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## An Investigation into the Conditions of ICT Application at the Teacher Education Institutions

*Vannasouk Bouasangthong, Say Phonekeo\*, Sithane Soukhavong, Khamseng Thalungsy, Thongsay Phongphanit, Phonesy Vathana, Phoutsakhone Channgakham, Senglamphanh Dyvanhna, Khammeung Sybounheaug, Chintana Phengphilavong*

Faculty of Education, National University of Laos, Laos

\*Correspondence: E-mail: [phoneksaykeo2020@gmail.com](mailto:phoneksaykeo2020@gmail.com)

### ABSTRACT

Information Communication Technology (ICT) has become an indispensable part of teachers in most countries in the world to keep up with the needs of learning and teaching. This paper aims at investigating the conditions of using ICT, exploring the need for ICT training, and examining the guidelines for developing ICT works in the Lao teacher education institutions, Lao PDR. The sample group for this research was 460 teachers and 32 administrators from 16 teacher education institutions throughout Lao PDR. The questionnaire and semi-structured interviews were employed to collect the data. The data were analyzed by using descriptive statistics for the quantitative data and the thematic and content analysis was used for the qualitative data. The findings reveal that the overall conditions of ICT application were at a moderate level in terms of the ICT Infrastructure, ICT facilities, and ICT personnel. The needs for ICT training range from how to use applications to using software for data analysis. The guidelines and suggestions for developing ICT works include: encouraging teachers to undertake ICT, conducting ICT professional training, providing sufficient financial support, supporting ICT facilities/tools, creating ICT resource rooms, and inspecting and monitoring the ICT integration of the teachers. It is recommended that regular support and training from related stakeholders, ICT can be best facilitated and fostered in the Lao teacher education institutions to provide a high-quality education in the new era.

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## 1. INTRODUCTION

The XI Lao Revolutionary Party Congress has claimed various important issues regarding national development; including the national solidarity, ensuring a stable political system, and turning social-economic development into a better to upgrade people's livelihood and to graduate the country from a poverty status. It has also stated that the general directions and expectations from 2020 to 2025 and vision in 2030 are to develop the nation that aligns with the formulated guidelines and goals of the government by focusing on human resources development due to its vital role in lifting the country out of poverty. Additionally, the Congress has outlined important strategies to upgrade the country into a modern, systematic, and civilized society. The directions have also emphasized three characteristics and five pillars of Lao national education. It has also been stated that the Lao education system needs to be revolutionized to keep up with the regional and international stages, aiming to ensure that the Lao citizens master both generic and specific skills.

To achieve the goals, it is important to place a priority focus on human resources development to become qualified as key for social and economic development. Having seen and witnessed the significant role of human resources development, the government of Laos (GoL) has issued a decree regarding the human resource development plan for 2025 and formulated a vision for 2030 by indicating that "Develop human resources to become the driving force for economic development sustainably, following the direction of modern industrialization, being able to connect and integrate into the regional and international arena. To accomplish this, the GoL has to pay close attention to supporting and promoting staff and officials to be competent in the subject content knowledge, ICT skills as well as a foreign language together with curriculum development, guidelines, and modern staff management system.

The world is now moving forward to a digital and ICT landscape. This phenomenon has direct influences on countries to shift the mode of teaching and learning through using ICT tools. The significance of ICT in education cannot be denied during the unprecedented pandemic, COVID-19. This requires the students to have access to a large variety of online sources to get information. Therefore, teachers should create a learning environment that allows students to discover, experiment, and apply new knowledge in new and novel situations (Kilag, 2023). This form of learning and instruction fosters open-ended learning situations rather than a learning condition that focuses on the transmission of knowledge. ICT has the potential to create powerful learning environments in various ways. Furthermore, ICT also helps to understand the complex concept by finding out relevant data for further analysis, contributing to an authentic learning environment. ICT is also a transformational device if used effectively and appropriately, can shift the classroom atmosphere to a learner-centered environment and collaborative learning (Kilag, 2023).

The outbreak of Covid-19 has been severely affecting the development processes in all sectors including education in Lao PDR. All education institutions were mandated to close down and required to teach online. Because of this, there is a need to adapt the mode of teaching and learning from a face-to-face mode to distance learning. Therefore, the integration of ICT in education has a vital role in addressing the new challenges. In this regard, teachers can create online classrooms, making online teaching and learning materials that can be accessible and self-directed learning. To ensure the effective use of ICT in learning and teaching as well as in education, the ICT Competency Standards for Teachers in Lao PDR was developed and approved in collaboration with and assistance of UNESCO Bangkok in early 2022 to ensure unity and increased capability of the education institutions in Lao PDR.

Although most teachers can conduct learning and teaching through ICT integration, many still encounter challenges and difficulties in actual practices such as insufficient budget for ICT devices, lack of proficiency in using ICT, and resistance to new and innovative methods. This phenomenon even places a burden on the teacher educators to cope with when it comes to integrating ICT tools into teaching and working in general. To better understand the difficulties of using ICT tools in the Lao teacher education institutions, the present study was conducted.

