Journal of Educational Sciences, XXV, 1(49) DOI: 10.3592/JES.2024.1.08

Received: 28.04.2024
Revised: 12.07.2024
Accepted: 17.07.2024
Published: 26.07.2024

# Teachers Perception on Digital Technology in Teaching and Learning as a Quality Factor in Ethiopian Universities

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## Abstract

*In this 21st century, HEIs are experiencing a dynamic change in technology, and they should be responsive to stay in the competition space. A recent phenomenon of the COVID-19 outbreak was an alarm that caused many HEIs to look back at their capacity in digital technology to deliver online teaching and learning. This paper presents technology-based teaching and learning at two Ethiopian higher education institutions. Two research questions were set to guide the study: -how do academics perceive tech-based teaching and learning as an element of quality? Do other Inputs, Processes, and Outputs impact the application of digital technology in teaching and learning? A quantitative research method was employed to assess the case. 188 university teachers were taken from two universities as a sample for questionnaire administration. Jamovi software was deployed for data analysis. The result shows that digital technology-assisted teaching and learning are among the important elements of quality. Teachers believe that technology-based teaching and learning improves quality. Their beliefs were similar across their qualifications, departments, university type, and gender. In contrast, their service years have made a significant difference between teachers of less than five years (5) experience and those between five to ten (5-10) years. Inputs and processes-oriented quality elements significantly affect the integration of ICT into teaching and learning. It is recommended that HEIs of Ethiopia be proactive in planning to adopt relevant and timely digital technologies to deliver quality teaching and learning. Besides this, their openness to cooperate with Ethio Telecom, the Ministry of Education, and other NGOs to work toward capacity building to integrate digital technology into their teaching and learning by minimizing the challenges related to poor digital competency, scarce resources, internet connection, and infrastructure.*

**Keywords**: digital technology; online teaching and learning; digital skill; ICT; quality teaching and learning

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## 1. Introduction

We live in a globalized era where responsiveness to dynamic changes and challenges is needed. Therefore, being proactive and using new technologies to overcome these challenges is essential. The knowledge and skills youths possess today may be obsolete and out of use for tomorrow's needs and interests. In line with this, (OECD, 2019) described that digital transformation is challenging the traditional ways of thinking, doing, and influencing the policy-making processes in different settings.

The education sector is one of the largest service institutions that employs new technologies and digital systems to stay connected globally and internationalize the teaching and learning system. One of the definitions of quality is fitting for the purposes (Harvey, 2004), digital-based higher education is believed to prepare a skilled and competent future workforce who would contribute to the Labor market demand. In this regard, it contributes to the quality by assisting the teachers, students, curriculum developers, and policymakers with modern technologies to develop relevant educational materials and design in the best way to deliver them. Additionally, to prepare citizens for a knowledge-based economy, digital technology in the education sector is vital (Yigezu, 2021).

As the situations dictate the use of ICT in teaching and learning, promoting digital skills of the teachers and youth would be necessary to deliver quality teaching and learning apart from soft skills. Sá & Serpa (2020) argues that improving digital sustainable development in teaching is needed for higher education institutions if they want to be at the forefront. Higher education institutions produce a prospective workforce with the knowledge, skills, and attitudes. Hence, they need to be familiar with relevant new technologies and infrastructure. In line with this, Stéger (2014) in her review of the European Teachers' Related Policy, identified that teacher educators of this century teach in very dynamic, multicultural settings where using new technologies like digital skills is necessary.

Digitalization can lay the ground for smart education (Dneprovskaya et al., 2018). Digitalizing the higher education system has a paramount effect on marketing their business. In some country's HEIs, digitalization is in its beginning stage of development, even though university teachers are willing to use digital systems and an increasing number of technical tools than ever (Thoring et al., 2017). This study elaborates that the course administration and examination are not well digitized and only the registration of students is well digitized. This case is like the Ethiopian context. As researchers have identified the challenges associated with integrating digital technology into teaching and learning, this study focuses on the teachers' beliefs and understanding of whether digital-technology-assisted teaching and learning improves quality.

Cognizant of the benefits and the expanded usage of digital technology at higher education institutions, this study aims to answer the following research questions:

1. How do university academics perceive the implementation of digital technology as an element of quality teaching and learning?
   1.1 How do they rate the extent to which Digital technology improves quality?
2. Do educational inputs, processes, and outputs impact the implementation of digital technology in teaching and learning at universities?

