In-service teachers' readiness to adopt technology-enhanced pedagogy in a Sub-Saharan country

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ABSTRACT

This study was conducted among in-service teachers working in secondary schools in Uganda before the COVID-19 lockdown in 2020. The purpose of the study was to explore the technological competencies of in-service teachers to use technology-enhanced pedagogy in the implementation of secondary school curricula in Uganda. Using a cross-sectional survey and self-administered questionnaire, data were collected from a sample of 349 respondents. Collected data were entered into the SPSS 21 software program. We then used descriptive statistics of frequency counts and mean scores to conduct analyses of the responses to each question on the questionnaire. The findings revealed that 40.4% of participants had limited access to digital learning resources, 48.1% lacked the confidence to use digital pedagogies, 83.7% needed intensive professional development in the use of digital pedagogies and 59.7% had barely used technology-enhanced pedagogy. This study concluded that most of the in-service teachers were less skilled in the use of technology-enhanced pedagogies. The study recommended that teacher education institutions roll out professional development programs in online facilitation for in-service teachers.

Keywords: *In-service teachers; secondary schools; blended learning; technology-enhanced pedagogy.*

INTRODUCTION

In-service teacher education is designed for manpower development of the education system. If teachers are to perform their functions effectively and efficiently, it becomes imperative for them to access training in new skills and modern methodology. In-service teacher education can be defined as the relevant courses and activities in which serving teachers may participate to upgrade their professional knowledge, skills, and competence in the teaching profession (Osamwonyi, 2016). Therefore, it encompasses all forms of education and training for teachers who are already on the job in the teaching and learning environment. According to Shulman (1987) teacher competency refers to the ability to demonstrate Pedagogical and Content Knowledge (PCK) mastery. With the surge of technology in every sector including education in general and teaching and learning in particular, Koehler & Mishra (2009) expanded Shulman's (1986) model by including technology, hence the rise of the Technological Pedagogical and Content Knowledge (TPACK) framework. To Koehler & Mishra (2009), the interaction of technology, pedagogy and contents, in theory and in practice, produces the types of flexible knowledge every teacher needed to meaningfully integrate technology in the practice of teaching and learning. Inclusion of technology in teaching and learning has thus taken on different terminologies including e-learning, blended learning, online learning, virtual learning, and technology enhanced pedagogy. In this paper we use technology-enhanced pedagogy which is a term often used in discussions about the place and role of technology in teaching and learning. The term technology-enhanced pedagogy is used to describe the application of technology to teaching and learning. Pedagogy refers to principles and practices guiding instructional action with a goal to support learning (Bishop et al., 2020). Recognizing that technology is a strategic tool, encourages teachers to deliberately align technology with underlying pedagogical strategies. Every advancement in technology has had a corresponding impact on pedagogy and the methodologies therein. Both hardware and software technologies have evolved

over time from the earliest times of teaching machines, radios, televisions, films, computers to Internet and multimedia including video conferencing, touch screen and virtual collaboration technologies (Daniela, 2021). The COVID-19 pandemic accelerated the adoption and usage of technology in pedagogy. By April 2020, over 185 countries had closed learning institutions, affecting approximately 89.4% of all enrolled students (Monova-Zheleva, Zhelev & Nikolova, 2021). Likewise, in Uganda, all schools were locked down on 20th March 2020 because of the COVID-19 pandemic. School closure in Uganda left 36,314 primary and 5,705 secondary schools unable to physically meet their learners (UBOS, 2019 in MoES, 2021). Consequently, a total of 10,777,846 primary school students and 1,986,362 secondary pupils alongside 460,646 teachers were unable to conduct face-to-face learning in schools (UBOS, 2019 in MoES, 2021).

Initially, in Uganda, the lockdown of schools was expected to last for no more than 32 calendar days. However, as time went by, the lockdown was extended to January 2022 with partial openings for candidate classes. However, arrangements were put in place to continue with learning amidst school closures. In this regard, the government of Uganda reached out to primary and secondary school learners through radio and television-delivered lessons using study materials developed by the National Curriculum Development Centre (NCDC). Even though the radio and television broadcast mode of instructional delivery has had the potential to benefit a wider audience, educationists and citizens were not convinced. Negative voices echoing poor networks and coverage of these media have persistently been cited. In addition, there have been debates about the limited interactivity of radio/television-based lessons with learners. This was further exacerbated by the lowering of the morale of students to attend these lessons.

