement. The study shows that the mandatory introduction of this learning environment within South African universities has faced numerous challenges regarding acceptance. The educational system introduced Moodle without a clear explanation of the underlying theory, training, and implementation framework for its adoption. Additionally, the introduction of Moodle in a top-down manner inhibited adoption and made it difficult to measure its full potential.

Kibuku et al. (2020) presented a literature review on the challenges faced by some Kenyan universities regarding the implementation and delivery of e-learning. These challenges are mainly caused by the absence of adequate e-learning policies, insufficient ICT infrastructure, and a lack of technical and pedagogical skills among teachers. In a study aimed at examining the impact of ICT on teaching in Nigerian tertiary institutions, Oluwaseyi (2024) found that teachers' skills are inadequate for the proper integration of ICT in the teaching and learning process. Many educators lack the technical skills necessary to effectively use ICT in teaching due to limited training opportunities. Similarly, Yousfi and Yousfi (2023) reported a lack of adequately trained teachers and insufficient infrastructure, such as computers and fast internet connections, in Nigerian universities. The scholars propose reforming teacher training programs to equip educators with appropriate ICT skills. In the Nigerian educational context, Ogwu et al. (2023) discussed the importance of consolidating the adoption of ICT. The authors emphasise that effective adoption requires commitment from both educational practitioners and the government. Therefore, while researchers highlight the importance of in-service training for education professionals in using these innovations, they also focus on the need for the Nigerian government to adopt a systematic approach to procuring and installing ICT infrastructure. In Ghana, studies by Agormedah et al. (2020) and Akomea et al. (2022) argue that training in the use of ICT is insufficient for both teachers and students (Yidana et al., 2023).

Moreover, Masenya (2021) analysed how digital literacy can influence the effective use of mobile technologies in higher education institutions in South Africa.

The findings show that teachers' lack of digital literacy prevents the use of mobile technologies in teaching and learning, generally due to factors such as reluctance to change, lack of trust, inadequate technological infrastructure and insufficient access to digital or mobile devices. These challenges can be linked to the concept discussed by Hanemann and Scarpino (2016), who emphasised the importance of improving the use of ICT through professional incentives and motivation. The scholars argue that the development of standards related to ICT competence is not the only component that could ensure the mainstreaming of ICT. Professional incentives and motivation are needed to encourage the use of ICT to improve the quality of learning. In particular, it is suggested that governments and institutions should integrate the assessment of the use of ICT by institutions and academics into systems and practices for monitoring the quality of learning.

3.2 Current academic training in ICT integration

Regarding the characteristics of current ICT training courses for academics, some scholars have identified areas for improvement to enhance ICT integration into teaching.

Alemu (2015) conducted a study to investigate the process of integrating ICT into teaching practices and the emerging challenges at Adama Science and Technology University in Ethiopia. One of the barriers to the integration of ICT into teaching and learning practices was the absence of adequate training courses for teachers to develop the requisite ICT skills. The lack of training courses for the development of ICT skills among teachers represents one of the obstacles to integrating ICT into teaching and learning practices, despite a positive awareness and understanding of the potential of ICT within the university. This challenge is further aggravated by other significant obstacles in the implementation of ICT, such as insufficient institutional and technical support, classroom overcrowding, and limitations of ICT facilities.

According to Yousfi and Yousfi (2023) training should "encourage teachers to reflect on their learning and practice" and "intervene on beliefs" (p. 70). Furthermore, training should include not only technical skills but also pedagogical skills. Teaching these skills involves placing the learning environment at the centre and providing a context that facilitates critical reflection and the conscious integration of ICTs into teaching practice. Finally, it is important to work on the representations that learners have of technology, as this could have a significant impact on professional and pedagogical practice.

Olurinola (2022) claimed that, despite having access to technology, many African teachers lack the necessary skills and knowledge to use it effectively in their teaching. The researcher proposes a shift in focus from teacher trainers in ICT skills to training them in digital pedagogy, which "focuses on empowering teachers to make better technology selection and use decisions". The study explains that the definition of digital pedagogy used is "the use of digital tools from a pedagogical perspective, with an emphasis on the influence of the digital tool on learning rather than on the use of digital tools for teaching and learning". Therefore, "digital pedagogy

encompasses the intersection of educational technologies and innovative pedagogies, as well as the ways in which classroom interaction with and through technology can inspire new pedagogies". The author suggests that the development of digital pedagogical skills can maximise the impact of technology on student learning.

Peraya et al. (2013) examined the training of African academics in the use of ICTs and proposed models to improve the quality of training in digital literacy. The scholars developed the "UTICEF Master's Degree—ACCREDITED", which is a key component of AUF's educational technology training strategy. This master's degree aims to provide professional training and create experts capable of developing distance learning in Southern countries. The distinctiveness of the master's program lies in its use of innovative approaches in both pedagogical planning and the utilisation of IT tools. This program employs a pedagogical model based on (a) virtual seminars, (b) promoting collaborative work in small groups to analyse cases and solve problems, and (c) both synchronous and asynchronous tutoring. The "virtual seminar" facilitates collaboration in both the classroom and at a distance, creating a spatio-temporal experience through the virtual environment of Apprentissage COLlaboratif à Distance (ACOLAD). In addition, the pedagogical model prioritises the personal needs of students and offers remote training. It involves solving practical problems within the student's professional context and conducting activities in small groups of three to five students, with constant communication to encourage collaboration. The central role of the tutor is fundamental. A tutor group operates in a modular fashion. Throughout the course, students are exposed to different tutoring styles and are assigned to various tutor groups, providing a range of perspectives.

Finally, Hussein (2021) highlighted that, in the context of the COVID-19 pandemic, many African universities were unprepared to transition to online teaching. The researcher argued that this issue is not solely attributable to the lack of technological infrastructure, but primarily due to the inadequate ICT training of academic staff. Drawing on Paulo Freire's educational theory (Freire, 1974), he stated that the training of academics has been "dehumanising," as it is often imposed without the active involvement of teachers and does not address their real needs. He emphasised that adopting more humanising and dialogic training approaches is essential to ensure the success of future ICT projects in African universities (Hussein, 2012).

The review of the current literature highlights a variety of courses and technologies that focus on integrating ICT in higher education. We identify three main types of courses: technical training courses develop basic skills in using ICT; pedagogical training courses focus on integrating technologies into teaching; and digital pedagogy courses emphasise the importance of making a conscious and pedagogically informed choice of technologies. Among the mentioned technologies, online learning platforms such as Moodle, mobile technologies used in teaching, and general ICT infrastructure like computers and Internet access play key roles in supporting the use of ICT in higher education. This diversity of approaches and tools underscores the importance of an integrated and intentional use of ICT that meets the specific needs of teachers and students.

Additionally, the literature review identifies several challenges and gaps in the current state of ICT training. These challenges include limited participation of academics in ICT training, difficulties in adopting technology, inadequate digital skills

among educators, and the need for effective training models. However, researchers have not systematically examined the characteristics of training courses and how these affect academics' preparedness for integrating ICT into teaching. Without this understanding, determining whether existing training courses meet the needs of educators and facilitate their success in using ICT becomes challenging. Therefore, a research study that concentrates on the distinctive characteristics of ICT training courses for academics can provide considerable value.

This research carefully examines the structure of the ICT course, the teaching content, the ICT concepts used for teaching, assessment methods, and more. Analysing these characteristics offers a comprehensive overview of the current training course structure and identifies potential areas for improvement.

4 Methods

This study employs a qualitative methodological approach to examine the context and processes involved in the ICT training of academics in depth. The qualitative method adopts an interpretive and naturalistic approach to understanding the phenomena under study (Denzin & Lincoln, 1994). Moreover, qualitative research is an iterative process that leads to a more nuanced understanding through the identification of novel and meaningful distinctions (Tyler, 1949). Specifically, using qualitative research in teacher education provides a detailed and comprehensive perspective (Lauwerier & Akkari, 2015).

4.1 Participants

We defined theoretical sampling as the identification of social aspects relevant to our research and the selection of participants, events, and processes that significantly reflected these aspects. This selection was guided by our theoretical understanding of the research objectives and the need to ensure that the sample represented the social phenomena studied (Mukamurera et al., 2006). Our research interest was to define a sufficiently diverse sample to ensure the transferability of the results. Consequently, we selected interviewees with different roles (trainers and trainees) and varying levels of expertise. This diversification allowed us to build a representative sample capable of providing a broader range of perspectives and experiences. Finally, we closely monitored the saturation of the data collected during the research process. When the final interviews failed to yield significantly new data, we considered the sample saturated and ended the data collection phase, as suggested by (Mukamurera et al., 2006).

The study identified eight interviewees, three of whom had participated in an ICT training course and five ICT teacher trainers from three African states, such as Cameroon, Nigeria, and South Africa. Furthermore, one of the ICT trainers resided in Geneva. The inclusion of this respondent was justified by the fact that although he did not live in Africa, he conducted training courses for African professionals,

including African academics, in collaboration with other lecturers from African universities.

The two profiles — teacher trainers and ICT course participants — were necessary to obtain a comprehensive understanding of ICT education from multiple perspectives, in line with the principle of diversification. Moreover, we defined a socially representative sample by including a range of higher education institutions located in different geographical areas of Africa.

Our goal was to include respondents from diverse cultural and linguistic backgrounds who had undergone various ICT training courses. These included (a) ICT teaching-specific courses that were designed to train educators on how to teach ICT to students, (b) generic ICT courses that provided a broad understanding of ICT without focusing on any specific aspect, and (c) specialised ICT courses that concentrated on teaching or learning computer programming, covering specific programming languages, algorithms, data structures, software development, and more.