The main purposes of this research are to investigate the conditions of using ICT, find out the need for ICT training, and examine the suggestions/guidelines for improving ICT works in the Lao teacher education institutions. It aimed to seek answers to the following research questions: (i) What are the conditions for using ICT in the Lao teacher education institutions in terms of infrastructure, facilities, and personnel?; (ii) What needs did the teachers perceive most in terms of ICT training in the Lao teacher education institutions?; (iii) What are the suggestions/guidelines for developing ICT works in the Lao teacher education institutions?

## 2. LITERATURE REVIEW

The use of technology as a tool to help facilitate and develop education cannot be denied. This has received great attention as teachers all around the world are frequently exposed to new ways of teaching practices. The shift was made during the Covid 19 outbreak in 2019. This instantly changes the traditional mode of teaching to a hybrid where online classes are needed and delivered in response to the changing situation. In Laos, apart from curricular changes that come officially - usually from the Ministry of Education and Sports and short training introduce new techniques and activities to promote the use of ICT in teaching and learning. However, teachers are faced with barriers that prevent them from applying ICT tools in the classroom or developing supporting materials through ICT. To better understand the current situations and conditions of using ICT in the Lao teacher education institutions, it is important to define the term for this research as it is context specific.

### 2.1. Defining ICT

ICT is not a new term. ICT has been coined and used in various contexts, including education. For this research, ICT is defined as technologies that provide access to information in education through communication devices such as the Internet, computer, and other communication mediums (Zuppo, 2020). Another definition of ICT, as Sharma *et al.* (2016) has put it, is the "diverse set of technological tools and resources used to communicate, create, disseminate, store, and manage information". The definition captures important aspects of resources and capacities. First, the use of ICT in education is related to ICT devices or tools. These include physical settings, materials, and Internet connections which are important for educational institutions. Without support and sufficient devices, distant teaching and learning, conferences, and communication can be challenging. Second, the application of ICT concerns the teachers, educational personnel, and students. They must have the ability to use those devices for the sake of effective and efficient work performance and teaching and learning. This is key to the full and effective integration of ICT in education. However, the problems of using ICT cannot be ignored since there are various components and constraints. In Lao PDR, the main challenge of using ICT in education is mainly related to a lack of practical ICT skills and knowledge among the teachers and students, a lack of facilities, and stable internet connections. Attempts have been made to address the issues, including in-service ICT training for teacher educators, academics, and students. The impacts, however, were not conclusive, suggesting that more effort is needed to foster the abilities of

the teachers and educational staff to use ICT tools efficiently to increase the better quality of teaching and learning in the Lao teacher education institutions.

## 2.2. Importance of ICT in General and Education

The role and importance of ICT have become an indispensable part of lives in the new era and globalization. In education, ICT has a tremendous potential to serve and help educational practitioners and students carry out teaching and learning during an unprecedented phenomenon such as the Covid-19 outbreak. ICT can bring the existing educational system in alignment with the knowledge-based and information-rich society by providing services of sophisticated tools, techniques, and methods at their usefulness and convenience. The important role of ICT in education as follows. First, the application of ICT brings about a new mode of teaching from the traditional ways of teaching and learning to distant teaching and learning. This mode helps save time and expenses for both teachers and students. Second, the use of ICT helps transform teacher-centered instruction into learner-centered teaching and learning. This allows students to develop self-directed learning in the acquisition of knowledge and skills of the lesson learned. Third, the benefits of using ICT in education also help change the role of teachers from sole knowledge transmitters to a facilitator. This, in turn, motivates students to navigate and become the agent of their learning. Fourth, through using ICT, students are encouraged to become more responsible about their learning as they can use ICT tools to find related information, evaluate, synthesize, and share knowledge with peers in a distant mode. Last, ICT helps students develop critical thinking and reflect on their learning processes when they work online.

In terms of ICT roles for teachers, many benefits can be identified as follows. First, ICT helps foster the professional development of teachers. ICT devices can be a platform for teachers to learn various language skills and knowledge. In addition, the current situation requires teachers to upgrade themselves to reduce the digital gap. Second, a teacher can increase various domains of knowledge with the help of ICT such as access to journals, e-magazine, and e-library. The teachers can also take part in online platforms of discussions and conferences to improve knowledge and skills of the content knowledge. ICT also helps teachers develop innovations in teaching and learning as various online sources are useful and practical for teachers to learn from. ICT can also help teachers study the curriculums of different countries so that they can compare what works and does not work in their context (Sharma et al., 2016).

