Original Research Article

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Lecturers' Perceptions of Using Information and Communication Technology in Nepalese Higher Education Institutions

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Abstract: This study explored Nepalese lecturers' perspectives on the use of Information and Communication Technology (ICT) in Higher Education Institutions (HEIs) for teaching and learning activities. The study employed a convergent mixed-method research design collecting quantitative data from 102 randomly selected participants who responded to questionnaires in Google survey form. Qualitative data were collected from 10 participants who had expressed their interest to participate in the semi-structured interview while responding to the Google survey form. The quantitative and qualitative data were analysed using Statistical Package for the Social Sciences (SPSS 20.0) and thematic analysis respectively. Findings indicated that lecturers were believed to have built technological knowledge, pedagogical knowledge and technological pedagogical knowledge. Participants also thought that the COVID-19 pandemic was a stepping stone of a paradigm shift in the use of ICTs in their institutions. Lecturers having experience of less than 15 years were found to have been more comfortable in using the Google survey form compared to lecturers having experience of more than 15 years. Similarly, lecturers who have more than 15 years' work experience and above explained the lesson's objectives to students better than those who have less than 15 years' experience. Such association of teachers' experience on explaining lesson's objectives in students was also found statistically significant. Likewise, male lecturers

were found to be better in applying ICT tools for teaching students with additional learning needs than female lecturers.

Keywords: Information and Communication Technology; Higher education institutions; Technological knowledge; Pedagogical knowledge; Technological pedagogical knowledge

1. Introduction

The utilization of Information and Communication Technology (ICT) in education is deemed crucial for the development of emerging information and knowledge societies, supporting widespread learning essential for social and economic progress (Gebremeskel et al., 2016). In the educational context, ICT contributes to cognitive learning enhancement, motivation, and engagement by employing interactive tools, gamification, and multimedia integrated with reward systems. It promotes social interaction and collaborative learning online, aligning with constructivist theories. Adaptive systems, rooted in cognitive load theory, optimize learning, and real-time assessment and feedback guide instructional strategies. This means ICT has been acknowledged as a key method for improving research, teaching, and learning in higher education (Eggen & Kauchak, 2007). Learning Management Systems (LMSs) facilitate self-regulated learning, and inclusive education is advanced through accessibility features and assistive technology to address diverse psychological needs.

Higher Education Institutions (HEIs) around the globe have extensively used Information and Communication Technology (ICT) to improve the quality of education (Hew et al., 2020; Thapaliya, 2014, 2021, 2023;). It can be useful in making contents accessible and ensuring high-quality interactive sessions. Therefore, the application of ICT in HEIs has been an integral part of teaching and learning in all modes: face-to-face, online or hybrid. Because the COVID-19 outbreak caused the shutdown of academic institutions, lecturers in HEIs implemented new technologies and instructional strategies in both synchronous and asynchronous modes to ensure that their students continued receiving quality education despite the traumatic time (United Nations Educational Scientific and Cultural Organization, UNESCO, 2022). During the pandemic, the use of ICTs in the HEIs of developing countries exponentially increased because it was the only viable means of continuing teaching and learning activities (Thapaliya et al., 2023; Shrestha et

al. 2022). Expectedly, the trend is being continued even in the post-COVID pandemic situation.

Nepal has been positioned as the 123rd rated nation in terms of ICT use (Shrestha et al., 2022). Considering its ICT infrastructure, access, and quality, it appears that Nepal is in the entering stage when measured against the four-point ICT development framework prepared by Anderson and Van (2002). Prior to the COVID-19 crisis, the use of ICTs in Nepal did not have sufficient investments in ICT-related infrastructure (Thapaliya, 2014). However, the government's policy documents had already endorsed the notions such as ICT-friendly schools, e-learning, e-library, and e-pedagogy that require adequate ICT infrastructure (GoN, 2013; MoE, 2007). Certainly, these policies prioritized the ICT-embedded teaching modes in HEIs by emphasizing non-traditional modes of education aiming to offer access and ensure quality education.

In 2015, Tribhuvan University (TU) enacted a policy to integrate e-learning components in its conventional programs with a view to offering courses in the hybrid format (Thapaliya et al., 2023). Consequently, the students who could not attend face-to-face classes would receive quality education through synchronous or asynchronous modes. When COVID-19 broke out, universities in Nepal, like in many other countries, used ICT to continue their teaching and learning activities thereby increasing the use of ICT tools for pedagogical purposes (MWU, 2020; TU, 2020; UGC, 2020).As a part of contingency management, HEIs trained their faculty members on how they could teach their students online effectively and efficiently (Kunwar et al., 2022). While doing so, they faced challenges of ICT infrastructure, digital competence, training, and technical assistance (Thapaliya et al., 2023; Laudari & Maher, 2019). Yet, they continued their academic activities amid these challenges, and they are still believed to be using ICT tools in this post-pandemic situation too. In such a backdrop, this paper reports on the findings of the study that aimed to gauge lecturers' Technological Knowledge (TK), Pedagogical Knowledge (PK) and Technological

Pedagogical Knowledge (TPK) bases using Mishra and Koehler's (2009) TPACK framework. Specifically, it aims to answer (a) how lecturers used ICT tools in their teaching activities in HEIs and (b) what kinds of ICT tools were used by lecturers to deliver their instructions.