In addition to national-based interventions by the government to reach out to learners through radio and television, individual affluent schools ventured into online teaching by exploring pedagogical uses of WhatsApp, ZOOM, Big Blue button, and Google meetings to reach out to their learners. Whereas this option brought on board a sizable number of students for individual schools, it was hit by teachers limited technological pedagogical competencies to facilitate online learning. It is against such a background that this study was undertaken to explore the technological competencies of in-service teachers to use technology-enhanced pedagogy in the implementation of the secondary school curricula in Uganda. This study was undertaken to:

1) Examine in–service teachers' access to technology-enhanced pedagogical resources.
2) Assess in-service teachers' confidence in the use of technology-enhanced pedagogy.
3) Analyse in-service teachers' professional development needs in the use of technology enhanced pedagogy, and
4) Assess the extent to which in–service teachers use technology enhanced pedagogical tools.

To obtain data to meet these study objectives, we adapted instruments from Doculan (2016) and The William and Ida Friday Institute for Educational Innovation (n.d). that were reviewed and approved by two curriculum and education technology experts at Makerere University. In addition, we collected data from 99 schools from the Central, Eastern, Western and Northern regions of Uganda.

LITERATURE REVIEW

The emergence of COVID-19 has led to both positive and negative consequences in the provision of education worldwide. According to Garg, Aggarwal, Upadhyay, Kumar & Singh (2020), the positive effects of COVID-19 are a move towards blended learning, improved digital literacy, an increase in the use of learning management systems, soft copying of learning materials and increased demand for open and distance learning. Therefore, the global lockdown of schools due to COVID-19 has accelerated the need for teachers to adopt the use of existing technologies to

reach out to their learners. We are living at a time where teachers are no longer challenged by what to teach and how to teach it but by how one can successfully use available technologies to reach out to his or her learners. Whereas it is important to bear in mind pedagogical content knowledge (PCK) to determine "what to teach, how to represent it, how to question students about it, and how to deal with the problem of misunderstanding?" (Shulman, 1986 p. 8), we need to reflect on how to use available technologies to meet the digital needs of our digital learners (Koehler & Mishra, 2009). Since 2000, the world has been experiencing the fourth industrial revolution (4IR), characterized by computer-generated products such as 3D printing technology, intelligent agents, worldwide connected classrooms, and learning that infuse all facets of a student's life within and outside the classroom (Byabazaire, Walters & Sailin, 2020). Despite the two-decade-long existence of the 4IR, it has failed to reach great coverage, especially in the least developed economies of the world, such as Uganda.

However, we are experiencing the wide-scale impact of the 4IR due to the COVID-19 emergency that created several challenges for schools, leading to their quick adoption of technology-enhanced learning (TEL) to reach out to their learners and remain competitive and relevant (Monova-Zheleva, Zhelev & Nikolova, 2021). It is thus urgent that teachers, regardless of the grade they teach, revisit their knowledge, attitudes, and skills to conduct technology enhanced pedagogy. As previously stated, the change in attitude is a reactionary measure to unprecedented times that have seen the homes of teachers and learners turn into classrooms to reach out to one another through available technological media (Önalan & Kurt, 2020). However, even then, education practitioners need to accept the changes that they have encountered and acquire relevant skills and knowledge for the competitive environment they are to continuously work in during and after the COVID-19 pandemic (Byabazaire et al., 2020). Henceforth, Önalan & Kurt (2020), Handrianto, Jusoh, Goh & Rashid (2021), Srivastava & Dey (2018), and Sonia (2017) urge teachers to be partners with students they teach by embracing professionalism and pedagogical knowledge to design instructional materials that facilitate online learning. The popularity of TPACK transcends decades. Its relevance continues to inform contemporary use of ICT in modern classrooms. Literature underpins various assumptions such as a higher level of technology, but knowledge does not guarantee integration in pedagogy (Kadıoğlu-Akbulut et al., 2023). Indeed, expertise in technology alone does not cascade into meaningful ICT integration in pedagogy. Likewise, pedagogical and content mastery as advocated by Shulman (1987) does not significantly influence adoption and integration of ICT in pedagogy. This means that, independent of teachers' specific subjects, their pedagogical prowess in their respective subjects and technology literacy levels without meaningful continuous professional development, creates an intersection of how to use subject content delivery (TPACK), and integration shall remain on paper but not in practice. Unfortunately, whereas there is a global urge to embrace TPACK, the extent to which in-service teachers in Uganda have access to the necessary digital technologies and whether they have the relevant competencies to facilitate online learning remains unclear. Hence, a need to conduct this study with subsequent discoveries of the nature of professional development they need, to become ardent users of Technology Enhanced Learning during and after the lockdown of schools.