## 2. Theoretical background

Nowadays, digitalization in higher education is becoming popular because of the influence of globalization. It is an undeniable truth that higher education institutions of this century apply ICT tools and digital systems to make their education easier, timesaving, easily accessible, standardized as well as internationalized. The difference lies in the extent to which they are used. The theoretical background focuses on the purposes and problems associated with tech-based teaching and learning in Higher Education Institutions and Ethiopian HEIs.

### 2.1 Digital Technology in Improving Higher Education Teaching and Learning

#### *2.1.1. Improving Quality of Education Through Digital Knowledge and Skills*

Connectivism- a recent learning theory developed by George Siemens and Stephen Downes promotes the idea that society learns from one another through online connection (Betsy Duke, Ginger Harper, 2013). According to this theory, learners learn diverse opinions and knowledge through personal networks. Digital skills, communication skills, responsibility, and a positive attitude are essential to realize this kind of teaching and learning.

In addition, Kalman (2019) pointed out that short training like e-learning and teaching is helpful for teachers' professional development. Baimuldina et al. (2019) have also added that smart technology is essential for teachers' professional development as it helps them create educational materials and promote ICT skills. ICT Skilful teachers can design the best and most relevant content and deliver it with quality when they are required to do so. Teachers can solve their teaching and learning problems through discussion and research when their online experience and communication improve. Besides, teachers would develop communication skills and interpersonal relationships through online networks.

Similarly, Hénard (2010), found that digital technology has improved the interaction between students, teachers, and the pedagogy. Samar Hassan (2016) on his hands, mentioned the purpose of flexibility to adopt modern learning technologies to realize quality education.

To sum up, as digital skills are important skills of the 21st century, competency to maintain competitiveness in this industrial revolution (Pacher & Woschank, 2020), through the design and inclusion of educational programs that aimed at the extensive use of digital

technology and the internet (Astratova et al., 2021), as well as the integration of IT for quality teaching Aytaged (2012) are needed to be considered by higher education institutions.

### *2.1.2 Improving Quality Education Through Digital Resource Accessibility and Internationalization*

The implementation of digitalization in teaching and learning of higher education is vital not only to respond to unforeseen problems like Covid-19 but also to meet the demands of this digital age. Integrating ICT in higher education helps to create a network of people around the globe. A study found that digitalization enhances students' relationships, future job search, and employment opportunities (Benedek & Molnár, 2015; Uğur, 2020). Therefore, developing innovative, relevant, and attractive educational content; Implementing innovative information and communication technology, and promoting academic mobilities are essential (Djakona et al., 2021). As Digital technology allows for online storage, retrieval, and use of information and knowledge, learners tend to share their thoughts, and understanding, and learn from each other. There is interdependence, collaboration, cooperation, and global experts' inputs on specific fields of study.

As a study indicates, students are interested and get used to digital technology through online course attendance (Benedek & Molnár, 2015; Uğur, 2020). Based on these scholars' findings, students of this generation are familiar with at least some online platforms and use their phones if not personal computers.

According to the European Union's experience, there is an increased interest in driving Educational Institutions in Europe toward the effective use of technology and innovation. The intention behind this is that it facilitates the students' self-paced learning, the development, and organization of learning content by teachers and students as well as to access them from wherever they are (European Council, 2012). These witnesses how HEIs, which had the digital teaching and learning system managed the educational crisis during the Covid-19 time. According to the OECD (2020), many Countries had planned for an emergency to slow the spread since the first coronavirus outbreak to continue their regular activities.

A large-scale study conducted in about sixty-two (62) countries indicated students' satisfaction with the online shift of teaching and learning as the support provided by universities and teaching staff comforted them (Aristovnik et al., 2020). The availability of the best educational content from experienced teachers around the globe (Frolova et al., 2020) is another opportunity that helps learners get quality education which in turn helps them to compare different sources of knowledge.

From the studies, it is possible to understand that digitalizing the higher education system helps to pool and store educational resources from various experienced and qualified

people online and make it accessible for the needy person wherever they are and whenever they want most probably at a lower cost.

### 2.2 Digital Technology at Ethiopian Higher Education

When writing about digitalization from the Ethiopian higher education context, it is good to raise the situation during the pandemic. Because it was when the higher education institutions saw their capabilities and deficiencies of digitalization. Ethiopian higher education institutions experienced the lockdown in April 2020. The situation was difficult for them compared to other countries, having sufficient facilities, internet connections, and expertise to respond to the educational crisis. The case has posed a serious condition that ranges from school closure to collapse in schedule, and it created inequality among bachelor students, masters, and PhD students. For Instance, the bachelor students couldn't continue their second semester in the 2019/20 academic year. They couldn't attend online because some students cannot afford smartphones and internet connections on top of the universities' readiness (Reinders, 2020).