## 2.3. ICT and Education: The Lao Context

Lao PDR has been undergoing rapid transformation over the past decade due to the development and application of advanced ICT in various sectors; including education. This changing landscape was further accelerated by the Covid-19 pandemic. ICT is now playing a crucial role in sustaining and growing the sectors: industries, banking, business, education, and the governments to continue providing basic services to the people. Over 90% of jobs in the market demand a digital component, thus digital literacy is now a requirement for employees and workers rather than auxiliary skills. The preparation of students with digital literacy in Laos, however, still faces challenges and constraints. However, because of the Covid-19 pandemic, the mode of teaching in Lao PDR has shifted from face-to-face to remote (distance) learning to avoid the risk of contracting the virus and maintain the health of the students, teachers, and other school personnel in Lao PDR. The GoL of Laos decided to close the educational institutions and businesses and later imposed a full lockdown due to the spread of Covid-19 two years ago. Because of this, education institutions faced the challenge of teaching and mastering the new digital landscape of education.

To continue the education, however, distance learning was required in the form of blended and other modalities like non-digital platforms. According to the Lao PDR Education Covid-19 response plan in 2020, the report emphasized the support of stakeholders in preventing the transmission and spread of disease and ensuring the continuity of learning by providing sound implementation of key learning activities and safe reopening of classes. With the reopening of schools in Laos in the second half of 2020, educational institutions operated in shifting schedules practicing social distancing regulations.

In addition, given the natural disasters that damaged school facilities and resources and the limited access of rural communities, a mix of interventions has been placed to meet the learning demands of students, including those vulnerable and disadvantaged. Interventions include the use of print and non-print (TV, radio, and online platforms) resources to support continuity of learning. The Ministry of Education and Sports (MoES) instantly dedicated an educational TV channel and created various educational programs. Further, UNICEF Laos has put efforts into using innovations to improve learning outcomes. In this regard, support has been provided to the Government to set up a digital teaching and learning online platform for students and teachers that can bridge the digital divide and helps more learners in Lao PDR with distance learning (See <https://www.weforum.org/agenda/2020/04/coronavirus-education-global-covid19-online-digital-learning/>). Because of this, students and teachers must acquire the necessary digital skills they need to grab and take full advantage of the opportunities being provided by the digital economy during the pandemic and emerging globalization.

#### **2.4. ICT Competency Standards for Lao Teachers**

In response to the demand of education institutions and the current situation of learning and teaching in Laos, the ICT Competency Standards for Teachers in Lao PDR was drafted and approved to foster Digital Resilience through Competency-Based Teacher Training Reforms to Facilitate ICT-Pedagogy instruction. The project was supported by UNESCO Bangkok and the main purposes are to: 1) provide technical and practical support for ICT work indicated by the education policies and sector development plan and 2) to increase the capacity of teacher education institutions in Lao PDR to integrate ICT tools into training pre-service teachers so that they can apply the skills into their classroom instruction and in daily life.

The framework was developed and adapted from various national and international ICT competency standards that are context-specific, the Lao context. Specifically, the framework consists of three levels of competency (e.g., Basic, Proficient, and Advanced); six domains (e.g., understanding ICT policy in education, curriculum and assessment, pedagogy, application of digital skills, organization and administration, and teacher professional learning); and eleven standards and forty-seven indicators (e.g, fourteen indicators for the Basic Level; sixteen indicators for the Proficient Level; and seventeen indicators for the Advanced Level). To better understand each level, the following sections give the details of each level.

#### **2.5. ICT Proficiency Level**

As previously indicated, three levels of ICT proficiency were developed for teachers in Lao PDR. The first level is the Basic Level. For this level, teachers must be able to understand the role of using ICT devices in teaching and learning for all grades. For this reason, teachers need to understand the policies and what is needed for integrating ICT tools into education and classroom instruction. Furthermore, teachers should be able to select appropriate ICT tools for designing, delivering the lessons, and motivating students to take part in the learning

processes. In addition, teachers be able to master basic ICT skills and knowledge through independent learning by using various forms of ICT devices. In brief, this level aims to equip teacher educators with an understanding of ICT policy and basic skills in integrating ICT devices into classroom teaching and related work.

The second level is the Proficient Level which is aimed at equipping teacher educators with a good grasp of knowledge and abilities to use ICT tools and digital knowledge and skills to facilitate a teaching and learning process to foster effective and efficient learning outcomes. Also, the teachers must or should be able to apply the regulations and principles of ICT in designing and planning lessons as well as integrating ICT strategies for educational purposes. To sum up, the key qualities of this level are to foster teacher educators' abilities to master the knowledge and skills of integrating ICT tools into teaching more effectively.

The final level, Advanced Level, is concerned with equipping teacher educators with the ability to plan and apply advanced ICT tools and digital resources to innovatively design lessons and teaching activities that align with the policies and context of instruction. Also, this level aims to foster criticality, analysis skills, assessment, and innovation in teaching and learning. In summary, this level aims at fostering advanced skills and knowledge of ICT for teacher educators.

## **2.6. ICT Competency Standards Domains for Teachers in Lao PDR**

There are six domains of the ICT Competency Standards for Teachers in Lao PDR which include: 1) Understanding ICT Policy in Education, 2) Curriculum and Assessment, 3) Pedagogy, 4) Application of Digital Skills, 5) Organization and Administration, and 6) Teacher Professional Development. These domains were developed to help teacher educators in Laos to be able to integrate ICT tools in teaching and learning.