METHODOLOGY

Setting

The researchers collected data for this study between July and August 2020. During this period, the COVID-19 pandemic outbreak increased. There were many restrictions on travel and gatherings of people. It was not possible to reach out to most of the teachers at their workplace, and meetings had been banned. Hence, it was not possible to conduct focus group discussions. Consequently, to collect data, the researchers used self-administered questionnaires (SAQs) that were carefully distributed to accessible teachers who were working with 99 secondary schools

before the lockdown of schools in March 2020. In the following section, we discuss details concerning participants, data collection tools, process, analysis, and ethical considerations.

Participants

The study population consisted of 114,859 in-service secondary school teachers in Uganda. Among these, 349 teachers were purposely selected to participate in this study from 99 schools. The 99 schools were from Eastern (06), Central (38), Northern (50), and Western (05) areas of Uganda. Among these participants, 64.6% were male and 35.4% were female. In terms of qualifications, most of the participants in the study had obtained at least a bachelor's degree in education (67%), followed by those with a Diploma in Education (16.8%), a Master degree (9.5%), a Postgraduate Diploma in Education (4.7) and those with other qualifications at 1.8%. Regarding the number of years' participants had worked as teachers, most of the participants had served between 0 – 5 years (30.1%), followed by those between 6 – 10 years (26.2%), then 11 – 15 years (19%), 16 – 20 years (12.7%) and above twenty years (12%). Looking at the number of years of service in the teaching profession, these participants were well distributed to offer us relevant information on their TPCK competencies urgently needed in this study for the continuity of learning during and after the lockdown.

In addition, most of the participants in the study were less than 40 years of age. Considering the current retirement age in Uganda, these participants have more than 20 years of active teaching. Therefore, innovations proposed by this study are important in practice now and in the future. Further, participants in the study held different portfolios in the schools they were teaching in before the lockdown. The majority were classroom teachers (36.7%) without any academic leadership responsibilities in the schools. These were followed by heads of departments (26%) and class teachers (25.4%). Overall, 11% of the participants were school administrators holding portfolios of deans/directors of studies, deputy head teachers, and head teachers. Therefore, the scaffolding of this professional development course can easily be realized. School administrators and heads of departments will be able to see its absorption in their respective schools.

Finally, participants were teaching the following subjects: Art and Design, Biology, Physical Education, Chemistry, Commerce, Entrepreneurship, English Language, Literature in English, Foods and Nutrition, Technical Drawing, ICT, Geography, Economics, CRE/IRE, Luganda, Kiswahili, General Paper, Agriculture, Mathematics and Physics. Therefore, the entire formal secondary school curriculum was sampled. The TPK competencies of teachers in all the subjects taught at secondary school were examined during the needs' assessment survey.

Data Collection Instruments

Data were collected using adapted instruments from Doculan (2016) and The William and Ida Friday Institute for Educational Innovation (n.d). Specifically, Doculan's (2016) instrument was adapted to collect data from in-service teachers about their access to digital technologies (20 close-ended questions) and confidence in the use of digital technologies (29 close-ended questions). William and Ida Friday Institute for Educational Innovation (n.d.) was adapted to facilitate the collection of data on in-service teachers' digital professional development needs (17 close-ended questions) and the extent to which they blend their pedagogies (15 close-ended questions). The adapted instruments were reviewed and approved by two curriculum and education technology experts at Makerere University.

Data Collection Process

The study population was 114,859 in-service secondary school teachers (UBOS, 2019 in MoES, 2020). Using the confidence interval technique by Krejcie & Morgan (1970), the recommended

sample size for this study was 382. Unfortunately, due to the restrictions on travel, only 349 in-service teachers participated in this study. Researchers and research assistants participated in collecting data for this study. Self-administered questionnaires (SAQs) were issued to in-service secondary school teachers in Central, Northern, Eastern, and Western Uganda. To participate in this study, one was supposed to have had a running contract with a secondary school in Uganda by March 20, 2020. The use of the SAQ was adopted for this study because of its flexibility in gathering a large amount of data and ease of quantification after it is collected (Teeroovengadum, Heeraman & Jugurnath, 2017).

Data Analysis

After collecting data from the field, researchers checked the returned scripts for the accuracy of the filled instruments. Then, data were entered into the SPSS 21 software program. We then used descriptive statistics of frequency counts and mean scores to conduct analyses of the responses to each question on the questionnaire. The results of the analyses were consequently based on the study findings and are presented in the tables below.

Ethical Considerations

The study was physically and emotionally harmless to the human respondents; therefore, the researchers did not subject this study to clearance by existing research ethics committees in Uganda. In addition, this study was sanctioned by the Government of Uganda through the Makerere University Research and Innovations Fund. However, researchers conformed to basic research ethical practices of confidentiality, and anonymity of participants by hiding both names of participants and the schools they were working with prior to school lockdown, providing a full explanation of the purpose of this study and seeking written consent. Last, participants were at liberty to withdraw their participation from the study.