Although there is a promising movement in using ICT to prepare Ethiopian citizens for a knowledge-based economy, there are still poor infrastructure and trained professionals (Yigezu, 2021). Moges Alemu (2017) has also argued that lack of proficiency in ICT, in the ability to facilitate consistent and quality training for teachers by public funds as the programs are expensive, are some of the challenges that are the bottlenecks to digitalizing the teaching and learning system.

For instance, according to a study conducted in about six universities in Ethiopia, software applications are poor (Adamu, 2019). Different departments are not supported with useful software to provide standardized services. Similarly, teachers' and students' competence in ICT, the availability and functioning of the internet, the classroom infrastructure, management support, and the nature of the course are the determinants of using ICT for teaching and learning in Ethiopian HEIs (Ferede et al., 2021). ICT is used only for facilitating teaching and learning, but not as an independent and transformative way of integrating ICT into teaching and learning (Ferede et al., 2022). However, COVID-19 has created an opportunity (Tamrat & Teferra, 2020) for higher education to look at their practice of digitalizing the system and plan to work on it. The current Ethiopian government's plan to begin online education is also a good starting point that would lay the ground for a robust digitalization system (MOE, 2018).

To sum up, the integration of digital technologies in Ethiopian higher education is at its infant age. The reasons that many researchers have raised for the underdevelopment of the system are poor internet connectivity, infrastructure, poor ICT competency, lack of management support, and financial constraints (Adamu, 2019; Aytaged, 2012; Ferede et al., 2021; Tadesse et al., 2018; Yigezu, 2021; Alemu, 2017).

However, some promising initiatives and developments are planned to integrate digital technology to transform the education system in general and higher education in particular. The e-SHE (MOE, 2023), which aims at e-learning to support higher education, and the D-TEST (Digital Technology for Education Sector Transformation) are among the projects and platforms that show the Ministry's commitment to digitalize the system which in turn helps to impact the quality of education.

### 2.3 Challenges of Integrating Digital Technology into Higher Education

The current technology and digital system of information storage and sharing face the possibility of every individual publishing online, and the probability of less quality and cheap information found online (Moser, 2016). Only people who are critical thinkers and who can question and evaluate online information and resources would be able to go for reliable data and information.

Teachers and students' perceptions of ICT use in teaching and learning (Ergado et al., 2022), the weak culture of ICT use, and the lack of change management (Ergado et al., 2021) are among the challenges of integrating digital technology in HEIs teaching and learning.

A study found teachers' positive perceptions toward integrating ICT if there is an encouraging environment (Gebremedhin & Fenta, 2015). Supporting this idea Balić et al. (2024) stated that students perceive the flexibility and time-saving nature of the digital learning system, even though some students raise the low human interaction accorded by online teaching and learning.

Many researchers have stated their findings related to the challenges of integrating ICT into higher education teaching and learning. Teachers digital literacy and ICT competence (Baimuldina et al., 2019), lack of material and financial resources for the creation of the ICT infrastructure (Frolova et al., 2020), lack of training, competency, lack of technical support (Ghavifekr et al., 2016), Digital readiness gap among different departments and gender (Balić et al., 2024), students ICT competence, management support (Ferede et al., 2023), technological, organizational and environmental factors (Ergado et al., 2021), teachers and students ICT skills and negative perceptions of ICT use (Ergado et al., 2022), limited ICT adoption, ICT infrastructure and professional development (Asabere & Ahmed, 2013) and limited access to ICT apparatus (Naqvi, 2018) are happen to be the most challenging issues to integrate or implement digital technology to enhance the quality of higher education teaching and learning.

Generally, the literature revealed both the advantages and obstacles of applying digital technologies in higher education institutions teaching and learning. It is inescapable to digitalize teaching and learning at this time when HEIs are influenced by many digital systems including Artificial Intelligence. Therefore, it seems important to consider the challenges thereby boosting the competencies of the leadership and academics in ICT and

other digital technology systems. If HEIs are not open to considering the timely digital system in their education, their teaching and learning might not be of the required quality, graduates might not be competent enough in the current world of work.