Finally, we carefully considered the selection of participants to ensure diverse representation. The five trainers, who were experts in ICT training, came from different backgrounds. Some of them had a background in information technology and had subsequently specialised in educational technology, while others had an educational background and subsequently focused on educational technology. The three participants in the ICT training course had heterogeneous skills. One was an expert in educational technology, while the other two came from humanistic fields and had recently taken an interest in educational technology to integrate it into their work. The diversification of profiles, including those of ICT trainers and course participants, aimed to facilitate a comprehensive understanding of ICT education from multiple perspectives.

Table 2 presents the participants in the study, identified by an "I" code followed by a number to maintain anonymity. The table also includes the date of the interview, the role of the interviewers, the locations of the interviews, and the target audience of the ICT courses.

4.2 Data collection

We collected data through semi-structured interviews, focusing on specific topics as starting points for the conversation. We formulated an interview guide that contained open-ended questions with follow-up questions that were not read in the same order in each interview, as the goal was to establish a flow that facilitated smooth interviews. The guide allowed us to tailor the questions to the interview and its flow (Lindlof & Taylor, 2002; Ruslin et al., 2022). The interview guide focused on various themes, including key elements such as course content, teaching strategies, challenges encountered in course implementation, expectations, and the impact of the ICT training course.

We conducted data collection after receiving ethical approval from the Scientific Ethics Committee of the University of Geneva, which also approved the information and consent form for the interviewees. We distributed the form to participants prior to the interviews, asking them to complete and sign it.

Table 2 List of the eight interviewees with the identification code, date interview, role, expertise, geographical location, institute provider, and target audience of the ICT training course

Code	Date Interview	Role	Expertise	Location	Institute	Target Audience
I-1	23.10.2023	ICT teacher trainer	Education, Digital education	ICT training course in Geneva for African academics	University	Academics from Africa, and NGOs decisionmakers
I-2	25.10.2023	Participant to ICT training course as a teacher	Education Digital education	Cameroon	University	Professionals, teachers, and students
I-3	25.10.2023	Participant to ICT training course as professional support staff	Humanities studies, Academic development, and teaching	Southern part of South Africa	University	Academic staff
I-4	31.10.2023	ICT teacher trainer	Digital pedagogy, Educational Technology, Global education	Southwestern part of Nigeria	University, NGOs	Academic staff, students, professionals
I-5	1.11.2023	ICT teacher trainer	Computer Science	Northeastern part of Nigeria	Centre forming part of the university	Academic and nonacademic professionals, students, sometimes college students
I-6	6.11.2023	Participant in the ICT training course as professor	Sociology Anthropology	Southern part of South Africa	University	Academic staff
I-7	7.11.2023	ICT teacher trainer	Design, Development and use of computer video games, Information communication technologies	Northern part of South Africa	University	Young and Academics

Table 2 (continued)

Code	Date Interview	Role	Expertise	Location	Institute	Target Audience
I-8	20.11.2023	ICT teacher trainer	Computer science, Education, Library, Information systems	South-eastern part of Nigeria	University	Faculty members (teaching and nonteaching, who are professionals, anyway)

Data collection occurred between September and November 2023. We conducted the interviews using Zoom videoconferencing software, licensed by the University of Geneva and certified under the Swiss-US Privacy Shield agreement. We emailed the link to the meeting to the respondents. Before the meeting, we asked them to replace their name on the Zoom screen with a provided pseudonym and to verbally confirm their agreement to the video recording. One interviewee conducted the interview in writing due to connectivity issues, making it the only exception to the video-conference format.

The interviews lasted between one and a half and two hours and were conducted in English or French, depending on the interviewee's preferred language. Each interview began with a brief explanation of the study, followed by questions on the topics identified in the entry guide (see Appendix 10.1). During the interview, we asked additional questions based on the previous conversation or the interviewee's responses. The interviews maintained a conversational tone, with the interviewer allowing questions and topics to emerge naturally from the interaction with the interviewee.

4.3 Data analysis

In the data analysis phase, the researcher who had conducted the interviews remained involved to ensure consistency in interpreting and coding the data. We subjected the coding and analysis of the data to an internal review process. The researcher reviewed the labels and categories to verify they accurately reflected participants' responses and maintained consistent interpretations.

We conducted data analysis using the methodological model of Lejeune (2019) and the iterative data model of Miles and Huberman (2003). Lejeune's theoretical model divided the data analysis process into three main stages: open coding (Sub-section 4.3.1), axial coding (Sub-section 4.3.2), and selective coding (Sub-section 4.3.3). This process was key in extracting meaning from the data collected through the interviews.

4.3.1 Open coding for label assignment and organisation of labels and categories

Open coding marked the first stage of data analysis. Lejeune (2019) defines it as "the first contact with the material. The objective is to identify the characteristics of the phenomenon under study. To achieve this, the researcher should explore multiple research approaches" (p. 22) [free translation]. During this stage, we carefully examined the interview texts to identify recurring themes, patterns, and concepts. We transformed the participants' responses into labels or "open codes", reflecting various characteristics of the phenomenon under study. For example, we coded participants' impressions of the teaching approach as "unidirectional presentation", "lack of interaction", and "quick learning approach", among others.

Next, we organised these labels into categories and subcategories, as shown in Table 3. Each category highlights logical relationships among the labels, allowing

Table 3 Main themes and sub-themes for data analysis of the interviews

N	Themes	Sub-Themes
1	Content of ICT Training Courses	▶ Course objectives ▶ ICTs concepts ▶ Course structure
2	Teaching Strategies	▶ Learning types ▶ Evaluation ▶ Adaptability and/or Personalisation of the ICT training course
3	Challenges to Implement the ICT Training Course	▶ Availability of resources ▶ Resistance to the use of ICT
4	Expectation and Impact of ICT Training Course	▶ Expectations of ICT trainers of the ICT training course ▶ Impact on professional career of trainees

us to construct concepts that reflect the experiences of the individuals involved in the study.

The theme no. 1 comprises three sub-themes: (a) the objectives of the course, (b) the ICT concepts taught to trainees, and (c) the structure of the course. The *course objectives* include labels relating to respondents' views on the purposes underlying the ICT training course design. This sub-theme allows us to evaluate the suitability of the ICT training course by providing clear guidance on the expected learning outcomes. The *ICT concepts* summarise the characteristics that respondents attribute to the knowledge acquired. This sub-theme enables us to examine the type of ICT training received by trainees and provides insight into the skills and level of technological innovation they have acquired. Finally, the *structure of the course* outlines the teaching modules delivered during the training courses.

The theme no. 2 covers three sub-topics: (a) types of learning, (b) evaluation, and (c) adaptability and/or personalisation of the course. *Teaching methods* refer to how ICT-related knowledge and skills are delivered. *Evaluation* refers to the assessment methods used. This subtheme aids in understanding the broader approach to teaching and learning. *Adaptability and Personalisation* include labels that reflect adjustments made to meet trainees' needs. In this context,

"adaptability" refers to the ability to adjust to changing circumstances, such as participants' logistical or work-related challenges, like difficulty travelling or inability to attend sessions on site. In contrast, "personalisation" means modifying or adapting a course to suit the individual's conditions, skills, preferences, prior knowledge, interests, and objectives, and also adapting it as the learner's skills and knowledge evolve (Sampson & Karagiannidis, 2002; Shemshack & Spector, 2020).

The theme no. 3 allows identifying and understanding barriers that could impact effective course delivery and trainee learning. This theme is divided into two subthemes: (a) resource availability and (b) perceived resistance or hostility from trainees. *Resource availability* is a broad criterion that can encompass factors such as electricity reliability, Wi-Fi connection, and cost-savings measures. The difference

with *perceived resistance* is that resources availability is an objective criterion, whereas resistance is subjective.

Finally, the theme no. 4 comprises two criteria, such as (a) the *expected benefits* of an ICT training course as identified by the trainers and (b) the *impact of the ICT training course on trainees' career paths*. These criteria evaluate the impact of training on professional opportunities, as seen by both trainers and trainees. They enable an assessment of the course's effectiveness and relevance.

4.3.2 Axial coding to define the relationships between labels

The next step, axial coding, examined the relationships between the labels identified during open coding. We connected the properties two by two, reflecting on how the first varies according to the second (Lejeune, 2019).

For example, we have found a relationship between "Learning Management Systems (LMSs)" and "theoretical modules", since they both appear in certain situations. Another correlation was found between "adaptability to participants' needs" and "no feeling resistance". This phase requires a continuous comparison to establish relationships.

4.3.3 Selective coding to map relationships between properties that define scenarios

In the final phase of selective coding, we integrated the relationships identified in axial coding to construct scenarios that address the research questions. Table 4 outlines scenarios that illustrate potential outcomes based on the relationships identified during the analysis.

Figure 1 illustrates these scenarios, applying some of the display rules regarding interconnections (lines and arrows) from Lejeune (2019).