2. Literature Review

2.1 Information and Communication Technology in Higher Education Institutions

The need for and importance of ICT in HEIs can hardly be exaggerated in the contemporary technologically mediated world because individuals working in these institutions employ ICT to create and consume knowledge (Guillén-Gámez et. al, 2022; Li et. al., 2022; Stewart et al., 2023). Given the exponential growth of their use in almost all sectors, including education, the knowledge of ICT has been the third literacy skill after literacy and numeracy (Livingstone, 2012). This belief implies that all individuals are required to acquire the knowledge of using ICT to maintain their daily lives. At present, the modes of knowledge acquisition, creation, storage, and dissemination primarily depend on ICT (Duță & Martínez-Rivera, 2015). However, the access and use of ICT tools are disproportionate across countries due to the existing digital divides. For instance, while universities in Europe and North America use Learning Management Systems (LMSs) such as D2L, Canvas, and Blackboard to conduct their teaching and learning activities effectively, universities in developing countries rarely use them (Lim et al., 2020; Mishra et al., 2020; Shields, 2011). However, online teaching and learning during the COVID-19 pandemic substantially increased lecturers' access to ICTs in the context of Nepal (Thapaliya et al. 2023). Indeed, this kind of teaching challenged the notion that ICT tools are just alternative mediational means of teaching. As lecturers' used various ICT tools extensively during the pandemic, it appears that they might have substantially used them for conducting teaching and learning activities in the post-pandemic situation too.

2.2 ICT Tools and their Uses in Higher Education Institutions

Lecturers teaching in HEIs leverages various kinds of ICT tools that they need to buy or get for free, depending upon their HEIs' policies, financial strengths and investments. Based on the purpose for which ICT tools are used, Pombo et al. (2016) categorize them as Learning Management System (LMS) (e.g., Moodle, D2L, and Canvas), content-sharing tools (e.g., Blogs, Wikis, Podcasts, YouTube, and Flicker), collaborative technologies (e.g., Google sites, Del.icio.us), social networking sites (e.g., Facebook and Twitter), interpersonal communication tools (e.g., e-mails, Skype, and VOIP), content aggregation technologies (e.g., Websites and web 2.0 tools), and 3D tools. They report that more than 86% HEIs use some type of LMS in Portugal and Moodle is the most popular LMS in Portugal's HEIs. They use this tool to supplement classroom activities, training e-learning and b-learning scenarios, supervising research activities, and creating communities of learning (Pombo, et al., 2016).

During the pandemic, lecturers in HEIs would try to use Flipgrid, VoiceThread, Marco Polo, and Adobe Connect (Lowenthal et al. 2020; Turnbull et al., 2021). The lecturers teaching in HEIs use ICT tools that for free such as Google Classrooms, Zoom Meetings, Google Meet, Skype, WhatsApp, and Facebook (Kunwar et al., 2022; Mishra et al., 2020; Vijayan, 2021). They use these applications mainly on their cell phones and laptops rather than desktops and tablets (Shrestha et al., 2022). However, the extent to which they have used these tools differs remarkably due to the digital divide across nations and institutions within nations (Soomro et al., 2020).

2.3 Factors Influencing the Use of ICT in HEIs

There can be several factors that can determine whether or not lecturers of any HEIs leverage ICT tools in their classrooms. They usually include their knowledge, self-efficacy, pedagogical beliefs, purposes, and institutional cultures (Ertmer & Ottenbreit-Leftwich, 2010). Naturally, if they build a good knowledge of ICT tools, have positive attitudes towards them, and get institutional support incessantly, they are likely to use them in their classrooms. As such, whether lecturers are interested in using ICT tools depends on "cultural, social, and organizational contexts in which they live and work" (Somekh, 2008, p. 450). These are the factors that determine whether there is access to the ICT tools and a conducive environment for their use for both administrative and academic purposes because they can directly impact lecturers'' motivation towards

using ICT tools for building their own knowledge bases of ICTs and leveraging them in their instructions. In the case of Nepal, access to ICT is limited which hinders the teachers from using them effectively and efficiently even if they desire to use them in their classrooms (Thapaliya, 2021).

Another important factor that can impact the use of ICT is whether the lecturers are novices or experienced in their professions. Usually, it is expected that novice lecturers are more inclined towards the use of ICT tools in their classrooms (Englund et al., 2017). They report, "The technology has shown that novice teachers developed their conceptions and approaches to teaching with technology, which, in turn, are related to student-centered approaches while their established colleagues failed to do so" (Englund, et al., 2017, p. 80). However, the teachers who had teaching experiences of 15 or more than 15 years of experience demonstrated that they had better digital competence compared to the ones who had less than 15 years of teaching experience (Guillén-Gámez, 2022). These contrasting findings evidently demonstrate that lecturers' teaching experience impacts the use of ICTs in their academic institutions.

2.4 Benefits of Using ICT in HEIs

Lecturers in HEIs believe that they can have numerous affordances when they use ICT tools effectively and efficiently (Oliver, 2002). Some of them include developing professionalism, increasing student-centeredness, having access to resources, collaborating and cooperating with other professionals beyond their academic institutions within or across the countries, and offering constructive feedback to their students effectively (Pombo, et al., 2016; Xiao & Sun, 2022).