## 3. Methodology

### 3.1. Research Strategy

This study deployed a quantitative method. A review of related literature was done to understand the status of the digitalization system at higher education in different countries and contexts and to construct the theoretical basis. The digitalization case in Ethiopia then focused only on two universities. The data was part of the data collected for a dissertation done on quality teaching and learning at Ethiopian higher education institutions. Accordingly, only related questions were picked and analyzed to realize this objective.

A questionnaire was used to collect quantitative data from the university teachers. It was used to reach a large population size. Besides this, questionnaires enable us to collect information respondents do not want to provide through interviews. It was organized focusing on beliefs of quality based on inputs (for example, 'quality teaching depends on universities', 'quality teaching and learning is determined by teachers' professional development', and many more questions), based on process (for instance, 'quality teaching and learning depends on effective management support', 'quality teaching and learning depends on aligning outcome, learning experiences and assessment', and other questions), based on output (for example, quality teaching and learning depends on students' independent learning, quality teaching, and learning is indicated by the graduates' competences and other questions) that are rated on the scale ranges from 1-5 where 1 is for strongly disagree and 5 is for strongly agree.

Finally, the quantitative data from the questionnaire was analyzed using Jamovi. Statistical methods including descriptive and inferential were computed. Therefore, the mean, standard deviation, frequency, percentage, T-test, ANOVA, Factor analysis, and linear regression were employed.

### *3.*2. Population and Sample

The population is teachers of two universities comprising 937 of which 188 (M=170 and F=18) samples were taken. The original plan was to choose the universities in the country randomly. However, due to the political instability and COVID-19 influences, the research design and sampling methods were changed. As a result, the study was focused on the case of two Ethiopian universities. Even though simple random sampling based on the stratification of the departments was planned, it was changed to a convenient sampling

method for the above reasons. The characteristics of the sample are summarized in Table 1 below.

**Table 5. Background information on the sample**

| Background variables | | Number of respondents (%) |
|---|---|---|
| **Gender** | | |
| | Male | 170 (90,4%) |
| | Female | 18 (9,6%) |
| | Total | 188 (100%) |
| **Qualification** | | |
| | BA/BSc | 7 (3,7%) |
| | MA/MSc | 159 (84,6%) |
| | PhD | 22 (11,7%) |
| | Total | 188 (100%) |
| **Years of service** | | |
| | less than 5 years | 53 (28,2%) |
| | 5-10 years | 75 (39,9%) |
| | 10-20 years | 49 (26,1%) |
| | more than 20 years | 11 (5,9%) |
| | Total | 188 (100%) |
| **Disciplinary background** | | |
| | Natural sciences | 49 (26,1%) |
| | Social sciences | 86 (45,7%) |
| | IT | 19 (10,1%) |
| | Health | 34 (18,1%) |
| | Total | 188 (100%) |
| **University-type** | | |
| | Comprehensive | 98 (52,1%) |
| | Applied | 90 (47,9%) |
| | Total | 188 (100%) |

As depicted in Table 1 the gap between female staff (9.6%) and male staff (90.4%) is big. Regarding their qualification, only 11.4% of the academics were PhD holders and a significant percentage (84.6%) were Masters' degree holders.

## 4. Results

*4.1 How do university academics perceive the implementation of digital technology as an element of quality teaching and learning?*

Descriptive statistics were done to summarize teachers' views on the digital technology application for quality teaching and learning in higher education.

The descriptive result depicts that most university teachers agreed (87,23%) that technology-assisted teaching and learning is an element of quality teaching and learning. The following diagram shows the percentage of their responses to the level of agreement.