The first domain, Understanding ICT Policy in Education, is aimed at raising awareness among teachers regarding the vision, mission, and policies of ICT. As the guideline points out, the teachers in Lao should consider and, to some extent, try to integrate ICT tools in classroom instruction. At the basic level for this domain, the teachers should be able to identify and promote government policies and missions related to the ICT application in education. For the proficient level, the teachers should adapt and apply the government policies and vision regarding ICT integration in education appropriately. Regarding the advanced level, teachers should be able to contribute and develop vision, mission, and policies for ICT integration in education and learning processes. The second domain, Curriculum, and Assessment, is concerned with how to use ICT tools in designing, developing, and assessing curriculum and student learning outcomes. For the basic level, teachers should be able to understand curriculum standards and select appropriate ICT tools to support the achievement of the standards. Concerning the proficiency level, teachers should be able to design ICT-integrated lesson plans to achieve the curriculum standards and foster students' knowledge acquisition and active learning. Regarding the advanced level, teachers should be able to support and provide guidance to colleagues and peers to use ICT tools to design lessons and support students to achieve a deeper understanding of and implement curriculum and assessment strategies.

In terms of the Pedagogy Domain, the main focus is on how to conduct teaching activities by using ICT tools in an effective and meaningful way. As globalization has emerged, teachers should know how to design innovative teaching activities that allow for ICT integration. The aim is to promote active and student-centered learning, leading to the development of criticality, lifelong learning skills, and professionalism. In this respect, the students need to take responsibility for their learning as sole researchers, experimenters, and knowledge

creators. Another domain, the Application of Digital Skills, focuses on the teachers to be the ability to use ICT functions, software, online applications, and digital resources in education. The teachers should be able to explain these tools and understand the basic functions of the tools. At the proficient level, teachers should have the ability to use these tools in the process of teaching and learning. Other than that, teachers should be able to support peers and learners or lead their colleagues in designing and using ICT in education.

The fifth domain, Organisation, and Administration, primarily focuses on ensuring a conducive learning environment for all students with different abilities to use ICT tools. Teachers should be able to organize teaching and learning in a friendly and meaningful environment so that learners can engage in learning more effectively and productively. Also, teachers should have the skills to manage the ICT system and know how to solve basic ICT constraints in teaching and learning. The last domain, Teacher Professional Development, is about how to use ICT to foster teacher learning and professional development and advancement. Integrating ICT into education is regarded as a form of promoting and supporting teachers to learn, develop, and grow. The form of teacher professional learning can be reflected in ICT in-service training, peer teaching, and learning from online platforms. A further discussion about the relationship between ICT and teacher professional development is described in this chapter to increase a better understanding of how ICT plays a role in developing and enabling teacher growth during their professional and personal journey.

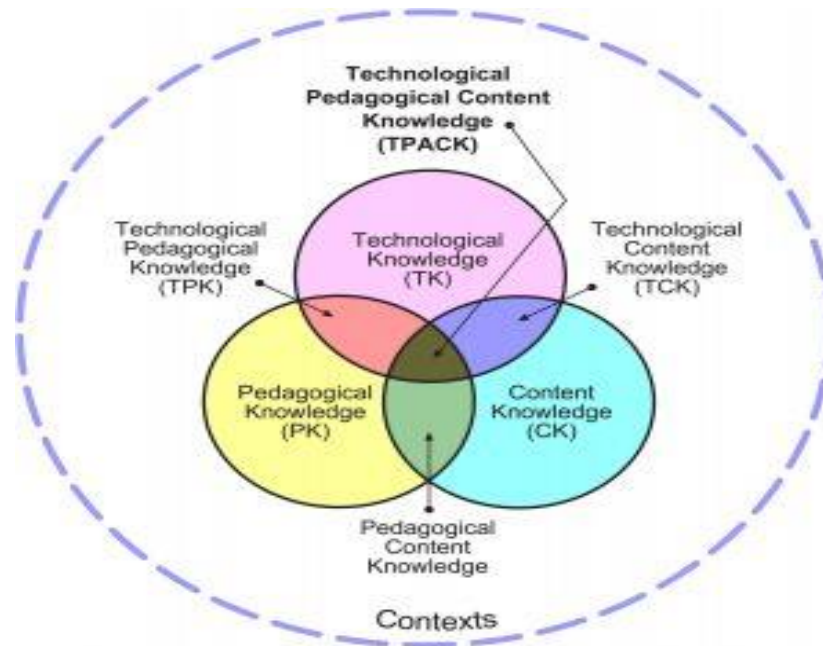
## 2.7. Conditions for Integrating ICT in Teaching and Learning

Integrating ICT into teaching and learning is context specific. Whether the integration is effective or not depends primarily on the context. To ensure effectiveness in using ICT tools, a variety of methods, approaches, and pedagogical skills are suggested by scholars in the area. However, the effective use of ICT tools depends largely on how and why is applied and integrated in actual integration. Specifically, many different ICT tools and applications are integrated into teaching and learning. Some of these tools and applications may be designed specifically for educational purposes and others for general use. The choices of resources, and the way they are used, can be linked to different learning theories which may be invoked to explain or predict learning benefits from the use of ICT. It is believed that the use of ICT in education has emerged from two main approaches, namely directed and constructivist instructional methods. The theoretical foundations of directed instruction are based on behaviorist learning theories and information processing theory, which is a branch of cognitive psychology. The theoretical foundations of the constructivist approaches are based on the principles of learning derived from cognitive learning theory (Salehi & Salehi, 2012).