By adopting various ICT tools such as Virtual Learning Environments (VLEs), Adobe Connect, emails, and discussion forums, they can enhance their professional knowledge, skills, and attitudes (Englund et al., 2017). Similarly, they can increase learner-centeredness by creating self-paced and active learning environments, creating interactive learning opportunities, and integrating teaching, learning, and assessment seamlessly (Englund et al., 2017; Jääskeläet al., 2017). Likewise, they can access online resources such as videos, websites, books, and journals from anywhere at any time (McKnight, 2016). On the other hand, they can make those resources available to their students in case they cannot attend face-to-face classes. As such, lecturers can use ICT tools to have students interact asynchronously.

3. Conceptual Framework

We used Koehler and Mishra's (2009) Technological, Pedagogical and Content Knowledge (TPACK) model as a conceptual framework. It provided us with an analytical tool to determine the extent to which teachers had built the knowledge required using ICT for teaching. This framework comprises Technological Knowledge (TK), Content Knowledge (CK), Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), Pedagogical Content Knowledge (TCK), and Technological Pedagogical Knowledge (TPK) for effective online teaching and learning activities (Koehler & Mishra, 2009). Depending upon the nature of our study, we adopted three components only: Technological Knowledge (TK), Pedagogical Knowledge (PK) and Technological Pedagogical Knowledge (TPK) as shown in **Figure 1** below.
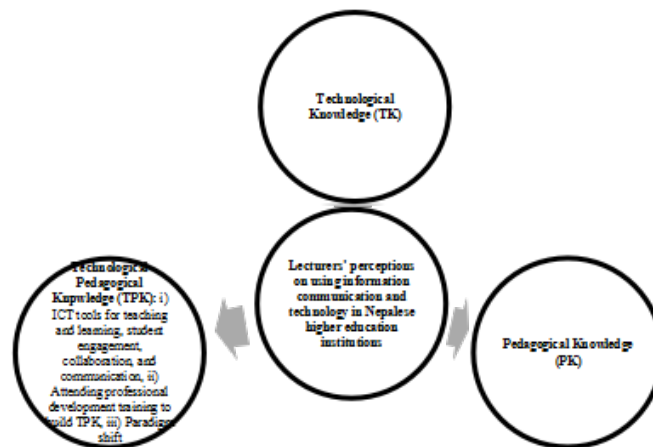
Figure 1. Lecturers' perceptions on using information communication and technology in Nepalese higher education institutions.

In this study, Technological Knowledge (TK) refers to knowledge regarding information and communication technological devices (e.g., computers, hardware, software, laptops, iPads, interactive whiteboards, multimedia projectors, mobile phones and television) (Thapaliya, 2014, 2021). Additionally, it includes the skills required to operate, learn and adapt to ICTs in teaching and learning activities. Similarly, Pedagogical Knowledge (PK) is the generic form of knowledge required to conduct teaching and learning activities effectively and efficiently. This knowledge basically includes knowledge for managing classrooms, planning lessons; implementing lessons, and, knowledge of teachers about pedagogy and assessment. Likewise, Technological Pedagogical Knowledge (TPK) blends both Technological Knowledge (TK) and Pedagogical Knowledge (PK) in this study.

4. Methodology

4.1 Research Design: Convergent Mixed Method

The study was conducted using a "convergent mixed method design" (Creswell & Creswell, 2018, p. 217). In this design, both qualitative and quantitative data are gathered and analysed separately and then their findings are compared and contrasted to identify similarities, differences, and complementarity (Cohen et al., 2018; Moseholm & Fetters, 2017). This design allowed us to understand lecturers' perceptions of using ICT in their classrooms by offering us both quantitative and qualitative data at a time.

4.2 Methods of Participant Selection

Research participants of this study were lecturers teaching in HEIs in Nepal. In this study lecturer denotes faculty members who are teaching in HEIs. For the selection of participants, a Google survey form was created and sent via email, to all Nepalese HEIs' authorities requesting them to forward it to their lecturers. This form was also shared on Facebook. One hundred and two participants voluntarily filled out the Google survey form. A majority of them (63.73%) had 15 or more years of teaching experience in HEIs. In terms of categorical variables, most of them were males (86.27%). While a majority of them (54.9%) worked in government-funded HEIs, others worked in community-funded HEIs. Similarly, a slightly higher percentage of the population (52.94%) taught either English or Nepalese language courses and the rest of them taught other content courses such as science, education, and mathematics. All of them had at least a master's degree. Among these respondents, the research participants listed in **Table 1** below expressed their interest in being interviewed while responding to the survey questionnaire. **Table 1** presents the research participant names, gender, teaching experience, teaching courses, qualification and using ICT experience.

Table 1. Demographic Information of Research Participants.

Name	Gender	Experience	Teaching courses	Qualification	ICT experience
Hari	M	25	Nepali	Ph.D.	5 years
Sita	F	10	Maths	M.Ed.	4 years
Nitub	M	25	Social	M.Phil.	10 years
Bipul	M	20	English	Ph.D. Student	8 years
Kiran	M	4	Special Edu.	Ph.D. Student	4 years
Anit	M	20	English	Ph.D. Student	5 years
Hem	M	20	English	M.Phil.	10 years
Manoj	M	15	English	M.Ed.	4 years
Ritesh	M	10	Sociology	M.Phil.	3 years
Ekwal	M	5	Linguistics	M.Phil.	4 years

Research participants were given pseudonyms to protect their identities.