From Fig. 1, we can identify the following relationships. In Scenario no. 1, a simple green line links the project-based learning method to learner participation, indicating a positive relationship. As the use of project-based learning increases, learner participation also increases. Additionally, increased learner involvement enhances professional prospects, demonstrating that the project-based learning method directly boosts learner engagement, as shown by the green arrow representing this positive cause-and-effect relationship. In Scenario no. 2, connectivity issues and the use of offline and shared

Table 4 Description of three examples of scenarios

Scenario 1	Project-based learning and student engagement exhibit a positive reciprocal relationship. Then, increased learner engagement enhances career prospects, while the adoption of project-based learning leads to higher participation among trainees
Scenario 2	Connectivity issues and the use of offline devices have an inverse relationship, where the reliance on offline devices increases learner participation
Scenario 3	Collaborative work is inversely correlated with resistance to ICTs and teacher-centred method, which demonstrate a positive reciprocal relationship

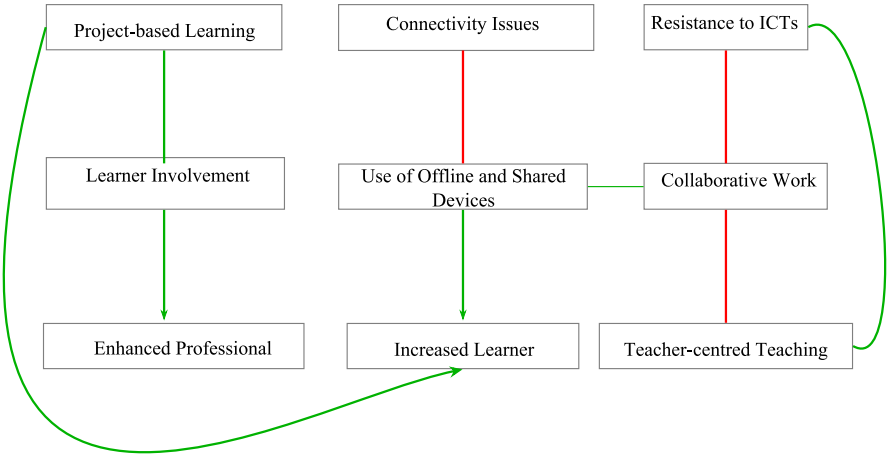

Fig. 1 Illustration of three scenarios

devices are connected by a red line, representing an inverse relationship. As connectivity problems rise, the reliance on offline devices also increases. Moreover, this increased use of offline devices leads to higher participation, illustrated by the green arrow indicating a positive, directed relationship. Lastly, Scenario no. 3 links resistance to ICTs and collaborative work with a red line, showing an inverse relationship: the greater the resistance to ICTs, the less collaborative work occurs. Furthermore, collaborative work is linked to the teacher-centred teaching method by a red solid line, indicating that increased collaboration among learners typically results in a decreased reliance on teacher-centred approaches. The relationship between resistance to ICTs and the teacher-centred teaching method is illustrated by a green solid line, indicating that when educators resist technology, they tend to use traditional teaching methods.

The selected coding phase provided a deeper understanding of the phenomenon under study by enabling the formulation of hypotheses and predictions based on the collected data.

4.3.4 Circular, progressive, and retrospective approach

We finally examined the data following a circular, progressive, and retrospective process as defined by Miles and Huberman (2003). During this process, we continually revised and updated the categories and codes based on our emerging understanding of the data. For example, we did not consider the category related to participants' feedback to instructors relevant to the pursuit of our research objectives.

5 Results

We summarised and organised the results of the interviews in four tables corresponding to the four themes (Appendix 10.2).

We structured the analysis of the results according to four main themes and sub-themes described in Table 3. We represented the results using histograms to identify key points of focus.

5.1 Content of ICTs training courses

The analysis of the results of the ICT content course theme, presented in Table 5 and Figure 2, enables us to answer the research sub-question no. 1: "*What are the objectives, content, and structure of the ICT training course?*".

Regarding (a) *course objectives*, four courses focused on understanding the use of ICTs tailored to the specific needs of the target audience, while only one course focused on understanding the functions of ICTs, emphasising a broad understanding of technologies. Two courses concentrated on the use of LMSs, platforms that managed, distributed, and monitored online learning. One course provided specialised and comprehensive training on ICTs. For (b) *ICT concepts*, training courses taught various ICT-related concepts: four courses provided personalised training tailored to the specific needs and objectives of the participating group. Two courses concentrated on specific ICTs, including the acquisition of skills related to tools, software, or platforms used in specific contexts. Two courses focused on using online training management platforms for the creation, distribution, and management of educational content. One course offered generic ICT training, covering basic concepts and generic ICT skills, without focusing on specific technologies or contexts of use. Regarding (c) the structure of the ICT training course, three courses emphasised teaching ICT-related theoretical concepts, including fundamental principles, theories, and basic concepts, without allowing the acquisition of direct practical skills. Five courses provided a combination of theoretical and practical modules, enabling students to acquire theoretical knowledge and apply it directly through practical exercises or labs.

Table 5 Overview of themes, sub-themes, examples, and frequency in the analysis of ICT training courses

Theme	Sub-Themes	Examples	Label	Frequency
Content of ICT Training Courses	**Course Objectives (C.O.)**	Use of ICT	C.O.1	4
		Functions of ICT	C.O.2	1
		LMS	C.O.3	2
		Specialised ICT	C.O.4	1
	ICT Concepts (ICT Conc.)	ICT for needs	ICT Conc.1	4
		Specific ICTs	ICT Conc.2	2
		LMS	ICT Conc.3	2
		Generic ICT	ICT Conc.4	1
	Course Structure (C.S.)	Theory	C.S.1	3
		Practice	C.S.2	0
		Theory + Practice	C.S.3	5

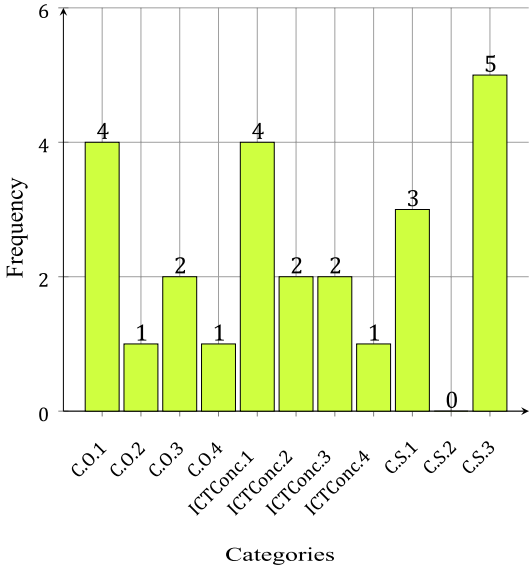

Fig. 2 Distribution of frequencies by categories

5.1.1 Teaching strategies

The analysis of the outcomes of teaching strategies theme, presented in Table 6 and Figure 3 addresses the sub-questions no. 2: "*What teaching strategies are used in the ICT training course?*".

For (a) the *ICT learning approach* used within the course, we observed that three courses attended by trainees adopted an approach that focused on traditional teaching, where the trainer delivered knowledge and information directly to the participants. In two courses, participants encountered real or simulated problems and

Table 6 Overview of themes, sub-themes, examples, and frequency in the analysis of teaching strategies

Theme	Sub-Themes	Examples	Label	Frequency
Teaching Strategies	**Learning Type (L.T.)**	Teacher-centered	L.T.1	3
		Problem-based	L.T.2	2
		Project-based	L.T.3	4
		Collaborative	L.T.4	5
	Evaluation Method (E.M.)	Pre-test/Intermediate Tests	E.M.1	2
		Problem-based Evaluation	E.M.2	1
		Project-based Evaluation	E.M.3	5
		Tests	E.M.4	1
		Non-Evaluation	E.M.5	2
	Adaptation/Personalisation (A.P.)	A/P Needs	A.P.1	4
		P-Tutors	A.P.2	2
		No A/P	A.P.3	3

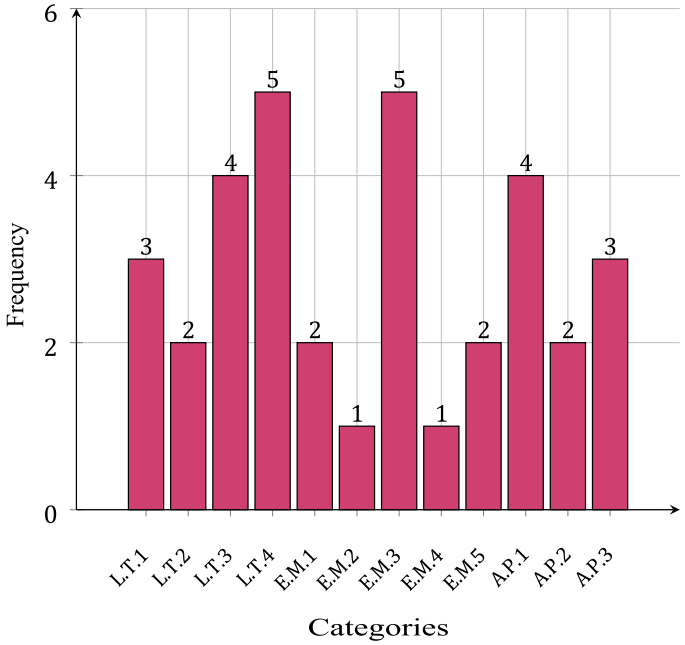

Fig. 3 Results for theme no. 2 (Teaching strategies)

worked to solve them through active learning and critical analysis. In four courses, participants engaged in specific projects that required the practical application of the acquired knowledge. Finally, in five courses, participants interacted and collaborated with one another. As for (b) the *evaluation* of the participants in the courses, we noticed that in two courses, pre-tests or intermediate tests assessed the knowledge of participants before or during the training. One course employed problem-based assessment, which evaluated participants' abilities to solve practical or theoretical problems. Five courses utilised project-based assessment, which evaluated the results of the projects on which participants worked. One course utilised test-based assessment, which administered standardised tests to evaluate participants' knowledge and skills. Two courses attended by participants did not include any participant evaluation process. Regarding (c) *adaptability and personalisation*, four courses were designed to be adaptable and/or personalised to meet specific learning needs. In two courses, personalisation of the ICT training course occurred through tutor intervention, with individual sessions with tutors to discuss participants' learning needs and adjust the learning path accordingly. Three courses that learners attended did not provide any measure of adaptability and/or personalisation.