The framework is the result of a longitudinal study focused on teacher professional development in higher education institutions. The framework attempts to identify the essential qualities of teacher knowledge and skills required for technology-based teaching while addressing the complex, multifaceted, and situated nature of this knowledge. The framework focuses on Technological Pedagogical Content Knowledge (TPCK) which looks at the complex roles of, and interplay among, three main components of learning environments: Technological Knowledge (TK) Pedagogical Knowledge (PK), and Content Knowledge (CK). Also, this model has much to offer to discussions of technology integration at multiple levels. Details of TPCK are illustrated in **Figure 1**.

As **Figure 1** shows, three main types of knowledge form the foundation for ICT integration in teaching and learning. These include technological, pedagogical, and content knowledge. First, Technological Knowledge (TK) is concerned with teachers' knowledge, skills, and abilities

to use various ICT tools and resources. Specifically, it concerns an understanding of specific knowledge of and flexibilities in using ICT resources in classroom instruction, including the ability to adapt to modern technology offerings. Second, the framework describes Pedagogical Knowledge (PK) that teachers should possess. This is important for teachers to know how to process, design, and deliver teaching and learning through ICT-based methods. This knowledge encompasses the purposes, aims, steps, styles, management skills, lesson planning, and assessing learning outcomes. The framework finally discusses the importance of Content Knowledge (CK) which is related to ICT integration in teaching. This aspect focuses on the subject matter knowledge, including conceptual and theoretical knowledge of a particular subject matter. Additionally, this type of knowledge might include practical and professional knowledge which are related to teacher professional development and learning.



**Figure 1.** TPACK Model of ICT Integration.

The three types of knowledge cannot stand alone in terms of ICT integration. They must work together to achieve effective teaching and learning outcomes. According to the Figure, Technological Pedagogical Content Knowledge (TPACK) describes teachers' understanding of how technology, pedagogy, and content can be integrated and influence each other in the processes of designing and instruction. TPACK involves understanding how the subject matter can be communicated via different ICT offerings, and considering which specific ICT tools might be best suited for specific subject matters or classrooms. These tools and content knowledge should be considered in terms of pedagogical affordances and constraints.

In brief, this aspect integrates and relates all aspects of technology, pedagogy, and content knowledge. Another interplay is Technological Content Knowledge (TCK) which addresses teachers' abilities and skills of how technology and content knowledge can both influence and push against each other in teaching and education. Technological Pedagogical Knowledge (TPK), focuses on teachers' understanding of how particular technologies can change both the teaching and learning experiences by introducing new pedagogical methods that are suitable for teaching and learning.

Another aspect of TPK concerns understanding how such ICT tools can be deployed alongside pedagogy in ways that are appropriate to the discipline and the development of the lesson at hand. Finally, Pedagogical Content Knowledge (PCK) addresses teachers' knowledge



regarding foundational areas of teaching and learning, including curricula development, student assessment, and reporting results. PCK aims at promoting learning and tracing the links between pedagogy and its supportive practices. In all cases, PCK seeks to foster teaching practices by focusing on connections between the content and the pedagogy employed to achieve the objectives of the lessons. This research aims at investigating the conditions of ICT integration such as ICT infrastructure, ICT facilities, and ICT personnel. The underlying for focusing on these three components is that they serve as the main drivers for integration and application.

### 3. METHOD

The design of this research was driven by the research objectives, research questions, and ICT theories and literature. The present study employs mixed methods research: quantitative and qualitative methods. Data saturation and to obtain an in-depth understanding of the issues. The survey questionnaire was used to collect data from a large volume of participants (teachers) regarding the conditions of using ICT and the semi-structured interview was utilized to seek insights into the issue under investigation from administrators, the needs for ICT training and suggestions for developing ICT in the Lao teacher education institutions. Specifically, the design of this study draws on important elements of exploratory and ethnographic research. This in turn ensures the credibility, dependability, conformability, and transferability of the study (Nowell *et al.*, 2017).

#### 3.1. Participants

The research participants were the teachers and administrators who served at the Lao teacher education institutions. The teachers were selected by using Yasmine formula for determining sample size. The total number of teachers at the teacher education institutions in Lao PDR in the academic year 2021-2022 was 1,742. According to the formula, 460 teachers were recruited to participate in the survey (4% of margin error). In terms of the administrators, three main tiers (e.g., Deans-Directors, Committees, Heads of academic sections, and offices) in a total of 32 people were selected to share insights about the conditions of ICT application in Lao teacher education institutions. They were selected by using a purposive sampling method. The participants were interviewed to provide data about the issue under investigation. conditions of using ICT and needs for ICT training in teacher education institutions in Lao PDR.