FINDINGS AND DISCUSSION

The key findings in this study are in line with the following: access to technology enhanced pedagogical resources, competence in using technology enhanced pedagogical resources, blending of technology enhanced pedagogical resources in in-service teachers' pedagogical practices, and in-service teachers' technology enhanced pedagogical professional development needs. A detailed presentation of the key findings is hereby offered below:

In-service Teachers' Access to Technology Enhanced Pedagogical Resources in Uganda

In this section, data are presented on seventeen variables that were adopted from Doculan (2016). These 17 variables were examined from 349 SAQs responses on the digital learning technologies that in-service teachers in Uganda had access to prior to and during the total lockdown. In collecting data on in-service teachers' access to digital learning resources, respondents were asked to state their opinions as either YES or NO. Those who indicated YES were informing the researchers that they accessed digital learning resources, and the reverse was true for those who selected NO. Specifically, the variables that were examined during the needs assessment are highlighted in Table 1 below:

The data in Table 1 shows that over 90% of in-service teachers in Uganda have access to working computers and smartphones. In the same vein, over 74% of practicing teachers in Uganda have access to storage devices, technical support and computers installed with the necessary software and search engines such as Internet Explorer. This is a good start to TEP, as teachers must be sensitized to the pedagogical uses of these devices in their day-to-day classroom practices. Equally, as the lockdown of most learners from schools continued, teachers could reach out to their

learners, and continue with the coverage of the curriculum while they awaited appropriate vaccines for COVID-19. Unfortunately, a small fraction (29.2%) of Uganda's student population locked out from school could access online learning from their homes. This is further worsened by many teachers (63.6%) not being able to access the Internet outside school premises. In addition to failure to access the Internet outside school premises, 67.2% and 66.5% of the teachers respectively who participated in this study had never used LMS' to teach and were teaching in schools without active websites. Therefore, it was not even possible to either carry on online pedagogy or deposit notes for learners to access from their homes. Thus, the continued lockdown was a disaster for their student population who could continue their education because of failure to access the Internet at home (70.8%) or were studying in schools that lacked active websites (66.5%) and being taught by teachers who have never taught online (67.2%).

Table 1: In-service Teachers' Access to Digital Learning Resources

Variable	Respondents	Frequency (%)	
		YES	NO
Working Computer	336	90.5	9.5
Computer Installed with necessary software	338	74.6	25.4
Computer Installed with a printer	339	67.7	32.3
Computer with Internet Connection at home	338	36.4	63.6
Computer with Internet Connection at school	338	69.5	30.5
Computer installed with search engines (ex. Explorer, Firefox, etc.)	336	75.0	25.0
Computer installed with up-to-date virus protection software	334	65.9	34.1
Possession of a personal smartphone	339	91.4	8.6
Access to a Scanner	338	49.1	50.1
Access to a digital camera	337	45.7	54.3
Access to LCD Projectors	338	50.3	49.7
Access to Storage Devices (ex. Flash drives)	339	79.6	20.4
Access to technical support in case of encountering problems	338	75.1	24.9
Teacher's students access online learning at home	331	29.2	70.8
Teacher's students access online learning at school	334	46.7	53.3
Teacher's school has an active website	322	33.5	66.5
Have ever used an LMS before	296	32.8	67.2

Source: Doculan (2016) and Field Data

The findings in this study are consistent with earlier studies, such as Byabazaire et al., (2020), who reported that over four billion people in developing countries lack access to digital education, and Sailin and Mahmor's (2018) report that most student teachers are apprehensive about their ability to integrate Web 2.0 in their future teaching due to the problem of limited Internet and technology access at schools. Hence, the emergence of COVID-19 has increased the divide between rural and urban areas or between different countries in the adoption of technology-enhanced pedagogies (Monova-Zheleva et al, 2021). If we are to overcome these dilemmas, there is a need to discuss, learn and share experiences in adapting learning activities to new learning situations to recover and thrive in the educational world after the pandemic (Monova-Zheleva et al, 2021).

In-service Teachers' Confidence and Skills in the Use of Digital Learning Resources

In this subsection, data are presented on 29 variables that were adopted from Doculan (2016). These 29 variables were examined from 349 SAQs administered to in-service teachers. Data were

collected about in-service teachers' technology skills and confidence considering basic computer skills, Internet or online skills, software productivity and training attended to enhance one's technology competencies. Participants were requested to state truthful opinions about their levels of confidence and skills or competencies. The variables were as follows: "Please give us your honest opinion by either ticking 1= Not at all true of me, 2=Very least extent, 3= Little extent, 4= Great extent, 5= very great extent with each statement." Therefore, respondents who chose 1, 2, and 3 were by implication reporting that they lack the necessary skills and confidence to utilize digital learning resources. Those who chose 4 and 5 were of the view that they are confident in the use of a given digital learning resource. Specifically, the variables that were examined during the needs assessment are highlighted in Tables 2, 3, 4 and 5 below.