5.1.2 Challenges to implement ICT training course

The analysis of the results of the challenges associated with implementing an ICT training course, presented in Table 7 and Fig. 4, highlights the issues involved in implementing the ICT training course to answer sub-question no. 3: "*What are the*

Table 7 Overview of themes, sub-themes, and examples in the analysis of challenges to implement ICT training course

Theme	Sub-Themes	Examples	Label	Frequency
Challenges to Implement ICT	**Resource Availability (R.A.)**	Connection	R.A.1	8
		Limited Resources	R.A.2	5
		Low Motivation	R.A.3	1
		Low Trainer Skills	R.A.4	1
		Low Learner Skills	R.A.5	1
		Policy Absence	R.A.6	1
		Information Overload	R.A.7	2
	Resistance to ICT (ICT Res.)	Yes resistance	ICT Res.1	4
		No resistance	ICT Res.2	4

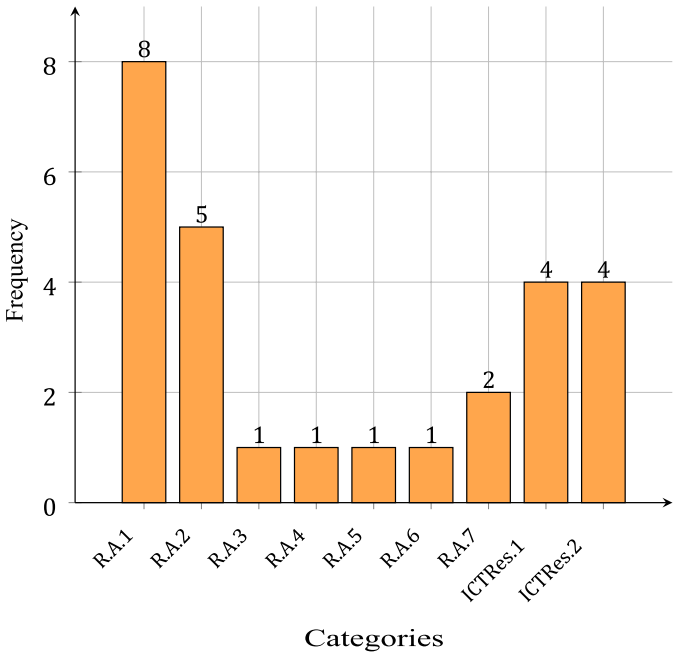

Fig. 4 Results for Theme No. 3 (Challenges for Implementing an ICT Training Course)

main challenges that could be an impediment to effective implementation of the ICT training course?"

Regarding (a) *the objective challenges faced in the implementation of ICT*, we identified that the most common challenge was poor connectivity due to power cuts. This hindered access to the Internet and the use of ICT during the training course. Five courses addressed the challenge of limited availability of technological materials necessary for conducting ICT training. Finally, interviewees

highlighted several objective challenges regarding the courses, including low motivation among trainers, which negatively impacted the quality of teaching and participation in the training course, limited ICT training skills of the trainers, and low competencies of the participants, which may have required a tailored teaching approach. In addition, a lack of clear policies and guidelines existed in the training of ICT for academics. Finally, two trainees reported experiencing information overload during the ICT training course. Among (b) the *subjective challenges*, we observed that in four courses, participants reported a feeling of resistance to the use of ICTs, manifesting a certain aversion or hostility towards ICTs. In four courses, participants did not report any feeling of resistance towards the use of ICTs, indicating that they were generally accepting or supportive of the use of ICT, without showing signs of aversion or hostility.

5.1.3 Expectation and impact of ICT training course

The analysis of the outcomes of the expectations or the impact of the theme of the ICT training course, presented in Table 8 and Fig. 5, answers sub-question no. 4: "*What are the expectations and outcomes of the ICT training courses?*".

Figure 5 shows that in five courses, ICT trainers hold specific expectations about how the ICT training course will influence their participants' professional careers. These expectations include the acquisition of specific skills, the expansion of job opportunities, or professional advancement. However, three trainees reported that they do not perceive any impact of the ICT training course on their professional careers. This discrepancy between instructors' expectations and participants' perceptions of the actual impact of the course on their careers highlights a need for further investigation.

6 Discussion

The analysis of the interview results reveals several aspects of ICT training courses, which are discussed separately for each research question.

Table 8 Overview of themes, sub-themes, examples, and frequency in the analysis of expectation and impact of ICT training course

Theme	Sub-Themes	Examples	Label	Frequency
Expectation and Impact of ICT	**Trainers' Expectations (T.E.)**	No Expectations	T.E.1	0
		Yes Expectations	T.E.2	5
	Learners' Impact (L.I.)	No expectations	L.I.1	3
		Yes Expectations	L.I.2	0

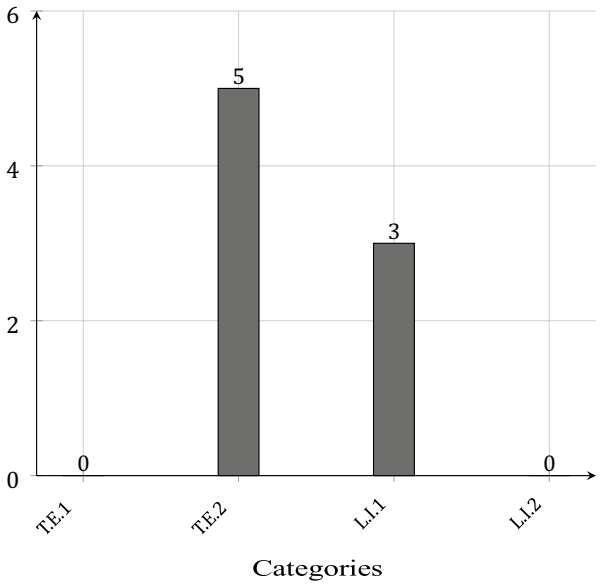

Fig. 5 Results for Theme No. 4 (Expectation and Impact of the ICT Training Course)

6.1 What are the (a) objectives, (b) content, and (c) structure of the ICT training course?

Firstly, (a) *ICT teaching objectives are diversifying*. The various objectives identified among the interviewed participants illustrate the multifaceted nature of ICT training courses. While all courses aimed to equip participants with ICT skills, the specific objectives differed, reflecting the unique needs and priorities of various target groups. Some courses aimed to adapt training to participants' needs, while others focused on integrating advanced technologies such as AI or LMS. The diversity of objectives observed in course design demonstrates the variety of priorities and approaches used in this area. These differences can significantly affect the participants' learning experience. A significant finding is that the courses primarily focused on enabling participants to understand and master the use of ICT, rather than merely consuming it. This indicates a growing importance for a comprehensive understanding of technology over mere superficial use (Oyelaran-Oyeyinka & Adeya, 2004; Plantard, 2016). However, none of the ICT training courses appear to focus on the quality of the learning objectives. Moreover, none of the trainers addressed the issue of motivating trainees to use technology, which represents a micro-level obstacle, according to Balanskat (2006).

The analysis reveals that (b) *the courses focused on the dissemination of various ICT competencies*. While some ICT-related courses prioritised ICT training that aligned with the needs and objectives of the target group, others concentrated on specific tools such as the use of LMS or specialised ICT skills like programming. However, offering ICT courses centred on specific tools raised the question of whether this approach benefits ICT training. As noted by Langset et al. (2018), these types of courses were designed to implement tools that had already been purchased

by the institution, such as the LMS. Furthermore, universities "expected faculty to use these tools in their courses." The researcher, quoting Kennedy (2005), suggests that "such top-down approaches typically involve centrally or externally delivered course content that supports existing routines, curriculum plans, or even a policy agenda." Additionally, educators are generally granted only a limited degree of autonomy.

The analysis also reveals that (c) *all trainers preferred a bi-modular approach to organising their courses, combining both theoretical and practical sessions*. Courses that integrate theoretical and practical modules offer a more comprehensive learning experience, enabling participants to not only grasp concepts but also apply them in real-world contexts. This aligns with the findings of Hussein (2014) and Yousfi and Yousfi (2023), who observed that such courses facilitate a more engaging learning experience for participants. However, the lack of practical modules in some courses may limit participants' ability to translate theoretical knowledge into practical skills. While theory provides the necessary foundation, practical application is crucial for skill development and mastery (Hussein, 2014; Ojo, 2005; Oyelaran-Oyeyinka & Adeya, 2004).

6.2 Which (a) learning approach, (b) evaluation, and (c) adaptability and/or personalisation of the ICT-course—are used in the ICT training course?

There are (a) *two main approaches to teaching strategies in ICT courses*: one centres on the teacher, while the other encourages active student participation. The first follows a traditional model, where the teacher controls and directs the learning process. The second is more interactive, promoting student involvement in learning. The data show a strong preference for methods that encourage student engagement, such as project-based and collaborative learning. A clear link exists between the chosen learning approach and the course structure. Courses following the traditional approach typically have a single-module structure, with the teacher playing a central role. However, this risks limit student participation, restricting their ability to develop critical and creative skills. In contrast, courses that actively engage students adopt a bimodal structure, combining theoretical and practical modules. This format fosters the development of transferable skills and the practical application of knowledge. Using methods like project-based learning highlights a growing understanding of the need to provide students with authentic, contextualised learning experiences. In this context, Dewey (1961) states that "students will develop a personal investment in the material if they engage in real, meaningful tasks and problems that mimic what experts do in real-world situations", as cited by Krajcik and Blumenfeld (2005) p. 317. The difference between learning methods focused on creating artefacts and those centred on problem-solving is significant. To enhance learning, university lectures should be combined with the practical application of knowledge in real-life scenarios. This approach encourages students to take responsibility for their learning and the tools they use to achieve sustainable development (Steiner & Posch, 2006) and promotes a "process necessitates that students collaborate to identify

solutions to authentic problems during the integration, application, and construction of knowledge" (Guo et al., 2020), (p. 2).