#### 3.2. Instruments

As previously indicated, the questionnaire and semi-structured interviews were used to collect the data. The instruments were designed by studying and reviewing theories, related studies, and documents. This was to ensure that the design of the instruments was in alignment with the research objectives. The questionnaire is in the form of a Likert scale from 5-1 (5 means strongly agree and 1 means strongly disagree). The questionnaire was piloted with a group of teachers who had similar characteristics to the participants of the main study. The semi-structured interview was designed and used to seek administrators' insights and opinions about ICT.

#### 3.3. Data Analysis

The data drawn from the survey questionnaire and semi-structured interviews were analyzed separately before corroborating the findings. The quantitative data were analyzed

by using descriptive statistics to find Mean and Standard Deviations. The qualitative data were analyzed by using a thematic and content analysis. The underlying reason for using this method is due to the nature of the data obtained. This method enabled the researchers to reduce, organize, code, and summarize a large volume of data inductively. It also enabled the research team to examine the emerging themes and patterns according to the literature review. Because the conditions of ICT application are dynamic, the data analysis was mainly inductive to summarize the emerging themes and provide answers to the research questions. However, this did not mean that new insights and themes that were not derived from the research questions or literature review were not taken into consideration. In other words, the analysis mainly looked at all emerging themes and content that were related to the issue being investigated.

#### 4. RESULTS AND DISCUSSION

The findings of this research are presented following the research objectives and questions asked earlier. The first research question asks 'What are the conditions for using ICT in the Lao teacher education institutions?'. Based on the statistical analysis, it was found that the conditions of using ICT were perceived as neither poor nor excellent. Details and descriptions of the results in three components are presented in the following tables.

**Table 1** illustrates the ICT Infrastructure. As can be seen, the findings reveal that this was at the 'agree level' ( $\bar{x} = 3.51$ ; S. D = 0.95). When closely considering each item, Item 4 (There are meeting rooms that are suitable for installing ICT tools) is perceived as the highest mean score ( $\bar{x} = 3.69$ ; S. D = 0.93). Followed by Item 1, which is about having buildings and facilities that are conducive to using ICT ( $\bar{x} = 3.66$ ; S.D = 0.90). The item that was perceived the lowest mean score is Item 2, which is about having sufficient operating rooms for ICT ( $\bar{x} = 3.24$ ; S. D = 1.03).

**Table 1.** The conditions of ICT infrastructure.

No.	Description	$\bar{x}$	S. D	Meaning
1	Some buildings and facilities are conducive to using ICT.	3.66	0.90	Agree
2	There are operating rooms for ICT (e.g., recording rooms, lab, video recording rooms) that are convenient.	3.24	1.03	Moderately agree
3	Some classrooms are suitable for installing ICT tools.	3.46	0.95	Moderately agree
4	There are meeting rooms that are suitable for installing ICT tools.	3.69	0.93	Agree
<b>Total</b>		<b>3.51</b>	<b>0.95</b>	Agree

**Table 2** demonstrates the results of the conditions of using ICT facilities/materials in the Lao teacher education institutions. As can be seen, the findings reveal that the Facilities/ICT Materials are at a moderate level ( $\bar{x} = 3.17$ ; S.D = 0.93). When examining each item, Item 2, which is about the availability of a stable and high-speed internet system that can be used on the campus/premises ( $\bar{x} = 3.29$ ; S. D = 0.93). Items 1 (There are sufficient computers for the needs of the institutions) ( $\bar{x} = 3.19$ ; S. D = 0.96) and 3 (There are sufficient ICT tools for teaching and learning such as LCD projectors, photocopiers, and digital scanners) come the second ( $\bar{x} = 3.19$ ; S. D = 0.88). The item that received the lowest mean score is Item 5, which is about the availability of software and computer programs such as SPSS and others ( $\bar{x} = 3.05$ ; S. D = 0.94).

**Table 3** shows the conditions of ICT personnel results perceived by teachers at the Lao teacher education institutions. The findings show that the ICT personnel was perceived as the moderately agree level ( $\bar{x} = 3.25$ ; S. D = 0.91). When considering each item, the highest mean

score is Item 3, which is about having ICT service consultants who can provide service and advice ( $\bar{x} = 3.40$ ; S. D = 0.84). The second one is Item 2, which is about having ICT personnel who could share and conduct training when in need ( $\bar{x} = 3.38$ ; S. D = 0.86). The lowest mean score is Item 1, which is having sufficient ICT personnel ( $\bar{x} = 3.13$ ; S. D = 0.90).