4.3 Data Collection Tools and Procedure

The required data for the study were collected using a set of survey questionnaires and semi-structured in-depth interviews. For the quantitative data, a Google Survey form consisting of 51 statements representing TK, PK, and TPK was created, and the participants

were asked to express their opinions on those statements in a four-point Likert scale: Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD). The survey form was sent to eleven universities' email IDs requesting to forward it to their lecturers. Additionally, the first author also shared it through his social media network (e.g., Facebook). The data were collected in 14 weeks, starting from mid-January and ending in the last week of April 2023. Consent forms were recorded in the online survey forms before they responded to survey questionnaires.

The qualitative data were gathered using semi-structured interviews. As stated by Taylor et al. (2016), this type of interview helped us to establish rapport with the participants, understand their perspectives about using ICT and obtain enough information on a phenomenon of interest. Following interview guidelines, the first author interviewed nine interviewees through Zoom Meetings and recorded the Zoom Meetings on the first author's laptop. The records were password protected and securely stored on the first author's laptop. The fifth author interviewed one interviewee face-to-face, and it was stored on his mobile phone. The participants were well-informed about the purposes of this research and consent forms were collected from them before conducting interviews. Research participants were assured of maintaining anonymity by using pseudonyms.

4.4 Data Analysis
The quantitative data were analysed using SPSS 20.0 based on categorical variables such as participants' gender, teaching subjects, and nature of institutions and continuous variables such as working experience.

While analysing the survey data, Strongly Agree (SA) and Agree (A) were merged into Agree (A) and, in the same way, Disagree (D) and Strongly Disagree (SD) into Disagree (D)] for the available sample size and statistical data analysis requirement of Chi-square.

The qualitative data were analysed using thematic analysis (Braun & Clarke, 2006). The thematic analysis provided us with a systematic procedure to break the data into manageable units and synthesize them based on the emerged patterns (Braun & Clarke, 2006). We followed the six-stage procedure. It includes (i) familiarising with data, ii) creating codes, iii) finding initial themes, iv) reviewing and developing themes, v) refining, defining, naming, and vi) writing up. An in-depth analysis of each theme was made and compared to how it fitted with the themes and sub-themes. The authors held meetings via Zoom meetings to further discuss data analysis and findings. The eight themes that emerged from the data were merged into three themes as stated in the conceptual framework.

5. Findings

5.1 Lecturers' technological knowledge
The analysis of both quantitative and qualitative data shows the lecturers in HEIs had built up their technological knowledge. **Table 2** demonstrates that lecturers believed that they were capable of using various kinds of ICT tools, which include (i) social media, (ii) freely available tools, (iii) paid ICT tools, (iv) devices and internet connectivity, (v) cloud computing, (vi) learning management system, (vii) web-based teaching and learning, and viii) computer-assisted learning program.

Table 2. Technological Knowledge (TK) of the Respondents by Working Experience

Technological Knowledge (TK)		Working Experience					
		Less than 15 years		15 years and above		Total	
		N	%	N	%	N	%
Social media Comfortable to open Facebook account	Disagree	4	10.8	6	9.2	10	9.8
	Agree	33	89.2	59	90.8	92	90.2
Comfortable with using Viber	Disagree	7	18.9	11	16.9	18	17.6
	Agree	30	81.1	54	83.1	84	82.4
Comfortable with using WhatsApp	Disagree	6	16.2	11	16.9	17	16.7
	Agree	31	83.8	54	83.1	85	83.3
Comfortable with using Skype	Disagree	6	16.2	18	27.7	24	23.5
	Agree	31	83.8	47	72.3	78	76.5

Continuation Table:

Technological Knowledge (TK)		Working Experience					
		Less than 15 years		15 years and above		Total	
		N	%	N	%	N	%
Comfortable with using Twitter	Disagree	7	18.9	20	30.8	27	26.5
	Agree	30	81.1	45	69.2	75	73.5
Freely available tools Comfortable with using Email	Disagree	3	8.1	5	7.7	8	7.8
	Agree	34	91.9	60	92.3	94	92.2
Using Google survey* (p = 0.041)	Disagree	10	27.0	31	47.7	41	40.2
	Agree	27	73.0	34	52.3	61	59.8
Paid ICTs tools Comfortable with using Microsoft 365	Disagree	10	27.0	13	20.0	23	22.5
	Agree	27	73.0	52	80.0	79	77.5
Sharing teaching content with power points	Disagree	5	13.5	8	12.3	13	12.7
	Agree	32	86.5	57	87.7	89	87.3
Comfortable with Microsoft Office Teams	Disagree	6	16.2	8	12.3	14	13.7
	Agree	31	83.8	57	87.7	88	86.3
Devices and internet connectivity Comfortable with using computers	Disagree	4	10.8	5	7.7	9	8.8
	Agree	33	89.2	60	92.3	93	91.2
Comfortable with using laptop	Disagree	4	10.8	6	9.2	10	9.8
	Agree	33	89.2	59	90.8	92	90.2
Comfortable with using iPads	Disagree	17	45.9	32	49.2	49	48.0
	Agree	20	54.1	33	50.8	53	52.0
Comfortable with using smart mobiles	Disagree	7	18.9	7	10.8	14	13.7
	Agree	30	81.1	58	89.2	88	86.3
using multimedia projector	Disagree	5	13.5	14	21.5	19	18.6
	Agree	32	86.5	51	78.5	83	81.4
Comfortable with using the internet	Disagree	5	13.5	3	4.6	8	7.8
	Agree	32	86.5	62	95.4	94	92.2
Cloud computing Comfortable with using Zoom Meetings	Disagree	5	13.5	4	6.2	9	8.8
	Agree	32	86.5	61	93.8	93	91.2
Learning Management System Marinating e-portfolio of students	Disagree	17	45.9	30	46.2	47	46.1
	Agree	20	54.1	35	53.8	55	53.9
Web-based teaching and learning Play online quizzes	Disagree	22	59.5	30	46.2	52	51.0
	Agree	15	40.5	35	53.8	50	49.0
Using different search engine	Disagree	5	13.5	9	13.8	14	13.7
	Agree	32	86.5	56	86.2	88	86.3
Computer-assisted learning programme Confident in using Google classroom	Disagree	10	27.0	15	23.1	25	24.5
	Agree	27	73.0	50	76.9	77	75.5
Confident in using computer-assisted learning programs	Disagree	7	18.9	16	24.6	23	22.5
	Agree	30	81.1	49	75.4	79	77.5
Total		37	100.0	65	100.0	102	100.0