Table 2: In-service Teachers' Confidence in Basic Computer Skills

Variable	Responses	Frequency (%)				
Basic computer skills		1	2	3	4	5
C1. I know how to open/save documents on storage devices.	335	4.2	5.7	15.8	26.0	48.4
C2. I am comfortable with things like installing software on my computer.	337	24.0	13.4	21.4	21.1	20.2
C3. I know how to resolve basic hardware or software problems	339	27.4	21.8	19.5	18.3	13.0
C4. I know how to use a scanner	337	25.2	15.4	21.1	20.5	17.8
C5. I know how to use a digital camera	337	16.9	11.6	21.4	32.0	18.1
C6. I am comfortable operating an LCD Projector	338	25.1	12.1	22.2	20.1	20.4
C7. I am comfortable with using a DVD player	336	4.8	6.0	11.0	34.2	44.0

Source: Doculan (2016) and Field Data

The data in Table 2 indicates that most of the in-service teachers surveyed in Uganda lack basic computer skills. The study findings indicate that 68.7% are not able to resolve basic hardware and software problems 61.7% do not use a scanner 59.5% are not comfortable operating a projector, while and 58.8% of the respondents are not comfortable installing software on their digital devices. Almost half of the teachers (49.9) are unable to use digital cameras. These findings indicate that there is a great challenge to the adoption of TEP in Uganda. It is not possible to adopt TEP in a teacher population that can hardly use scanners to scan learning resources, projectors to simulate, and digital cameras to capture both print and motion pictures necessary for holistic learning. Our study findings contradict earlier findings by Önalan & Kurt (2020), who indicated a high level of self-confidence in integrating computers into their teaching (scale mean score M=4.07) among Turkish EFL teachers.

***Table 3:** In-service Teachers' Confidence and Skills in the Use of Internet/ Online Resources*

Variable	Responses	Frequency (%)				
Internet/Online skills		1	2	3	4	5
C8. I have an email address.	333	3.3	2.4	4.2	23.1	67.0
C9. I can receive/send email messages including attachments	336	3.6	4.5	10.1	23.2	58.6
C10. I know how to search for materials from the internet	339	3.5	4.4	10.0	25.7	56.3
C11. I can ably use different web browsers (e.g., Internet Explorer, Google, Chrome, Mozilla Firefox)	339	5.3	5.9	13.9	28.6	46.3
C12. I know how to resolve common internet errors while surfing the internet.	338	13.3	15.7	22.2	29.9	18.9
C13. I can use multiple websites at the same time	334	23.4	18.6	20.1	18.9	19.2
C14. I know how to access an online library and other databases.	335	16.4	21.2	20.9	26.0	15.5
C15. I know how to use asynchronous tools (e.g., discussion boards, chat tools) effectively;	334	27.5	19.8	23.7	18.3	10.8
C16. I know how to use synchronous tools (e.g. Zoom, Skype, Google classroom) effectively	337	25.8	15.7	19.3	24.0	15.1

Source: Doculan (2016) and Field Data

While we note from the data in Table 1 that there is consistency in access to working computers (90.5%) or smartphones (91.4%) and possession of email addresses (90.1%) by the in-service teachers, there are inconsistencies in the skills of the teachers for use . As shown in Table 3 the possession of email addresses was not directly proportional to the possession of online/internet skills as 74.9% can comprehensively navigate through different web browsers, but only 38.1% can do so at the same time, while 81.8% can send and receive emails. Further, many of the in-service teachers lack appropriate Internet skills related to resolution of common Internet errors (51.2%), use multiple websites at the same time (62.1%), use synchronous tools (71%) or asynchronous tools (60.8%).

Table 4: In-service Teachers' Confidence in Software Productivity Skills

Variable	Responses	Frequency (%)				
Software productivity skills		1	2	3	4	5
C17. I can comfortably download and use PDF files.	338	7.4	9.2	13.9	26.9	42.6
C18. I am comfortable using Microsoft Word	335	4.2	7.8	14.3	26.0	47.7
C19. My typing speed is above 30 words per minute	337	6.5	16.6	25.5	30.9	20.5
C20. I know how to use file compression (WinZip, Rar, etc.)	335	33.7	17.6	20.3	17.3	11.0
C21. I know how to use a spreadsheet application (MS-Excel).	334	18.3	17.7	21.9	26.9	15.3
C22. I know how to use presentation software. (MS-PowerPoint)	335	20.0	14.3	18.5	26.3	20.9
C23. I know how to navigate through social media platforms (e.g., WhatsApp, Facebook, etc.)	334	6.6	6.6	11.1	31.4	44.3