**Table 2.** The conditions of ICT facilities/materials.

No.	Description	$\bar{x}$	S. D	Meaning
1	There are sufficient computers for the needs of the institutions.	3.19	0.96	Moderately agree
2	There is a stable and high-speed internet system that is available on the premise.	3.29	0.93	Moderately agree
3	There are sufficient ICT tools for teaching and learning such as LCD projectors, photocopiers, and digital scanners.	3.19	0.88	Moderately agree
4	There is an audio and visual system such as speakers, microphones, televisions, ...for teaching and learning, and conferencing.	3.11	0.93	Moderately agree
5	There are software and computer programs such as SPSS, Photoshop, OBS, Canvas, Windows movie markers, and others for creating teaching and learning materials/aids.	3.05	0.94	Moderately agree
<b>Total</b>		<b>3.17</b>	<b>0.93</b>	Moderately agree

**Table 3.** The conditions of ICT personnel.

No.	Description	$\bar{x}$	S. D	Meaning
1	There are sufficient ICT personnel.	3.13	0.90	Moderately agree
2	There are ICT personnel who can share and conduct training.	3.38	0.86	Moderately agree
3	There are ICT service consultants who can provide service and advice.	3.40	0.84	Moderately Agree
4	There are ICT personnel who can fix or install ICT tools.	3.13	0.99	Moderately Agree
5	There are ICT personnel who can manage and inspect the ICT system such as databases, online security, websites, or other ICT materials.	3.22	0.97	Moderately agree
<b>Total</b>		<b>3.25</b>	<b>0.91</b>	Moderately agree

The second research question asks "What needs were perceived most in terms of ICT training for the Lao teacher education institutions?"

**Table 4** illustrates the results of what teachers perceived as the need for ICT training. As **Table 1** indicates, the overall result of the need for ICT training is at the needed level ( $\bar{x} = 3.98$ ; S. D = 0.77). When closely considering each item, Item 4, which is about how to use Microsoft Office, is rated as the highest mean score ( $\bar{x} = 4.08$ ; S. D=0.89). The second highest means score is Item 5, which is about using tools in Google: creating Google Classroom and organizing meetings by using Google Meet, how to create questionnaires by using Google Form, ( $\bar{x} = 4.05$ ; S. D=0.92), especially how to use tools in Google (creating Google Classroom and organizing meetings by using Google Meet, how to create questionnaires by using Google form...). The lowest mean score is Item 1, which is about using Microsoft Office (Word) in formatting documents for writing textbooks (using functions in Microsoft Word), ( $\bar{x} = 3.92$ ; S. D = 0.49).

In addition to the quantitative data, the open-ended question section of the questionnaire asks the respondents to provide additional information about the need for ICT training. The responses were summarized and the emerging themes are as followings: first, most of the respondents expressed the need to train about how to use applications for teaching such as Google Classroom, using research engines, programs for data analysis, document formatting,

how to design a cover page, PowerPoint, software development, installing programs, and information about Microsoft offices.

The final question of the research asks 'What are the suggestions/guidelines for improving ICT works in the Lao teacher education institutions?'

The data were collected from education administrators through using semi-structured interviews. The data were analyzed by using a thematic and content analysis. The analysis reveals important themes about how ICT works in the Lao teacher education institutions can be improved and developed. First, the majority of the participants expressed that the teachers should be motivated to study ICT; that the institutions should provide ongoing training, that teachers should use PowerPoint more in teaching, that the macro level should provide financial support to build operation rooms and modern classrooms, that should have LCT projectors installed in every classroom, assess teachers' abilities to use ICT tools, and that there should be in-service ICT training for the teachers.

**Table 4.** Needs for ICT training.

No.	Description	$\bar{x}$	S. D	Meaning
1	Using Microsoft Office (Word) in formatting documents for writing textbooks (using functions in Microsoft Word).	3.90	0.49	Needed
2	How to use the reference function in Microsoft Word.	3.91	1.00	Needed
3	How to use Microsoft Office (Excel) to calculate scores, and manage grades (using functions in Microsoft Excel).	3.92	0.98	Needed
4	How to use Microsoft Office (PowerPoint) to design a presentation, make a poster, book cover... (how to use functions in Microsoft PowerPoint).	4.08	0.89	Needed
5	How to use tools in Google (creating Google Classroom and organizing meetings by using Google Meet, how to create questionnaires by using Google form...).	4.05	0.92	Needed
6	How to use Zoom and functions of Zoom.	3.98	0.98	Needed
7	How to create and make videos for teaching and learning, use OBS program, Windows Movie Maker...	4.00	1.12	Needed
8	How to design a book cover and documents (reports, projects, and final projects...)	4.03	1.01	Needed
9	How to design a poster and brochure.	3.95	1.18	Needed
10	How to use the program SPSS	4.00	1.15	Needed
<b>Total</b>		<b>3.98</b>	<b>0.77</b>	Needed

Drawing from the results of the present investigation, many important issues are discussed to better understand the issue being studied. In this regard, the discussion shall relate the main and consistent pictures of the findings to the literature, theories, and related studies being reviewed.