Furthermore, there is (b) *a preference for the evaluation of the most ICT courses*. In most cases, assessments focus on project presentations or problem-solving rather than tests. Evaluation is crucial for measuring learning progress. Without it, it becomes difficult to obtain feedback on teaching effectiveness. Project-based assessment remains the most preferred method, as it provides instructors with valuable feedback on their performance. However, two participants mentioned they did not undergo any evaluation. This lack of assessment contradicts the core principles of curriculum design outlined by Taylor et al. (2015). The reasons for the trainers' decision not to carry out an evaluation remain unclear. As the statements came from a trainee, it is uncertain whether they fully reflect the situation. Courses without evaluations tend to focus on teacher-led instruction and a modular course structure.

In addition, (c) *the courses attended by the three trainees did not offer modes of personalisation and adaptation*. The absence of tailored content to meet participants' needs may raise concerns, as customisation improves learning effectiveness by aligning content and instructional methods with individual needs (Shemshack & Spector, 2020). Evidence shows that personalised learning models can increase engagement and positively impact student motivation (Pontual Falcão et al., 2018).

6.3 What are the main challenges that are an impediment to effective implementation of the ICT training course?

The *implementation of ICT training courses faces a number of challenges*. All respondents consider load shedding a significant concern. It causes several other issues, including the limited ability of instructors and participants to use technology effectively. Hussein (2014) highlights that low digital proficiency among academics is a significant barrier to effective ICT training. Similarly, Masenya (2021) notes that teachers' inadequate digital literacy skills obstruct the effective use of technology in education. Alemu (2015) also points out that limited ICT resources restrict the development of digital skills, with poor ICT facilities being a key barrier to ICT integration.

Furthermore, the economic and social status of the participants may further limit their ability to acquire digital skills. Ferede et al. (2022b) discuss how students' ICT skills and access to ICT infrastructure, influenced by their economic and social status, affect their participation in ICT training. While many students own smartphones, these devices do not offer the same functionality as computers, which remain luxury items for many. Another major challenge arises from outdated operating systems and insufficient resources to upgrade them, as Kibuku et al. (2020) discuss regarding inadequate ICT infrastructure.

This might explain why some universities prefer to offer purely theoretical courses using slide presentations. The research reveals a challenge in the lack of university policies on ICT training. Kibuku et al. (2020) also note the absence of proper e-learning policies as a significant obstacle to effective ICT training. Despite the abundance of international guidelines, they are insufficient to regulate local ICT

integration, especially when considering the principle of subsidiarity. Another issue lies in trainers' lack of competence and motivation. Hussein (2014) addresses weak teachers' motivation as a barrier to effective ICT use, and Hanemann and Scarpino (2016) emphasise the need for professional incentives to enhance motivation. The motivation often suffers due to low salaries and transportation difficulties. There are also subjective challenges to consider. A notable issue is that 50% of interviewees resist using ICT, which Masenya (2021) links to reluctance to change and a lack of trust in new technologies.

6.4 What are the (a) expectations and (b) effects of the ICT training course?

We note that (a) *trainers hold positive expectations regarding participants*—Specifically, they believed that participants will easily understand how ICT can be used to address practical challenges. This reflects their optimism about the potential impact of ICT training on participants' career progression. Despite the trainers' positive expectations, no specific tools are in place to assess participants' ability to integrate ICTs after the course. This raises questions about the overall effectiveness of the training courses and their ability to influence participants' skills and career prospects effectively.

In contrast, (b) *participants expressed a negative view of the impact of ICT training courses on career prospects.* They reported having resorted to self-learning, which suggests dissatisfaction or a lack of benefit derived from the courses.

7 Implications and recommendations

This section presents strategies, in the form of recommendations, for designing an ICT training course for academics (Table 9). These strategies respond directly to the primary research question: "*What are the features and effects of ICT training provided to academics at various African universities?*", in particular to the first three sub-questions of the research (Sub-section 1.1). The recommendations are drawn from the findings and discussions presented in Sections 5 and 6, and they serve as guidelines for developing ICT training courses for academics.

The recommendations are not exhaustive but provide a starting point for designing ICT training programmes for academics. These recommendations can be integrated, adapted or expanded to meet the specific needs of academic institutions and participants.

The results of this study contribute to a deeper understanding of how ICT training is delivered in African universities. The recommendations help clarify ICT-related training processes and offer insights into strategies that can improve ICT training courses.

On a theoretical level, the study enriches existing literature on the integration of ICT in African higher education, offering fresh perspectives and practical models for future researchers. In particular, the qualitative analysis of ICT training courses highlighted key aspects of their objectives and methods. The objectives of these

Table 9 Recommendations for designing an ICT training course for academics

Theme	No	Recommendation
Content of ICT course	1	Clearly define the course objectives, including how you will verify their achievement. Also, establish a monitoring tool to track progress toward these objectives
	2	Teach participants the" functions" of ICT so they can apply it in various contexts and situations. Merely showing how to" consume" an ICT will not provide this understanding
	3	Avoid focusing solely on a specific type of ICT, as this limits the ability to master the tool. Design courses that provide a comprehensive understanding of ICT, whether through a generic or specialized approach
	4	Strive for a balance between theoretical and practical modules in the course
	5	Theoretical instruction is essential for understanding ICTs. Encourage trainees to conduct independent or group research based on their subject expertise to deliver this instruction
	6	Include practical activities to help trainees understand the use and function of ICTs, enabling them to use these tools effectively
Teaching strategies	1	Focus ICT training on active teaching methods that encourage greater participation from trainees to enhance their learning This approach can boost motivation and interest
	2	Actively involve trainees in collaborative projects and complex problem-solving to effectively use ICT in achieving teaching objectives
	3	Introduce evaluation measures to assess the ICT integration skills of trainees who have completed the training course. Conduct this evaluation in both the medium and long term after the course concludes
	4	Adapt the ICT training course based on trainees' levels, skills, and interests to enhance their motivation and participation
Challenges for ICT Course	1	Use offline collaborative tools to address connectivity issues
	2	Create ICT training programs that leverage available resources. If most trainees use smartphones, consider teaching ICT through applications. For limited technological resources, design programs that involve sharing tools among trainees for collaborative work

Table 9 (continued)

Theme	No	Recommendation
	3	Establish clear policies on ICT training for academics. Universities should commit to implementing these guidelines collectively
	4	Address resistance to learning ICT, which may stem from a lack of familiarity with the technology. Offer training courses that integrate theoretical and practical lessons, avoiding a mono-modular approach
	5	Prevent information overload in the ICT training course. Start with explanations or practical learning of recurring terms without if participants already understand the basic concepts. This approach can help reduce feelings of frustration and anxiety associated with learning ICT

courses are becoming more heterogeneous, with some courses now focusing on the integration of advanced technologies such as AI. This helps to inform the evolving ICT landscape in education. The study also looks at the effectiveness of different pedagogical approaches and training methods, offering a theoretical framework to guide future research. For example, centralised courses limit educators' autonomy, indicating a need for a more integrated pedagogical approach. The study emphasises the importance of bi-modular teaching approaches, which blend theoretical and practical learning to engage participants and make learning more meaningful. This provides a theoretical reference framework for future studies on ICT training.

On a practical level, the study provides concrete recommendations for designing and delivering ICT training programmes, helping educators and policymakers improve the quality and relevance of the courses. Specifically, it stresses the need for trainers to have the autonomy to choose courses that best meet the needs of students and educators. This approach allows for greater flexibility and adaptability in teaching. The study offers strategies to address infrastructural challenges, such as power outages and shortages of technical resources, which hinder teachers and students from using ICT effectively. Investing in infrastructure and resources is crucial to improving the training experience. Additionally, the research suggests revising the courses to align them more closely with the professional context of students, especially in response to participants' preference for self-directed learning.

In summary, the recommendations aim to optimise the design of ICT training courses for academics, considering both the theoretical contributions and practical implications that arose from the analysis, to ensure a more effective and meaningful training experience.

8 Conclusion

This research investigates the development of ICT training courses from both theoretical and practical perspectives, focusing on the integration of ICTs in some universities in Cameroon, Nigeria, and South Africa. The objective of this study is to analyse the characteristics of ICT training courses for academics, including course content, teaching strategies, implementation challenges, and academic expectations regarding the impact of these courses.

The analysis of the interview results revealed a number of significant aspects related to ICT training courses, which provide a complex and varied landscape. Firstly, the diversification of ICT teaching objectives emerges as a key factor. Although all the courses aim to provide ICT skills, the specific goals differ based on the unique needs of each target group. Some courses focus on adapting the training to the needs of the participants, while others emphasise the integration of advanced technologies. This evolution highlights the importance of a deep understanding of technology, rather than just a superficial application. However, none of the courses sufficiently addressed the quality of learning objectives, and trainers often overlooked participants' motivation to use technology, exposing a gap in training design. Furthermore, the analysis revealed that course content is mainly focused on teaching different ICT skills, with some courses prioritising adaptation to the needs of the target group, while others focus on specific

tools. However, the effectiveness of the courses focusing on specific tools remains questionable. The use of specific tools can limit the autonomy of trainers and reduce the personalisation of training. In terms of course structure, there is a clear preference for a bi-modular approach that combines theoretical and practical sessions. This approach not only helps participants understand concepts, but also enables them to apply what they've learned in real-world contexts. However, some courses lack practical modules, which may hinder the ability to translate theoretical knowledge into practical skills.