Source: Doculan (2016) and Field Data

The data in Table 4 indicates that most of the in-service teachers are comfortable with the use of the commonly utilized TEP software programs. Namely, navigation of social media platforms (75.7%), Microsoft Word (73.7%), downloading and usage of PDFs (69.5%), and possession of an average typing speed of 30 words per minute (51.4%). On the other hand, most of the in-service teachers had inadequate software productivity skills related to file compression (71.7%), use of Microsoft Excel (57.8%), and Microsoft PowerPoint (52.8%). These findings were positively related to those of Önalan & Kurt's (2020) study exploring Turkish EFL teachers' perceptions of the factors affecting their technology integration. Önalan and Kurt's (2020) findings revealed that participants could use a certain group of software programs more proficiently than others. For example, teachers could use either the Internet very well or well with the highest mean score of 4.61, email (M= 4.51), presentation software (M= 4.50), and word processing (M= 4.28). They moderately knew how to use programs such as graphics and spreadsheets (M= 3.34 and M= 3.12, respectively) (Önalan & Kurt, 2020).

Table 5: *Technology Enhanced Pedagogical Training attended by In-service Teachers*

Variable	Responses	Frequency (%)				
Training		1	2	3	4	5
C24. I have ever attended training in computer packages (e.g., Microsoft word, excel, database, internet)	338	22.2	13.0	20.4	20.4	24.0
C25. I have attended training in the use of Learning Management Systems.	331	43.8	15.4	19.3	12.4	9.1
C26. I have ever attended training in the development of online materials	330	52.7	14.9	15.2	9.2	8.0
C27. I have ever attended training in online assessment	330	55.2	13.6	17.0	8.5	5.8
C28. I have ever been trained in the use of social media in teaching and learning (i.e Facebook, WhatsApp)	338	40.8	13.9	16.0	16.3	13.0
C29. I regularly attend seminars/workshops related to online teaching.	336	45.5	21.7	16.1	7.7	8.9

Source: Doculan (2016) and Field Data

The data in Table 5 shows that the largest percentage of the in-service teachers have never received training in the use of digital learning resources. 85.8% had never attended training in online assessment, 83.3%, never attended seminars or workshops in online pedagogy, 82.8% never attended training for the development of online materials, 78.5% on use of LMS, 70.7% on use of social media in pedagogy, and 55.6% on different computer packages such as Microsoft Word. Therefore, if there is to be successful adoption of TEP by in-service teachers in Uganda, appropriate professional development opportunities in the utilization of TEP should be put in place. These findings are contradictory to those of Mailizar et al., (2021), who reported that teachers in Indonesia participate in many online professional development activities throughout their careers to develop their content knowledge and pedagogical knowledge.

In-service Teachers' Professional Development Needs in the Use of Digital Learning Resources in Uganda

In this subsection, data are presented on 17 variables adopted from The William and Ida Friday Institute for Educational Innovation (n.d). These 17 variables were examined from 349 PAPI responses. Data were collected about in-service teachers' professional development needs to be able to use digital learning resources in their pedagogical practices. Participants were requested to state the extent to which they thought each of the highlighted professional development activities was important in their quest for skills needed to be able users of digital learning resources. That is, "For each item, tick in the box with the response that best matches how much you agree or disagrees with the statement: 1 = "Strongly Disagree," 2 = "Disagree," 3= "Agree," 4= "Strongly Agree," and 5= If you do not have enough information to form an opinion about the topic of an item,

select 5= "Do Not Know." Specifically, the variables on PD requirements for in-service teachers that were examined during the needs assessment are highlighted in Table 6 below:

Table 6: *Professional Development Opportunities*

Variables	Responses	Frequency (%)				
The skill of ….,		1	2	3	4	5
D1) Using online research-based practices	336	5.7	3.0	38.7	45.5	7.1
D2) Teaching using necessary e-learning materials	336	6.3	2.7	35.7	50.6	4.8
D3) Using any mobile technology in instructional delivery	336	3.6	6.3	32.1	53.6	5.5
D4) preparing e-exercises/and-quizzes	335	4.2	5.4	35.8	48.1	6.6
D5) Using technology to collect and analyse student assessment data.	336	4.5	5.7	35.7	48.5	5.7
D6) Using interactive tools and technology in instructional delivery (e.g., smartboards, Smartphones, Zoom)	336	3.9	5.1	34.5	50.3	6.3
D7) Using multimedia tools and technology in instructional delivery	335	4.5	6.0	39.1	44.8	5.7
D8) Using social media discussion tools.	334	4.5	7.5	36.8	45.5	5.7
D9) Using of technology for differentiating instruction for students with special learning needs.	333	5.1	6.3	36.6	40.5	11.4
D10) Using technology to increase professional productivity	337	2.7	1.2	35.6	52.8	7.7
D11) Preparation of e-learning teaching materials	336	3.0	4.2	38.4	47.3	7.1
D12) Using technology to communicate with others	336	2.7	2.7	36.6	52.4	6.0
D13) Developing e-learning teaching materials.	329	2.4	5.5	41.0	44.7	6.4
D14) Selecting appropriate e-learning teaching materials	336	2.7	4.5	40.8	44.6	7.4
D15) Using wireless technologies (phone, laptop....)	337	2.1	3.0	33.2	55.5	6.2
D16) Using any Learning Management system (LMS)	336	3.0	6.8	37.5	42.5	10.4
D17) Designing an internet blog for pedagogical use	335	5.7	11.0	33.1	37.3	12.8

Source: The William and Ida Friday Institute for Educational Innovation (n.d) and Field Data

The data in Table.6 presents the different professional development opportunities that in-service teachers expressed interest in participating in, to be able to adopt online and blended pedagogy. In their order of importance, the following professional development opportunities were suggested by in-service teachers: use of technology to communicate and collaborate (89%), use of wireless technology (88.7%), use of technology to promote professional productivity (88.4%), and how to teach while using e-learning teaching materials (86.3%). Furthermore, 85.7% of in-service teachers indicated that they need professional development opportunities that can help them prepare and develop e-learning materials as well as use mobile technologies in instructional delivery. Other professional development opportunities sought by teachers to enhance their TEP competencies are training in the selection of appropriate e-learning materials (85.4%), use of interactive media (84.8%), analysis of students' assessment data (84.2%), and online research-based practices (84.2%). In addition, 83.9% of in-service teachers are also in need of professional development opportunities in line with the preparation of e-assessments (e- quizzes/e - exercises) as well as the use of multimedia and technology in instructional delivery. Finally, 82.3% indicated training in the use of social media discussion tools, 80% in LMS use, 77.1% in differentiation of learning for special needs education and 70.4% of in-service teachers indicated the training need for designing an internet blog for pedagogical use. Our study findings align with Sailin & Mahmor (2018) as well as Williams–Buffonge (2021), who advocated for the need to nurture teachers to be responsible facilitators of TEP to enhance students' construction of deep and connected knowledge, through ongoing training to build their confidence and self-efficacy. Ongoing training in online pedagogy is also emphasized with unexpected changes due to disasters such as COVID-19 (Ma, Chutiyami, Zhang, & Nicoll, 2021).

In-service Teachers' Use of Blended Pedagogy

In this subsection, data are presented on 15 variables that were adopted from The William and Ida Friday Institute for Educational Innovation (n.d). These 15 variables were examined from 349 PAPI responses. Data were collected about in-service teachers' use of blended pedagogy. Participants were requested to state their regular use of blended pedagogy in their teaching practices. That is, "for each item, tick in the box with the response that indicates how often you do the described activity - 1 = "Daily," 2= "Weekly," 3= "Once in a month", 4 = "Once in a term," 5 = "I have Never," and 6 = If you do not have enough information to select a number response for an item, select 6= "Do Not Know." An analysis of data on this variable, daily and weekly use of blended pedagogy was considered regular while once in a month, or term or never used were considered rare use of blended pedagogy. Specifically, the variables on the use of blended pedagogy by the in-service teachers in Uganda that were examined during the needs assessment are highlighted in Table 7 below.

The data in Table 7 below indicates that the in-service teachers in Uganda rarely apply blended pedagogy during actual instruction. Specifically, 74.9% of in-service teachers rarely blend pedagogy considering the use of spreadsheets to analyse students' assessments, 68.4%, rarely use to differentiate instruction for special needs students, 63% rarely use to identify appropriate technology resources, and 61.3% rarely use to integrate technology learner-centered strategies in their lessons. On the other hand, 45.1% and 45.5% of in-service teachers are regularly mindful of their online safety and security as well as consult their online journals, respectively. Our findings contradict those of Önalan & Kurt, 2020 in Turkey, where it was established that teachers felt comfortable (95.7%) and excited (90%) with the idea of using computers in their teaching. However, the contradiction can be explained by the lack of clear policies and enforcement measures to have all teachers blend their pedagogies within their classrooms (Williams–Buffonge, 2021). Other possible explanations for the limited use of blended teaching among the in-service teachers in Uganda are explained by Bingimlas (2009) cited in Bada et al. (2020) as a lack of teacher confidence and competence, teacher resistance to change, and school-level barriers. These factors are aligned with our earlier findings in this study. Therefore, the low levels of blended

pedagogy in Uganda is posited to result from poor self–efficacy in the use of digital technologies and lack of access to the same resources within and outside schools.