Note:***Significant in Chi-Square test at p < 0.001, = ** = p < 0.01 and * = p < 0.05 Na = Chi-Square test was not performed due to few numbers (< 5) in cell.

Table 2 shows that participants were comfortable in using all these eight different types of tools irrespective of the length of their work experiences. Lecturers having experience of less than 15 years were found to have been more comfortable in using Google survey form compared to lecturers having experience of more

than 15 years. This finding is also substantiated by the findings from the analysis of the qualitative data. All the interviewees reported that they confidently used ICT tools, including cloud computing video conferencing tools (e.g., Zoom Meetings and Google Meet), and social media platforms (e.g., Facebook and WhatsApp) to deliver teaching content and facilitate discussions. They maintained that these tools enabled them to continue their teaching and learning activities despite the physical distance between them and their students during the COVID-19 period and even in the post-pandemic situation. Regarding the use of their capabilities to use these tools, Sita, a research participant, said,

> …confident to use different ICTs tools such as Google Classroom, G-Suites, Microsoft Suites…cloud computing … Zoom Meetings and Microsoft Office Teams…although initially, we are… unfamiliar with the technology, we have now become proficient and are able to handle it easily. I am confident in searching for resources and downloading them from the internet…

What Sita reports here goes in line with the findings from the survey data. From her statement, it is clear that she is confident in using the ICT tools needed for conducting classes online. Like her, Manoj has a similar experience. He states that he used both internet-based technologies such as email, Microsoft 365, and Learning Management Systems and non-internet-based technologies such as the telephone to deliver his

lessons.Similarly, Ekwal, a research participant, states, "…I confidently use the Zoom Meetings application, YouTube Videos, Ted Talks, online games and Google classroom… confidently to share teaching material in the online portal". Comments received from research participants signalled that they used various ICT tools. The findings from the quantitative data as shown in **Table 2** indicate that the Nepalese lecturers in the HEIs are confident in using the ICT tools for delivering their teaching-learning activities. In other words, both types of data reveal lecturers in HEIs of Nepal have built their technological knowledge required for carrying out their professional activities.

5.2 Lecturers' pedagogical knowledge

This study found that lecturers teaching in Nepalese HEIs have built up a good knowledge of conducting their teaching and learning activities. Evidently, the quantitative data as shown in **Table 3** demonstrates that, at least,80% of the research participants believed that they had pedagogical knowledge to teach students. They expressed their opinions on following teaching procedures, ensuring student-centered teaching and learning activities and utilizing their available resources for effective teaching practice. **Table 3** presents that research participants agreed that they were comfortable in using the four kinds of teaching strategies such as i) warm-up activities, ii) ICT tools, iii) student-centred method, and iv) teaching resources.Interestingly, male lecturers were found better at applying ICT tools for teaching students with additional learning needs in comparison to female lecturers.

Table 3. Pedagogical Knowledge(PK) of the respondents by working experience

Pedagogical Knowledge(PK)		Working Experience					
		Less than 15 years		15 years and above		Total	
		N	%	N	%	N	%
Warm up activities Start classroom with warm-up activities.	Disagree	8	21.6	10	15.4	18	17.6
	Agree	29	78.4	55	84.6	84	82.4
Play online quizzes	Disagree	22	59.5	30	46.2	52	51.0
	Agree	15	40.5	35	53.8	50	49.0
ICT Tools Use ICT tools for teaching students with additional learning needs	Disagree	6	16.2	8	12.3	14	13.7
	Agree	31	83.3	57	87.2	88	86.3
Student cantered method Focus on students at the centered of learning	Disagree	7	18.9	5	7.7	12	11.8
	Agree	30	81.1	60	92.3	90	88.2
Focus on critical thinking strategies	Disagree	6	16.2	5	7.7	11	10.8
	Agree	31	83.8	60	92.3	91	89.2

Continuation Table:

Pedagogical Knowledge(PK)		Less than 15 years		15 years and above		Total	
		N	%	N	%	N	%
Explain lesson's objectives to students *(P = 0.047)	Disagree	6	16.2	3	4.6	9	8.8
	Agree	31	83.8	62	95.4	93	91.2
Explain to students how to do assignments	Disagree	5	13.5	6	9.2	11	10.8
	Agree	32	86.5	59	90.8	91	89.2
Design and assign project-based assignments	Disagree	6	16.2	9	13.8	15	14.7
	Agree	31	83.8	56	86.2	87	85.3
Reflect on my own teaching	Disagree	6	16.2	8	12.3	14	13.7
	Agree	31	83.8	57	87.7	88	86.3
Provide opportunities for students to present their tasks in the classroom	Disagree	6	16.2	7	10.8	13	12.7
	Agree	31	83.8	58	89.2	89	87.3
Teaching resources Use easily and locally available materials in the classroom	Disagree	5	13.5	12	18.5	17	16.7
	Agree	32	86.5	53	81.5	85	83.3
Total		37	100.0	65	100.0	102	100.0

Note:***Significant in Chi-Square test at $p < 0.001$, = ** = $p < 0.01$ and * = $p < 0.05$ Na = Chi-Square test was not performed due to few numbers (< 5) in cell

Research participants who have 15 years and above work experience explained the lesson's objectives to students better than those who have less than 15 years' work experience. Such association of research participants' experience in explaining lesson's objectives to students was also found statistically significant ($p = 0.047$) in chi-square test.

The themes that emerged from the analysis of qualitative data also show that lecturers were interested as well as capable of making their teaching and learning activities learner-centred. The research participants expressed their opinion that they usually applied learner-centred approaches. To this end, they stated that they would follow critical thinking strategies, collaborative, and cooperative learning strategies. Regarding using critical thinking and collaborative strategies, Hem, a research participant, stated,

I use critical thinking strategies in my teaching (e.g., peer-reading, peer-summarizing, what, so what?, now what? brainstorming, peer brainstorming, Directed Reading Activity (DRA), Directed Reading Thinking Activity (DRTA), reading with text coding, reciprocal teaching, think/pair/share).

Comments received from Hem revealed that he used critical thinking teaching strategies in his teaching and learning activities. It can be inferred that Hem has heightened knowledge of increasing critical consciousness. This is, in other words, the embodiment of lecturers having built PK. This is also substantiated by what Ritesh, another research participant, explained,

I followed the following phases in my teaching. These are: Anticipation (A), Building Knowledge (B) and Consolidation (C) in line with critical thinking teaching strategies. Think/Pair/Share (TPS), group work, and project-based learning are used in my class during and after the teaching. As a result, students were actively engaged, participated and contributed to the teaching and learning activities.

Like Hem and Ritesh, and other research participants, (e.g., Hari, Sita, Anit, and Ekwal) also maintained that they used cooperative teaching approaches, project-based teaching and critical thinking strategies, which they believed could increase student-centeredness in their classrooms.

However, the dominance of teacher-centered remained, somehow, unchallenged owing to the lack of needed infrastructures and resources. Ritesh, whose class was mostly lecture-based, explained the cause of using a teacher-centered method irrespective of his desire to make his pedagogical practices more student-centered.

In my university, we focus on student-centred

teaching in policy ... but in practice… we do not have sufficient infrastructures and resources to implement fully student-centered teaching strategies in my practice…as a result, I need to teach through existing traditional pedagogical approaches (e.g., lecture method) …

From Ritesh's statement, it is clear that lecturers had a theoretical understanding of student-centered learning. However, they were faced with infrastructural challenges such as the availability of ICT tools and devices in their classrooms.

5.3 Lecturers' technological pedagogical knowledge (TPK)

The study found that lecturers of HEIs had built TPK. In doing so, they used various kinds of technological devices, applications, and programs for their pedagogical purposes. **Table 4** presents the technological pedagogical knowledge of research participants by working experience.

Table 4. Technological Pedagogical Knowledge (TPK) of the respondents by working experience

		Working Experience					
		Less than 15 years		15 years and above		Total	
		N	%	N	%	N	%
ICT Tools Use my mobile phone to record teaching content	Disagree	16	43.2	35	53.0	51	49.5
	Agree	21	56.8	31	47.0	52	50.5
Create a Google survey form to record students' feedback and suggestions	Disagree	14	37.8	30	46.2	44	43.1
	Agree	23	62.2	35	53.8	58	56.9
Confident in using audio books in the classroom	Disagree	13	35.1	28	43.1	41	40.2
	Agree	24	64.9	37	56.9	61	59.8
Confident in using Google Classroom	Disagree	10	27.0	15	23.1	25	24.5
	Agree	27	73.0	50	76.9	77	75.5
Comfortable in usingMicrosoft Office Teams	Disagree	6	16.2	8	12.1	14	13.6
	Agree	31	83.8	58	87.9	89	86.4
Comfortable in using Zoom Meetings	Disagree	5	13.5	4	6.1	9	8.7
	Agree	32	86.5	62	93.9	94	91.3
Comfortable in fixing minor technical issues in computer	Disagree	8	21.6	15	22.7	23	22.3
	Agree	29	78.4	51	77.3	80	77.7
Teaching Resources Use easily and locally available materials in the classroom	Disagree	5	13.5	12	18.2	17	16.5
	Agree	32	86.5	54	81.8	86	83.5
Share teaching content with power points	Disagree	5	13.5	8	12.1	13	12.6
	Agree	32	86.5	58	87.9	90	87.4
Use a video camera to record teaching content	Disagree	17	45.9	39	60.0	56	54.9
	Agree	20	54.1	26	40.0	46	45.1
Total		37	100.0	65	100.0	102	100.0

Note:***Significant in Chi-Square test at $p < 0.001$, = ** = $p < 0.01$ and * = $p < 0.05$ Na = Chi-Square test was not performed due to few numbers (< 5) in cell.