The teaching strategies reveal a distinction between traditional, teacher-centred methods and more interactive approaches that encourage active student participation. There is a clear preference for methodologies like project-based learning.

However, there are a number of challenges to delivering ICT training, including electricity cuts that disrupt the effective use of technology. The reduced teacher motivation and resistance to the use of ICT due to lack of confidence in ICTs and economic factors complicate the implementation of these courses.

Finally, while trainers are optimistic about participants' ability to understand how ICT can solve practical problems, there are no specific tools in place to assess how this integration affects their work practices after the course. In contrast, participants often express a more negative view regarding the impact of the courses on their careers, indicating a desire for self-directed learning and suggesting that the courses they attended lack utility. This gap between trainers' expectations and participants' experiences underscores the need for a thorough review of ICT training courses.

Based on the research funding, we have developed several recommendations aimed at ensuring that the courses meet the specific needs of participants, providing a more personalised and relevant training approach. They highlight the importance of integrating both practical and theoretical content, promoting motivation and active engagement, and establishing clear assessment mechanisms to track the courses' impact on participants' careers. Such strategies can serve as essential guidelines for enhancing the quality and effectiveness of ICT training courses in academic settings.

9 Limitations and future perspectives

The limitations of this study relate to the number of participants. To improve the reliability of the data, increasing the number of participants would be beneficial. However, connectivity issues may prevent achieving this goal. Moreover, focusing on universities located in the same state could facilitate a more accurate comparison.

In the future, our research aims to design and implement a proposed ICT training course for higher education institutions based on the specific recommendations outlined in this study.

Appendices

Appendix to sub-section 4.2

Interview guide

These are the questions that were sent to the respondent. These questions are intended to guide the interviewee in a semi-structured interview. The following questions are designed as a starting point, allowing the interviewee to respond freely and without structure.

I. Introduction:

i. Are you a teacher trainer or trainee of ICT training courses?
ii. If you are a training teacher, could you provide a comprehensive overview of how you plan and run these ICT training courses?
iii. If you are a trainee, do you approach the ICT training course as a student or as a professional?

II. Course content:

i. Objectives of the ICT training course
ii. What topics are covered in the ICT training courses? (e.g., the type of ICT trained as LMS, etc.)?
iii. Is AI integrated into the content of the ICT training course? iv. Modules of the ICT training course

III. Teaching strategies

i. What types of learning methods are used to train academics in ICT (e.g., lectures, hands-on labs, interactive workshops, etc.)
ii. Do you incorporate interactive or collaborative lectures (such as practical sessions, group work, etc.)
iii. Duration of ICT training course iv. Participants' feedback
iv. Is there an evaluation session at the end of the ICT training course? If so, what kind of evaluation or examination is given?
v. How is the ICT training course adapted and personalized to match the participants' skill levels, needs, etc.?

IV. Challenges:

i. What are the main barriers to implementing an ICT training course? How do your ICT training courses address these challenges? (e.g., lack of resources, etc.)
ii. Is there any resistance, anxiety, or frustration related to the use of ICTs?

V. Expectations and impact of the ICT training course.

For teacher training
i. What are the expectations for the ICT training course in terms of what trainees will learn about using ICTs?
For trainee
i. How has the ICT training course impacted your ability to use ICTs?

VI. Conclusion

i. Is there anything else you would like to add or emphasise about your ICT training course?

Appendix to sub-Section 5

Summary of the results

We summarise the interview responses in four tables corresponding to the four themes. This method allows us to visualise the distribution of themes among the participants.

Tables 10, 11, 12, and 13 contain four labels indicating the main themes of the interview, the corresponding sub-themes, the identification code of each interviewee, and their responses. Each respondent's code is accompanied by a specification: consisting of "TT" for teacher trainer and "CT" for trainees of the ICT training course.

Table 10 The results of the content course

Themes	Sub-Themes	I-	Role	Outcomes
ICTs Content Course	Objective Course	I-1	TT	Adaptive ICTs use
		I-2	CT	Maximise effective use of ICTs
		I-3	CT	LMSs learning
		I-4	TT	Understanding the use of ICT
		I-5	TT	Comprehensive and specialised training in ICTs
		I-6	CT	LMSs and AI learning
		I-7	TT	Learner involvement in the use of ICTs Not just consuming ICTs
		I-8	TT	Adaptive ICTs use
	ICTs Concepts	I-1	TT	Not specific tool for ICTs training Tool tailored to the learners' needs
		I-2	CT	Comprehensive instruction on ICTs Pedagogical Exploitation of ICTs Train on the pedagogical use of video projectors

Table 10 (continued)

Themes	Sub-Themes	I-	Role	Outcomes
		I-3	CT	Learning Moodle, Microsoft Teams, and Camtasia Studio
		I-4	TT	Starting without specifying the ICTs to use Starting by defining the goals to achieve Identifying ICTs aligned with achievement goals as final step
		I-5	TT	ICT training courses on networking, programming, web development, etc
		I-6	CT	Learning Moodle, Microsoft Teams, AI
		I-7	CT	Technology is a mediator to learn Trainees can use ICTs they like
		I-8	TT	Diverse range of ICTs adapted to learners' needs
	Structure Course	I-1	TT	Introductory general background on ICTs Practical exercises aligned with the needs of the audience
		I-2	CT	Theoretical module
		I-3	CT	Theoretical module
		I-4	TT	Encouraging participants to do their own exploration and navigation of the ICTs Practicalapplication over detailed theoretical explanations
		I-5	TT	Theoretical module with teaching material on the digital platform Practical activity within the lab
		I-6	CT	Theoretical module
		I-7	TT	Document comprehension, information extraction, and use of ICTs to transform knowledge in something else
		I-8	TT	Theoretical module Asking trainees to create their background by themselves in small groups Each group discovers an aspect and shares its discovery in a plenary session Practical sessions like exercises and projects

Table 11 The results of the teaching strategies

Themes	Sub-Themes	I	Role	Outcomes
Teaching Strategies	Learning types	I-1	TT	Project-based learning Collaborative practical activities
		I-2	CT	Teacher-centred teaching method
		I-3	CT	Teacher-centred teaching method
		I-4	TT	Problems-based learning Project-based learning Collaborative groups between together trainees to work
		I-5	TT	Project-based learning Collaborative groups between together trainees to work
		I-6	TT	Teacher-centred teaching method
		I-7	TT	Learning by doing complex problems Need to work in collaborative groups because of the complexity of tasks
		I-8	TT	Learning by doing (project-based learning) Flipped classroom comes in Hands-on and interactive learning sessions
	Evaluation	I-1	TT	Final evaluation module with project resolution
		I-2	CT	Final evaluation through submission of a project
		I-3	CT	No evaluation
		I-4	TT	Pre-test and practical post-test for participant improvement
		I-5	TT	Intermediate test on digital platform Final examination to obtain certification
		I-6	CT	No evaluation
		I-7	TT	Complex problem-management assessment Absence of the “true” solution, but the reasoned process to create something
		I-8	TT	Project-based assessment

Table 11 (continued)

Themes	Sub-Themes	I	Role	Outcomes
	Adaptability and/or personalisation of the ICT training course	I-1	TT	Adapting content to learners' needs
		I-2	CT	No adaptability
		I-3	CT	No adaptability
		I-4	TT	Real-time support systems and co-facilitators Enhancing participant assistance
		I-5	TT	Providing online educational content and take virtual lessons
		I-6	CT	No adaptability
		I-7	TT	No adaptability
		I-8	TT	Personalised learning support Personalised tutoring according to the participant's requests and needs

Table 12 The results of challenges to ICT training course implementation

THEMES	SUB-THEMES	I-	ROLE	OUTCOMES
Challenge to ICT training course implementation	Availabilityof sources re-	I-1	TT	Connectivity problems and availability of few technological tools
		I-2	CT	The connectivity issues The scarce availability of laptops, and the computer rooms Difficult to practise ICT knowledge
		I-3	CT	The load shedding of the electricity Information overload
		I-4	TT	The lack of resources The electricity issues Difficult to implement ICT training courses
		I-5	TT	Obsolete systems Lack of smartphones Low motivation of trainers and their leave

Table 12 (continued)

THEMES	SUB-THEMES	I-	ROLE	OUTCOMES
		I-6	CT	The load shedding of the electricity Poor competences in formation of training teacher Complexity of ICT-designed training course
		I-7	TT	Some connectivity issues
		I-8	TT	Poor internet Absence of institutional support in terms of provision of effective and efficient tools institution-wide Policy that makes participation in ICT training courses compulsory The inability of some participants to upgrade their laptops Operating systems and some of the applications they commonly use
	Resistance to the use of ICTs	I-1	TT	No resistance feeling if ICT training courses aligned with participants' skills and resources
		I-2	CT	Absence of resistance to the use of ICTs
		I-3	CT	Overcoming resistance by exploring learners' discomfort with technological teaching methods
		I-4	TT	Resistance of some trainees
		I-5	TT	Overcoming resistance addressing challenges arising from trainees' limited Knowledge of ICT tools
		I-6	CT	Reduce anxiety simplifying ICT training for better understanding Reduce anxiety removing the mental blocks caused by specialisation
		I-7	TT	Absence of resistance emphasising process over initial skill differences in ICT training
		I-8	TT	Resistance sense due to influence of perception of ICT such as energy and connectivity challenges