Table 7: Use of blended pedagogy

Variable	Responses	Frequency (%)					
Use of...		1	2	3	4	5	6
E1) I consult online journals and other resources to use in teaching with technology.	336	19.9	25.6	21.1	11.0	19.0	3.3
E2) I often identify, evaluate, and use technology resources, e.g., OERs.	332	10.8	16.9	18.7	15.7	28.6	9.3
E3) I apply performance-based student assessment to technology-enhanced lessons	323	9.6	10.2	14.2	20.7	34.1	11.1
E4) I use spreadsheets regularly to collect and analyse student assessment data.	330	9.4	11.2	18.8	20.6	35.5	4.5
E5) My lessons include technology-enhanced learner-centered teaching strategies	331	16.3	18.7	17.8	11.2	32.3	3.6
E6) I am always conscious of my online security and safety.	332	34.3	10.8	8.1	9.9	26.8	9.9
E7) I use technology to differentiate instruction for students with special learning needs.	329	12.1	9.1	12.2	9.4	46.8	10.3
E8) I use technology to support and increase my professional productivity.	332	28.0	20.2	13.6	13.9	21.7	2.7
E9) I use technology to communicate and collaborate with parents about school programs and student learning.	334	24.0	11.1	15.9	23.4	23.7	2.1
E10) I use technology to communicate and collaborate with others.	334	52.7	13.2	10.2	7.2	15.6	1.2
E11) I use technology to teach my lessons (e.g., DVDs, LCD projectors, smartphones)	334	18.3	23.7	17.4	15.0	22.2	3.6
E12) I use social media platforms to teach my learners	333	12.6	17.7	13.2	14.1	37.8	4.5
E13) I use multiple sources of data for reflecting on professional practice.	330	19.7	17.6	13.9	15.5	26.1	7.3
E14) I use multiple sources of data to make decisions about the use of technology.	331	17.2	17.5	12.4	11.5	32.3	9.1
E15) I use technology to participate in professional development activities, e.g., online workshops, hands-on training in a computer lab.	333	13.2	15.0	14.1	15.6	36.3	5.7

Source: The William and Ida Friday Institute for Educational Innovation (n.d) and Field Data

CONCLUSION

At the heart of utilization of Technology Enhanced Pedagogy is teacher and student access to computers connected to the Internet both at home and school, as well as a functional learning management system. Unfortunately, most students and teachers in Uganda lack access to these tools. Hence, there are still low adoption levels of technology in teaching and learning in secondary schools in Uganda. Shortfalls in access to technology enhanced pedagogy are further worsened by inadequate competences in resolving basic hardware and software problems, Internet errors, accessing online libraries and utilization of asynchronous tools. Thus, however much it is crucial to migrate secondary school teachers' pedagogical practices to technology enhanced ones, it is still far from a reality to be achieved in the Ugandan context and in related countries at the same level of Internet coverage, access to technology tools as well as a poorly trained teacher workforce in blended and online pedagogies. Consequently, it is urgent to offer professional development courses to facilitate their adoption of blended pedagogy and improve their self–efficacy in the use of digital technology for teaching and learning purposes.

RECOMMENDATIONS

As a result of these study findings, the researchers put forward the following recommendations to parents, in-service teachers, school managers, teacher educators and the government of the Republic of Uganda.

- The government should provide computers, tablets, and Internet connections to teachers and learners, particularly in the rural areas of Uganda. This would facilitate technological development in most of rural Uganda, where most schools have no funds to install computer laboratories with accessible Internet connections, yet even teachers are underpaid to buy smartphones.
- In addition to increasing access to educational technological tools, there should be a deliberate policy from the Ministry of Education and Sports to provide computers to all teachers . In addition, before the operational licenses of secondary schools to social entrepreneurs are issued by the Ministry of Education, there must be proof that education technological tools are available for use by teachers and students.
- In addition, access to education technology tools should be increased through emphasizing a bring your own device strategy. Hence, parents should be encouraged to buy smartphones for their children. This will go a long way to enhance active participation in the competence based curriculum that emphasizes conducting research from Internet based resources. In addition, this will improve on active involvement in the ICT classes at high school. , For successful infusion of blended and online learning in secondary schools, the Ministry of Education and Sports, school proprietors as well as school administrators should retool in-service teachers in the appropriate use of spreadsheets to analyze students' assessments, differentiate instruction for special needs students, identify appropriate technology resources and integrate technology learner-centered strategies in their lessons.

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