Table 4 shows that teachers used various kinds of ICT tools to conduct their teaching and learning activities. Among these tools, Zoom Meetings was used by the highest percentages (91.3%) of the participants followed by PowerPoints (87.4%) and Microsoft Office Teams (86.4%) However, the majority of research participants denied using cell phones and video recordings for pedagogical purposes. Such a trend of using ICT tools could possibly be due to their handling skills of those tools prior to the pandemic.Similarly, the analysis of qualitative data shows that lecturers use several types of ICT tools while conducting their professional activities. They mainly use them for the following purposes.

5.3.1 ICT tools for teaching and learning, student engagement, collaboration, and communication

The research participants of the study believed that the use of various ICT tools such as video conferencing, online forums, and social media platforms made education more accessible. They mentioned the collaborative approach to teaching and learning through the use of social media and freely available technological tools (e.g., YouTube videos, Facebook Messenger groups, and email groups), and they shared teaching content, assigned tasks, and collected students' work. Furthermore, they highlighted the use of Zoom Meetings and Google Meet. However, they used very basic ICT tools as Nitub, a research participant, shared his experience in the following excerpt.

> I am currently employed as a teacher in a college situated in a semi-urban area that is not quite rural nor entirely urban. Although we use some ICT tools for teaching and learning activities, our usage is limited to basic technologies such as a multimedia projector … provided and supported by the campus…I download videos from YouTube related to my lesson content and recommend these to my students. … created Facebook group in Facebook Messenger and e-mail groups for students to share teaching materials and assignments…use Zoom Meetings to teach students during the COVID pandemic situation…

Nitub's experience is similar to other lecturers such as Bipul and Kiran. Regarding what tools he used for teaching, Bipul says, "…my classroom was technologically integrated, and I used a multimedia projector, YouTube videos, Ted Talks, WhatsApp… Microsoft Teams, Zoom Meetings, and online games (e.g., Kahoot)... to deliver the curriculum …" Similarly, Kiran and Anit, other research participants shared that they used various digital tools such as laptops, computers, iPad, Facebook Messenger, WhatsApp, Microsoft Suite, Google Suite, Google Classroom, Kahoot, Zoom Meetings, and PowerPoints while teaching. Some research participants even reported that they used other devices such as multimedia projectors. However, they agreed that their universities had limited ICT resources. What Kiran did while sharing resources with his students implicated the lack of LMS in his university. He explained,

> I prepare my lecture notes by writing on pieces of paper, taking photographs and sharing them with my students via email and social media. The next day, I will take a class and explain the concepts being included in the notes.

Kiran's experience is a clear indication that they did not use any kind of LMS. As a result, he shared his notes through emails or social media. Clearly, Nepalese HEIs used basic freely available ICT tools.

5.3.2 Attending professional development training to build TPK

Participants reported that they participated in Professional Learning Development (PLD) training on online teaching during the pandemic crisis, which they believed increased their capabilities and confidence in using various ICT tools for pedagogical purposes. A research participant, Bipul, shared his experience of attending PLD training. He described,

> I had an opportunity to attend two days of PLD in the operation of Microsoft Office Teams for online classes…I learn how to create classes, prepare PowerPoint slides, upload content, screen sharing, keep class notes and keep record of students' information in the database…

Other research participants, Hari, Manoj, Kiran and Sita's experiences were similar to Bipul's. They mentioned that they had a five-day training on how to teach through digital platforms such as Zoom Meetings, and Microsoft Office Teams. They further stated that the training exceedingly increased their confidence using these tools though the training itself was all about basics (e.g.,how to open Zoom Meetings ID, how to create Zoom Meetings, and how to share resources in Zoom Meetings). Comments received from research participants demonstrated thatlecturers obtained limited PLD training regarding using ICT tools.

5.3.3 Paradigm shift

Despite having challenges in using ICTs in Nepalese (HEIs),lecturers described that there was the possibility of a "paradigm shift" (Kuhn, 2012) in terms of lecturers' familiarity and ability to handle technology-integrated pedagogy in HEIs. This view was well-supported by research participant, Hem, who believed that the COVID-19 pandemic could be the cause of a paradigm shift in the modes of pedagogical practices of Nepalese HEIs. They had opportunities to build

their infrastructures while continuing their teaching and learning activities during the pandemic time as the existing face-to-face mode of learning would not work. Hem, a research participant, said,

> I observed many universities are designing online courses and students can access them from anywhere at any time…we became the citizens of a global village. I believe it brings a paradigm shift in teaching and learning activities.

This is supported by another research participant, Bipul. He explained,

> I believe that the pandemic has highlighted the importance of online education ... the pandemic has forced many universities to shift toward online education … the pandemic has brought about significant changes in higher education teaching and learning activities…

These participants' comments signalled that lecturers attempted to change their teaching and learning activities by incorporating ICT tools to meet 21st-century educational needs. As a result, research participants claimed that COVID-19 was a milestone for a paradigm shift in the modes of carrying out teaching and learning activities within Nepalese HEIs. These participants' comments revealed that they wished to use multiple modes of offering courses such as synchronous, asynchronous, hybrid, and face-to-face.