Table 13 The results of expectation and impact of ICT training

THEMES	SUB-THEMES	I	ROLE	OUTCOMES
Expectation and Impact of ICTs Training	Expectations on professional career as identified by the trainers	I-2	CT	The ability to understand social dimension of ICTs The ability to use ICTs according to social needs
		I-4	TT	Improving one's technological awareness after attending the ICT training course
		I-5	TT	Ability to use computers, work with software packages such as those from Microsoft, and acquire IoT skills
		I-7	TT	Training participant how to use the technology to learn about the world we live in
		I-8	TT	Pioneers in the field of technology-enhanced learning through ICT training
	Impact on professional path according to the trainees	I-2	CT	Not applied theory because of the lack of technology in the working environment Self-study as a complementary key to continuing professional development
		I-3	TT	ICT training course does not have a significant impact on educational path Overcoming frustration and finding ways beyond formal ICT training through self-learning
		I-6	CT	Utility of basic and low-enrolment ICT training courses

Abbreviations *ACEs*: African Higher Education Centres of Excellence; *ACOLAD*: Apprentissage COLlaboratif à Distance; *ADEA*: Association for the Development of Education in Africa; *AI*: Artificial Intelligence; *APHRC*: African Population and Health Research Center; *AU*: African Union; *AU/CIEFFA*: African Union International Centre for Girls' and Women's Education in Africa; *AUF*: Agence Universitaire de la Francophonie; *AVU*: African Virtual University; *ECOWAS*: Economic Community of West African States; *FOAD*: Formation Ouverte et à Distance (Open and Distance Learning); *GTC*: Global Teacher Campus; *ICT*: Information and Communication Technology; *ICTs*: Information and Communication Technologies; *IT*: Information Technology; *OERs*: Open Educational Resources; *ODL*: Open and Distance Learning; *TPACK*: Technological Pedagogical Content Knowledge; *UNESCO*: United Nations Educational, Scientific and Cultural Organisation

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Declarations

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References

ADEA, AU/CIEFFA, APHRC. (2022). Teacher Training and Support in Africa during the COVID-19 Pandemic. Technical report, ADEA, AU/CIEFFA, APHRC, Abidjan, Ouagadougou, Nairobi.

Adu, K. O., Mpu, Y., & Adu, E. O. (2020). Virtual Learning: A panacea for Effective Teaching and Learning During and After COVID 19 Pandemic. *KIU Journal of Education, 15*(1), 165–187.

African Union. (2015). Continental education strategy for Africa (2016-2025). Retrieved from https://ecosocc.au.int/sites/default/files/files/2021-09/continental-strategy-education-africa-english.pdf. Accessed 14 May 2023.

African Union. (2020). Digital transformation strategy for Africa (2020-2030). African Union. Retrieved from https://au.int/sites/default/files/documents/38507-doc-dts-english.pdf. Accessed 23 May 23 2023.

African Union Commission. (2015). The Africa We Want: Agenda 2063. African Union Commission. Retrieved from https://au.int/sites/default/files/documents/36204-docagenda2063_popular_version_en.pdf. Accessed 2 May 2023.

Agormedah, E. K., Henaku, E. A., Ayite, D. M. K., & Ansah, E. A. (2020). Online learning in higher education during covid-19 pandemic: A case of ghana. *Journal of Educational Technology and Online Learning, 3*(3), 183–210.

Agyei, E., & Agyei, D. (2021). Promoting Interactive Teaching with ICT: Features of Intervention for the Realities in the Ghanaian Physics Senior High School Classroom. *International Journal of Interactive Mobile Technologies (iJIM), 15*, 93.

Akkari, A., Seidikenova, A., Bakitov, A., & Minazheva, G. (2023). Internationalization of Higher Education in Kazakhstan: From political will to implementation. *Ensaio: Avaliação e Políticas Públicas Em Educação, 31*, 1–26.

Akomea, M., Pantah, A., & Asenso, J. (2022). Evaluation of remote teaching and learning in universities in ghana during the covid-19 pandemic. *Journal of Education, Curriculum and Teaching Studies, 3*(1), 21–31.

Alemu, B. M. (2015). Integrating ict into teaching-learning practices: Promise, challenges and future directions of higher educational institutes. *Universal Journal of Educational Research, 3*(3), 170–189.

Azionya, C. M., & Nhedzi, A. (2021). The digital divide and higher education challenge with emergency online learning: Analysis of tweets in the wake of the COVID-19 lockdown. *Turkish Online Journal of Distance Education, 22*(4), 164–182.

Balanskat, A., Blamire, R., & Kefala, S. (2006). The ICT impact report: A review of studies of ICT impact on schools in Europe. European communities. Retrieved from https://oei.org.ar/ibertic/evaluacion/sites/default/files/biblioteca/31_theict_impact_report_in_europe.pdf. Accessed 20 May 2024.

Bashir, S., Lockheed, M., Ninan, E., & Tan, J.-P. (2018). *Facing forward: Schooling for learning in Africa*. World Bank Publications.

Cappelli, M. A. (2024). Information and communication technologies (ICTs) in higher education in Cameroon, South Africa, and Nigeria. In Training academics in the use of ICTs. Master. Université de Genève. https://archive-ouverte.unige.ch/unige:175145

Denzin, N. K., & Lincoln, Y. S. (1994). Introduction: Entering the Field of Qualitative Research. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of Qualitative Research* (pp. 1–18). Sage.

Dewey, J. (1961). *Dewey on Education: Selections*. Teachers College Press.

Diallo, B., Thierry, K., Aguti, J. N., & Villet, C. (2012). The African Virtual University Teacher Education Program: Across borders and language barriers in 10 African countries. *Journal of Education and Practice, 3*(7), 31–40. Accessed on May 9, 2023.

Eltahir, M. E. (2019). E-Learning in Developing Countries: Is it a Panacea? A Case Study of Sudan. *IEEE Access, 7*, 97784–97792.

Ferede, B., Elen, J., & van Petegem, W. E. A. (2022b). Instructors' educational ict use in higher education in developing countries: Evidence from three ethiopian universities. *Journal of Computing in Higher Education, 34*, 658–678.

Ferede, B., Elen, J., Van Petegem, W., Hunde, A. B., & Goeman, K. (2022a). Determinants of instructors' educational ICT use in Ethiopian higher education. *Education and Information Technologies, 27*(1), 917–936. https://doi.org/10.1007/s10639-021-10606-z

Fomunyam, K. G. (2019). The role of information and communication technology in tertiary education in Africa. *International Journal of Civil Engineering and Technology, 10*(12), 60–69.

Freire, P. (1974). Pédagogie des opprimés; suivi de Conscientisation et révolution (trad.). *La Découverte/Maspero*, p. 197.

Guo, P., Saab, N., Post, L. S., & Admiraal, W. (2020). A review of project-based learning in higher education: Student outcomes and measures. *International Journal of Educational Research, 102*, 101586.

Hanemann, U., & Scarpino, C. (2016). *Harnessing the potential of ICTs: Literacy and numeracy programmes using radio, TV, mobile phones, tablets and computers; selected case studies from the UNESCO Effective Literacy and Numeracy Practices database (LitBase)* (2nd ed.). UNESCO Institute for Lifelong Learning.

Hew, K. F., & Cheung, W. S. (2013). Use of Web 2.0 technologies in K-12 and higher education: The search for evidence-based practice. *Educational Research Review, 9*, 47–64.

Hussein, A. (2012). Freirian and postcolonial perspectives on e-learning development: A case study of staff development in an african university. *The International Journal of Critical Pedagogy, 4*(1). Retrieved from https://janeway.uncpress.org/ijcp/article/id/656/ .

Hussein, A. (2014). Engaging academics in training in information communication technology (ICT): An African experience with special focus on Uganda. *Journal of Contemporary Issues in Education, 9*(2). https://doi.org/10.20355/C5V01F

Hussein, A. (2021). Information and communication technology for African higher education institutions: Challenges and opportunities. In *Teaching in the post COVID-19 era: World education dilemmas, teaching innovations and solutions in the age of crisis* (pp. 129–138). https://doi.org/10.1007/978-3-030-74088-7_12

Institut de la Formation à Distance de la Francophonie. (2012). Institut de la Formation à Distance de la Francophonie. Retrieved from https://ific.auf.org. Accessed 3 Feb 2024.

Inter-University Council for East Africa. (n.d.). *Programmes & projects*. IUCEA. Retrieved from https://www.iucea.org/programmes-projects/. Accessed 14 May 2023.

Isaacs, S. (2007). ICT in education in South Africa. Technical Report 10659, The World Bank Group.

Ivongbe, M. I., Ojeifo, S., Akhator, P., & Omorogbe, H. (2010). ICT and Education in Africa: a Paradigm Shift in Teacher Professional Development in the Gambia. In *INTED2010 Proceedings*, 4th International Technology, Education and Development Conference, pages pp. 4384–4392. IATED.

Kasenene, E. S. (2011). Obstacles to the internationalisation of higher education in Africa: The case of Uganda. *Makerere Journal of Higher Education, 3*(1), 73–90.

Kennedy, A. (2005). Models of continuing professional development: A framework for analysis. *Journal of in-Service Education, 31*(2), 235–250.

Kibuku, R. N., Ochieng, D. O., & Wausi, A. N. (2020). e-Learning challenges faced by Universities in Kenya: A literature review. *Electronic Journal of e-Learning, 18*(2), 150–161.