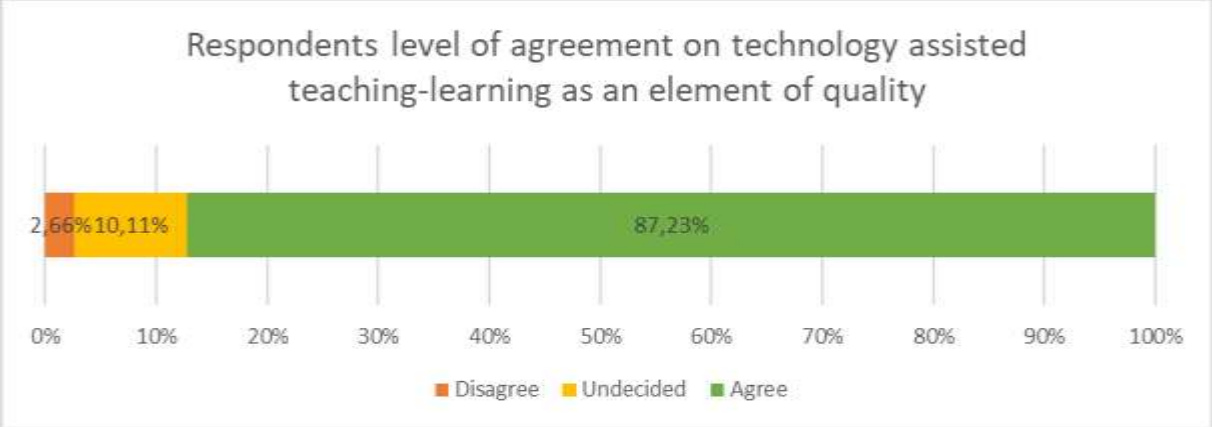


**Figure 4.** Respondents' level of agreement with the statement "Quality teaching is achieved when technological products are used to support students learning".

This result is like some previous research findings conducted in different contexts. For instance, Dneprovskaya et al. (2018) argue that implementation of ICT lays the ground for smart education. Hénard (2010) has also added that digital technology improves the interaction between students and teachers.

Statistical analysis was done to see if university teachers' perceptions depend on their background variables. Since the dependent variable is not normally distributed (Kolmogorov-Smirnov test $p < .001$), the non-parametric Mann-Whitney U-test was used for independent samples t-test, and the non-parametric Kruskal-Wallis test for the analysis of variance. First, we explore differences related to gender and university type (Table 2).

**Table 6.** Differences in teachers' perception of technology-assisted teaching and learning in the quality of teaching and learning according to background variables.

| Background variables | M (SD) | Test results (Mann-Whitney U) |
|---|---|---|
| **Gender** | | |
| ***Male (N=170)*** | 4.19 (0.722) | U=1204; p=.102 |
| ***Female (N=18)*** | 4.44 (0.784) | |
| **University-type** | | |
| ***Applied (N=90)*** | 4.27 (0.716) | U=4097; p=.355 |
| ***Comprehensive (N=98)*** | 4.16 (0.742) | |

As the result of the Mann-Whitney test shows, there were no significant differences between female and male respondents, nor between university types regarding their understanding of digital technology as an element of quality.

Similarly, a non-parametric test was run to see if there are significant differences among teachers' respondents' beliefs of digital technology implementation based on their service years, specialization areas, and qualifications. The following table (Table 3) summarizes the results.

**Table 7.** Comparison of teachers' beliefs of tech-based teaching and learning based on their departments, qualifications, and service years.

| Background variable | M (SD) | Test results (Kruskal-Wallis) |
|---|---|---|
| **Disciplinary background** | | |
| *Natural sciences (N=49)* | 4.43 (0.677) | $\chi^2(3) = 8.91$; p=.031while the Kruskal-Wallis's test is significant, the Dwass-Steel-Critchlow-Fligner pairwise comparisons showed nonsignificant differences between pairs. |
| *Social sciences (N=86)* | 4.15 (0.695) | |
| *IT (N=19)* | 4.32 (0.749) | |
| *Health (N=34)* | 4.00 (0.816) | |
| **Qualifications** | | |
| *BA/BSc (N=7)* | 3.86 (0.378) | $\chi^2(2) = 4.64$; p=.098 |
| *MA/MSc (N=159)* | 4.26 (0.698) | |
| *PhD (N=22)* | 3.95 (0.950) | |
| **Years of service** | | |
| *less than five (5) years (N=53)* | 4.00 (0.707) | $\chi^2(3) = 9.41$; p=.024 The Dwass-Steel-Critchlow-Fligner pairwise comparisons showed significant differences between "less than five (5) years" and "5-10 years" (W=3.895; p=.030) |
| *5-10 years (N=75)* | 4.33 (0.622) | |
| *10-20 years (N=49)* | 4.18 (0.882) | |
| *more than 20 years (N=11)* | 4.55 (0.522) | |

The output indicates that teachers' qualifications and fields of study did not make a difference. However, a significant difference ($\chi^2(3) = 9.41$; p=.024) existed among teachers of different service years experiences. The Dwass-Steel-Critchlow-Fligner pairwise comparisons showed significant differences between those teachers with "less than five (5) years" and "5-10 years" of service years (W=3.895; p=.030). Teachers of less than 5 years of experience are probably less experienced in teaching in higher education and thus the groups have different perceptions.