6. Discussion and Conclusion

The overarching goal of this study was to explore the use of ICTs by university lecturers teaching across universities in Nepal. The analysis of both quantitative and qualitative data demonstrated that the lecturers had knowledge bases of technologies and pedagogies needed for being able to integrate ICTs in their teaching and learning contexts. Using three components as discussed in Mishra and Koehler's (2009) TPACK model: technological knowledge, pedagogical knowledge, and technological pedagogical knowledge, we attempted to gauge the ICT knowledge bases of lecturers teaching in Nepalese HEIs. The findings indicated that they could use various types of technological devices (Pombo et al., 2016) such as content-sharing tools and social networking sites. This means that the lecturers of Nepalese HEIs have built their TK needed for carrying out teaching and learning

activities online. They expressed their beliefs that they could increase collaborative learning, critical thinking skills, and learner-centeredness with the use of ICT tools. This finding suggests that they have built their pedagogical knowledge. Similarly, they expressed that they could use various types of technological tools and software or applications for teaching both synchronously and asynchronously thereby indicating that they have developed their technological pedagogical knowledge.

The analysis of the quantitative data shows that the participants do not have significantly different ICT knowledge and skills in terms of their work experiences. The chi-square test shows that those who had more than 15 years of teaching experience and those who had less than 15 years of teaching experience responded to the given questions much the same way except in the case of responses to two statements: using Google survey forms and using ICT tools for teaching students with additional learning needs. While the lecturers lower than 15 year's teaching experience are better at using Google survey forms, the teachers with more than 15 year's teaching experience are better at using ICT tools for teaching students with additional learning needs. The overall finding on the use of ICT tools by the lecturers creates a third pattern, the other two being the ones discussed by Englund et al. (2017) and Guillén-Gámez's (2022). Englund et al. (2017) reported that established lecturers are relatively reluctant to teach with technology and follow a student-centred approach. On the other hand, Guillén-Gámez's (2022) finding shows that teachers whose teaching experience is 15 or more than 15 years of experience have better digital competence compared to the ones who have less than 15 years of teaching experience.

Similarly, lecturers believe that the COVID-19 pandemic crisis provided them with an opportunity to make a "paradigm shift" (Kuhn, 2012) by revamping the overall educational process as the existing modes of delivery could not support them to continue their teaching and learning activities. Indeed, the universities attempted to adopt e-learning practices during the pandemic for contingency management (MWU, 2020; TU, 2020; UGC, 2020). However, owing to the lack of infrastructure and resources needed for the continuation of e-learning and e-assessment (Thapaliya et al., 2023), many universities in Nepal have challenges

in integrating ICT tools into teaching, learning, and assessment.

Likewise, in the realm of behavioural and educational psychology, ICT involves the use of modern technology, including computers, digital devices, and associated software, to create an information society through learning scenarios, worksheets, and interactive exercises (Anderson, 2016; Subekti, 2003). ICT serves as a cornerstone for learning facilities, generating enthusiastic behavioural and psychological outcomes (Gebremeskel et al., 2016). It optimizes learning performance and access, addresses educational factors through communication, and establishes a robust foundation for information societies. Talebian et al. (2014) assert that the integration of ICT in education has significantly transformed learning and teaching processes, creating new opportunities and expanding access to educational resources beyond traditional confines. This is supported by Sakar (2012). Using ICT tools in higher education grew to be an effective tool for transforming a variety of educational practices in various states of India (Sarkar, 2012). Even in technologically disadvantaged countries such as Nepal, Thapaliya et al., (2023) explore the experiences of e-learning in higher education institutions, highlighting that despite hurdles in the ICT-based learning environment and paradoxical policies during the COVID-19 crisis, teachers have seized the opportunity to incorporate technologies into their teaching and learning activities. This emphasizes how important ICT is to education, even in countries facing technological challenges.

In conclusion, the lecturers teaching in Nepalese HEIs have demonstrated that they have TK, PK, and TPK needed to integrate ICTs to have various affordances while carrying out their teaching and learning activities. They believe that they have utilized different kinds of ICT tools for numerous benefits. For instance, they can perform their jobs effectively and efficiently (Oliver, 2002) and collaborate, increase learner-centeredness, and offer feedback (Pombo, et al., 2016; Xiao & Sun, 2022) by integrating ICT tools in their teaching, learning, and assessment seamlessly (Englund et al., 2017; Jääskelä, 2017 et al.). Also, they could offer their students access to online resources such as videos, websites, books, and journals from anywhere at any time (McKnight, 2016). In fact, they can create, store, disseminate, and consume knowledge (Duță & Martínez-Rivera, 2014; Guillén-Gámez et. al, 2021; Li et. al., 2022) using ICT tools. Despite the lack of resources (Thapaliya, 2023; Thapaliya et al., 2023), they used various kinds of ICT tools (Thapaliya, 2021; Pombo et al., 2016) to attain various kinds of affordances. What's more, they believe that the proper use of ICTs in academic institutions can support for a "paradigm shift" (Kuhn, 2012) in teaching, learning, and assessments. Therefore, it is high time for stakeholders of HEIs to integrate ICT tools in their teaching, learning, and assessments seamlessly.

Declarations

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