Kipchumba, S. K. (2019). African perspective of the challenges and prospects of massification of higher education. *Editon Consortium Journal of Curriculum and Educational Studies, 1*(3), 131–145.

Knight, J. (2003). Updated Internationalization Definition. *International Higher Education*, 33.

Krajcik, J. S., & Blumenfeld, P. C. (2005). *Project-Based Learning*, page 317–334. Cambridge Handbooks in Psychology. Cambridge University Press.

Kyem, P. A. K. (2012). Is ICT the panacea to sub-Saharan Africa's development problems? Rethinking Africa's contentious engagement with the global information society. *Progress in Development Studies, 12*(2–3), 231–244.

Langset, I. D., Jacobsen, D. Y., & Haugsbakken, H. (2018). Digital professional development: Towards a collaborative learning approach for taking higher education into the digitalized age. *Nordic Journal of Digital Literacy, 13*(1), 24–39.

Lauwerier, T., & Akkari, A. (2015). Teachers and the quality of basic education in sub-Saharan Africa. *Education Research and Foresight: Working Papers Series, 11*, 1–11.

Lejeune, C. (2019). *Manuel d'analyse qualitative*. Méthodes en sciences humaines. De Boeck Supérieur.

Lindlof, T. R., & Taylor, B. C. (2002). *Qualitative Communication Research Methods* (2nd ed.). Sage Publication.

Maina, A. M., & Kuria, J. (2024). Building an ai future: Research and policy directions for africa's higher education. In *2024 IST-Africa Conference (IST-Africa)*, pp. 01–09. IEEE.

Masenya, T. M. (2021). Digital Literacy Skills as Prerequisite for Teaching and Learning in Higher Education Institutions. *Mousaion: South African Journal of Information Studies, 39*(2), 20.

Mathende, A., & Beach, J. (2022). The integration of information communication technology in education: A review of policies and practices in Angola, South Africa, and Zimbabwe. *Journal of Special Education Preparation, 2*(1), 80–89.

Mboa Nkoudou, T. H. (2020). Epistemic Alienation in African Scholarly Communications: Open Access as a Pharmakon. In M. P. Eve & J. Gray (Eds.), *Reassembling Scholarly Communications: Histories, Infrastructures, and Global Politics of Open Access.* The MIT Press.

Miles, M. B., & Huberman, A. M. (2003). *Analyse des données qualitatives*. De Boeck Supérieur.

Mncwango, N., Mncwango, T., et al. (2024). Icts and e-governance in africa. *Digital Policy Studies, 3*(1), 73–92.

Mohamedbhai, G. (2011). Higher education in Africa: Facing the challenges in the 21st century. *International Higher Education*, (63). https://doi.org/10.6017/ihe.2011.63.8534

Moshtari, M., & Safarpour, A. (2023). Challenges and strategies for the internationalization of higher education in low-income East African countries. *Higher Education*, pages 1–21. https://doi.org/10.1007/s10734-023-00994-1

Mpungose, C. B. (2020). Emergent transition from face-to-face to online learning in a South African University in the context of the Coronavirus pandemic. *Humanities and Social Sciences Communications, 7*(1), 1–9.

Muftahu, M. (2020). Higher education and Covid-19 pandemic: Matters arising and the challenges of sustaining academic programs in developing African universities. *International Journal of Educational Research Review, 5*(4), 417–423.

Mukamurera, J., Lacourse, F., & Couturier, Y. (2006). Des avancées en analyse qualitative : Pour une transparence et une systématisation des pratiques. *Recherches Qualitatives, 26*(1), 110–138.

Ogwu, E. N., Emelogu, N. U., Azor, R. O., & Okwo, F. A. (2023). Educational technology adoption in instructional delivery in the new global reality. *Education and Information Technologies, 28*(1), 1065–1080.

Ojo, T. (2005). Wiring sub-Saharan Africa for development. *International Journal of Education and Development using ICT*, *1*(3), 94–107.

Okanda, P., & Andugo, E. (2023). Deploying contemporary information and communication technology (ICT) solutions for academic delivery in higher education institutions (HEIs) – The USIU-Africa experience. *International Education Studies and Sustainability, 3*, 68. https://doi.org/10.22158/iess.v3n1p68

Olatunde Aiyedun, T. G., Ogunode, N. J., & Aiyedun, E. (2021). Assessment Of Virtual Learning During Covid-19 Lockdown in Nigerian Public Universities. *Academicia Globe, 2*(05), 159–175.

Olurinola, O. (2022). *Fostering the development of digital pedagogical skills of teachers in Africa*. ELA News Portal. Retrieved from https://ela-newsportal.com/development-of-digital-pedagogical-skills-ofteachers-in-africa/. Accessed 8 May 2023.

Oluwaseyi, S. O. A. S. V. (2024). Effect of information and communication technology on curriculum delivery in tertiary institutions in nigeria. *Sumerianz Journal of Social Science*. https://doi.org/10.47752/sjss.72.15.20

Oyelaran-Oyeyinka, B., & Adeya, C. N. (2004). Internet access in Africa: Empirical evidence from Kenya and Nigeria. *Telematics and Informatics, 21*(1), 67–81.

Peraya, D., Depover, C., & Jaillet, A. (2013). Un master à distance pour une formation aux technologies éducatives : le diplôme uticef – acreditE. In Loiret, P.-J. (eds.), *´Un détour par le futur. Les formations ouvertes et à distance à l'Agence universitaire de la francophonie. 1992–2012*, pages 83–102. Agence universitaire de la francophonie et Editions archives contemporaines, Paris.

Plantard, P. (2016). La fracture numérique : mythe ou réalité? In *Colloque Scientifique ESPE*, Lille, France. ESPE.

Pontual Falcão, T., Mendes de Andrade e Peres, F., Sales de Morais, D. C., & da Silva Oliveira, G. (2018). Participatory methodologies to promote student engagement in the development of educational digital games. *Computers & Education, 116*, 161–175.

Ruslin, R., Mashuri, S., Rasak, M. S. A., Alhabsyi, F., & Syam, H. (2022). Semi-structured Interview: A methodological reflection on the development of a qualitative research instrument in educational studies. *IOSR Journal of Research & Method in Education (IOSR-JRME), 12*(1), 22–29.

Sampson, D., & Karagiannidis, C. (2002). Personalised learning: Educational, technological and standardisation perspective. *Digital Education Review, 4*, 24–39.

Shemshack, A., & Spector, J. M. (2020). A systematic literature review of personalized learning terms. *Smart Learning Environments, 7*(1), 1–20.

Steiner, G., & Posch, A. (2006). Higher education for sustainability by means of transdisciplinary case studies: An innovative approach for solving complex, real-world problems. *Journal of Cleaner Production, 14*, 877–890.

Stone, J. C. (1990). *Educational Evaluation and Policy Analysis, 12*(1), 102–106.

Taylor, S. J., Bogdan, R., & DeVault, M. (2015). *Introduction to qualitative research methods: A guidebook and resource*. John Wiley & Sons.

Tyler, R. W. (1949). *Basic principles of curriculum and instruction*. University of Chicago press.

UNESCO Office Dakar and Regional Bureau for Education in Africa. (2023). *Education in Africa: Placing equity at the heart of policy; Continental report*. UNESCO Multisectoral Regional Office for West Africa, African Union Commission, UNESCO. https://unesdoc.unesco.org/ark:/48223/pf0000384479. Accessed 14 Jan 2024.

UNESCO. (2016). Education 2030: Incheon declaration and framework for action for the implementation of sustainable development goal 4: Ensure inclusive and equitable quality education and promote lifelong learning for all. https://unesdoc.unesco.org/ark:/48223/pf0000243278. Accessed 20 May 2023.

UNESCO. (2020). ICT transforming education in Africa. Final report. Technical report. UNESCO. Retrieved from https://unesdoc.unesco.org/ark:/48223/pf0000373638. Accessed 13 May 2023.

UNESCO. (2023). *Forum on quality public digital learning and cross-country seminar of the UNESCO-KFIT Project "ICT Transforming Education in Africa": Report*. UNESCO. Retrieved from https://unesdoc.unesco.org/ark:/48223/pf0000385189. Accessed 9 June 2023.

UNESCO. (n.d.). Global teacher campus. Retrieved from https://globaleducationcoalition.unesco.org/global-teacher-campus. Accessed 9 Dec 2023.

UNESCO-IICBA (n.d.). Continuing Vocational Training Information System. Accessed on May 15, 2023.
United Nations General Assembly. (1948). Universal declaration of human rights. *UN General Assembly, 302*(2), 14–25.
Van De Werfhorst, H. G., Kessenich, E., & Geven, S. (2022). The digital divide in online education: Inequality in digital readiness of students and schools. *Computers and Education Open, 3*, 32.
Wan, X.-L., & Geo-JaJa, M. (2013). Internationalisation of Higher Education in Africa: Characteristics and Determinants. *World Studies in Education, 14*, 79–101.
World Bank. (2015). Setting goals to revitalize Africa's higher education systems. Retrieved from https://www.worldbank.org/en/news/feature/2015/03/12/setting-goals-to-revitalize-africas-highereducation-systems. Accessed May 2023.
Yidana, P., Asapeo, A., Laar, S. K., Linda, W., et al. (2023). Challenges facing online teaching and learning in african higher education institutions: Empirical review. *European Journal of Open Education and E-Learning Studies, 8*(2), 133.
Yousfi, S. and Yousfi, I. (2023). La formation des enseignants à l'intégration des TIC dans les pratiques pédagogiques. *Didactica*, 1(1). https://doi.org/10.46827/ejoe.v8i2.4974