*4.2. Do educational inputs, processes, and outputs impact the implementation of digital technology in teaching and learning at universities?*

Input, process, and output variables have been put into principal component analysis (PCA) to answer this question. Linear regression analysis has been conducted based on the components extracted from the PCA based on digital technology to improve the quality of teaching and learning in higher education.

First, we present the results of the PCA. Initially, we dropped items with low communality values until we arrived at a solution where all the items produced an acceptable level of communality (< 0.4). We checked the Kaiser-Mayer-Olkin measure of sample adequacy (0.736) and Bartlett's test of sphericity ($p < .001$). The preliminary test indicates that it is possible to proceed with the interpretation of the results. Based on the parallel analysis extraction method with a Promax rotation, the results offered two (2) components, explaining 30.8% of the total variance of the 18 items. The following table shows the component structure and loadings of the items.

**Table 8**. Results of the PCA.

| Items | PCA1 – Input- and process-oriented beliefs of quality | PCA2 – Output-oriented beliefs of quality |
|---|---|---|
| Teachers' pedagogical knowledge determines the quality of teaching and learning | 0.609 | |
| Engagement in research and innovation can lead to quality teaching-learning | 0.603 | |
| Quality teaching depends on teachers' qualifications | 0.586 | |
| Students' motivation contributes to quality teaching and learning | 0.586 | |
| Quality teaching-learning depends on aligning learning activities, assessments, and learning outcomes | 0.566 | |
| Quality teaching depends on teachers' lesson plan | 0.551 | |
| Support of the university management determines the quality of teaching and learning | 0.541 | |
| Quality teaching is about having a relevant curriculum to | 0.463 | |

| | | |
|---|---|---|
| the needs of the society and country | | |
| Quality teaching and learning is employing active learning/student-centred learning methods | 0.458 | |
| The quality of teaching and learning realized when supported by technological products | 0.447 | |
| Rules and Regulations of HE are the main determinants of quality teaching-learning | 0.432 | |
| Quality teaching and learning depend on teachers' ongoing professional development and learning | 0.427 | |
| The learning outcomes and competencies students achieved (Competence test results or exit exam) can tell the quality of teaching and learning. | | 0.694 |
| Fulfilling stakeholders' (teachers, students) expectations is the indicator of the university's quality | | 0.633 |
| Graduates' employment describes the quality of teaching and learning | | 0.585 |
| Students independent learning indicates the quality of teaching-learning the university provide | | 0.582 |
| Quality teaching and learning is employing active learning/student-centred learning methods | | 0.479 |
| The number of high achievers determines the quality of teaching provided by the university | | 0.363 |

The first component describes input- and process-related beliefs regarding the quality of teaching and learning (ex. Teachers pedagogical knowledge, engagement in research and

innovation, teachers' qualifications, and others.), The second component focuses on output-related factors (ex. The learning outcomes, stakeholders' expectations, graduate employment rates, etc.). We have computed the average ratings of the corresponding items for each component. Respondents rated input- and process-related factors significantly higher than output-related factors. Since the two variables have failed to meet a normal distribution (Shapiro-Wilk test p<.001), a non-parametric Wilcoxon signed-rank test was used (W=11821; p<.001), indicating a significant difference between the ratings of input- and process-related factors (M=4.16; SD=0.415) and output-related factors (M=3.79; SD=0.509). The two measures are not correlated (p=.189).

Linear regression has been conducted to see whether input- and process- or output-related factors can explain teachers' beliefs regarding the role of technology in improving the quality of teaching and learning. The last section of the questionnaire explored participants' beliefs regarding how influential different elements can be in enhancing quality teaching and learning (ex. “Focusing on the technology-based teaching-learning”) rated on a 1-5 scale (1 – very low, 5 – very high). We used this variable as a dependent variable and predicted this with our previously created components. The prerequisites of the linear regression were tested (normality: Kolmogorov-Smirnov test p=.196; heteroskedasticity: Breusch-Pagan test p=.106; autocorrelation: Durbin-Watson test p=.448; collinearity statistics: VIF=1.01 for both variables). The two components explain 20.9% of the variance in the dependent variable (F (2, 185) =25.7; p<.001). The results are presented in Table 5 below.

**Table 9**. Results of the regression analysis (Dependent variable: Influence of focusing on technology-based teaching-learning on quality of teaching and learning).

| | **Estimate (B)** | **Test results** | **Standardized estimate (ß)** |
|---|---|---|---|
| **Intercept** | -0.277 | t=-0.435; p=.644 | |
| **PCA1 – Input- and process-oriented beliefs** | 0.777 | t=6.042; p<.001 | 0.395<br>95% CI [0.266; 0.524] |
| **PCA2 – Output-oriented beliefs** | 0.342 | t=3.258; p=.001 | 0.213<br>95% CI [0.084; 0.342] |

Based on the regression result, the coefficient has been analyzed to identify the impact of independent variables. Input- and process-oriented beliefs have nearly two times stronger impact (ß=0.395) than output-oriented beliefs (ß=0.213) on respondents' perception regarding the influence of focusing on technology-based teaching-learning on the quality of teaching and learning.

This result has some similarities with other researchers' findings. Ferede et al. (2021, 2022) pointed out that inputs and processes like ICT competencies, ICT plans, management support, ICT infrastructure, and professional development are the determinants of integrating ICT into teaching and learning understanding. Moges Alemu (2017) has also mentioned a lack of relevant preparation and low proficiency in ICT as impediments to applying ICT in teaching and learning. Even though the inputs, process, and output in the current study are many and make the findings new compared to these previous findings, they coincide on the side of professional development.

## 5. Discussions, Conclusions, and Recommendations

### Discussions

Even though the Ethiopian Ministry of Education is planning to reach a 0:30:70 ratio of BA/BSC, MA/MSc, and PhD holders respectively until 2030 (MOE, 2018), the current situation might warn the higher education institutions to work on it. As academics' education level elevated it would contribute to the quality of their work.

Teachers have agreed on the tech-assisted teaching and learning for quality. This result is like some findings (see Dneprovskaya et al. 2018, Henard, 2010).

Inputs and processes were more impactful on tech-assisted teaching and learning than the output factors. The input-process elements would probably be the main contributors and accelerators of digital teaching and learning for quality. Because the facilities are mandatory as inputs, and academics' digital competencies, leadership support, and other processes are also important to digitalize the teaching and learning in HEIs. Outputs would be the results and with quality inputs and processes they are more likely to be achieved.

### Conclusions

Generally, the results of university teachers regarding their beliefs on the digital technology implementation as a quality teaching and learning element were positive and strong as they agreed with it. The result is like other researchers' findings like Moges Alemu's (2017) "ICT improves the quality of teaching"; Dneprovskaya et al. (2018) "ICT lays the ground for quality"; and Hénard (2010) "ICT improves the interaction between students and teachers." The respondents' beliefs differ based on their service years. However, gender, fields of study, university type, and qualifications did not make a difference.

On the other hand, the influence of other educational inputs and processes on digital technology implementation was almost two times stronger than the output factors. The result has become like other researchers' findings. Ferede et al. (2021, 2022) found that ICT infrastructure, management and technical support, ICT competence, and ICT plan; Moges Alemu (2017) found that lack of relevant preparation to impact and be determinants of ICT use in higher education instruction.

**Recommendations**

Hence, higher education institutions should build their capacity to digitalize their educational system, equip their learning environment with new technology infrastructures, and look for all possible ways to achieve their main mission of providing quality teaching and learning. The staff's professional development needs considerable attention as well. Collaboration with respective stakeholders like Ethio Telecom, the Ministry of Education, and other NGOs is essential to realize this.

## 6. Limitations and Future Directions

In this study, the sample selection process had some difficulties since some universities were not accessible due to obstacles that arose from the Country's political instability and COVID-19 by the time the data was collected. The plan to choose universities and samples randomly was not successful. Therefore, the study could not select representatives from all universities. Schedule changes in the universities were another challenge to reach the staff members. Hence, the result has limited generalizability.

As HEIs are in the digital age, they are influenced by AI and many digital systems. For instance, research results indicate there is an increase in innovative HEIs that adopt new technologies (Aruleba, Jere, & Matarirano, 2022). There is an interest in blended teaching and learning as a pedagogical strategy for the future (KARATAŞ AYDIN, 2023). Students are assisted with different kinds of assignments with AI and the learning and teaching can be supported by AI (Singh & Hiran, 2022). Hence, digital technologies play an immense role in teaching and learning. Therefore, researchers might conduct similar research in different settings. A large-scale study would contribute a lot to this field.

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