First, the conditions for using ICT tools in the Lao teacher education institutions, as the findings reveal, were at a moderate level. This indicates that the current situation of ICT applications was neither good nor poor. The underlying reason behind this is that the majority of the teachers who completed the survey had ever participated in the ICT training as the survey reveals, which allows them to perform basic ICT skills and have some degree of knowledge to apply ICT tools in working and teaching. Although the teacher educators were exposed to learning about basic ICT tools, they still have difficulties when it comes to applying ICT knowledge, skills, and tools to actual classroom practices and work-related tasks due to a lack of ICT materials and poor internet connections. The findings of this research are consistent with (Aidoo et al., 2022) who investigated the challenging and contributing conditions of using ICT in Ghana. This means that there are two sides of a coin when it comes

to applying ICT tools in education. These are advantages and challenges. The advantages are that ICT helps save time and can be used anytime and anywhere if internet access is available. This depends largely on the context in which ICT tools are used and integrated. The challenges are, as the literature and related studies suggest, it can be difficult in certain circumstances when ICT tools are not properly working and when there is a lack of devices and internet connections. Since using ICT tools involves both the users and the tools/materials, these two players must support and help each other.

In terms of ICT infrastructure, the findings show that this aspect was at a moderate level. This means that there are basic and necessary ICT infrastructures such as buildings and operating rooms for teacher educators to perform office work and teaching. The problems, however, are that some of these infrastructures are in poor conditions, meaning that they are not conducive to teaching and learning. This can impede and impact the quality of learning and teaching. The findings are related to (Bariuntorukiri *et al.*, 2021; Ghavifekr *et al.*, 2016; Gupta, 2022; Khatoony & Nezhadmehr, 2020; Sisombath *et al.*, 2022) who found out that the conditions of using ICT are affected by many contributing obstacles. One of the reasons behind this issue is a lack of upgrading and maintaining the existing infrastructures due to insufficiently properly support from the party concerned.

Regarding the ICT facilities/materials, the findings reveal that this component was at a moderate level. The conditions of ICT facilities in the Lao teacher education context were relatively similar to the other ASEAN contexts in terms of unstable internet connections, in-updated ICT tools, poor conditions of audio-visual materials, and in-updated software. The quantitative findings were also consistent with the qualitative results from the interviews in terms of unstable internet connections when it comes to using online modes for working and instructions. The underlying reason is because of a lack of financial support to provide and install high-speed and reliable internet connections, not only for the teacher education institutions but also for household families and individuals. Also, many teachers avoided using the internet provided by the institutions because of slow and unstable speed which affected the process of instructional practices. Therefore, most of the teachers had to use their private data packages and pay for the internet themselves, leading to extra expenses. Another reason is that not all teachers' educators and students have or can purchase high-quality ICT devices such as laptops for online classes. This is challenging in terms of learning and teaching. Also, as the findings reveal, some teachers perceived the ICT system as a strange thing to apply in their classroom practices, research, and work-related activities. All of these issues were related to the studies by (Amhag *et al.*, 2019; Laungsombath *et al.*, 2021; Sisombath *et al.*, 2022) who pointed out that the challenges of using ICT could be attributed to unstable internet connections, outdated ICT tools and unavailability of ICT software and applications.

In terms of the ICT personnel, the findings illustrate that this aspect was perceived at a moderate level. This can be interpreted and noted that ICT personnel served in the teacher education institutions were just available in terms of the number and abilities to conduct training, provide advice, maintain or install tools and inspect problems related to ICT services. The findings, however, reflect the overall picture of the issue being investigated without closely looking at each institution. The findings here suggest a promising result. What is interesting to note is that the result drawn from interviews reveal a lack of teachers who majored in ICT specialization. Because of this, teachers who were able to use computers, even though it was not their majors, volunteered to teach ICT or computer classes. This reflects a shortage of teachers to have majored in ICT or Computer Sciences. This phenomenon is consistent, there was a lack of ICT personnel at various education institutions in the Lao context.

Additionally, the findings of the present investigation also reveal a digital gap between the older and younger generation teachers, meaning that novice or newly employed teachers tended to have more confidence and skills in using ICT tools than the older generations. This has had a direct impact on teaching when integrating ICT tools into the actual classroom instruction. The result here is related to [Ngao et al. \(2022\)](#) who examined teachers' perceptions of the integration of ICT tools into teaching which illustrates that old-generation teachers had difficulties using ICT tools. More importantly, the results of an analysis regarding teacher educators' ICT proficiency indicate that many teachers still regarded themselves as basic users (Level 1). This means that they needed to be upgraded their skills in using ICT tools. Interestingly, only 3% of the teachers regarded themselves as advanced ICT users. The findings are consistent with what was expressed in the interview with the administrators in the sense that there was a lack of ICT specialists.

The second point of discussion here focuses on the need for ICT training which was one of the key components of this research. The results reveal a high degree of need for ICT training in Lao teacher education institutions. As previously indicated, using ICT tools/applications can be challenging for most teacher educators. Because of this, in-service teacher training did not have a significant impact on teachers' perceptions and performance. The findings reveal the need for using ICT applications, using search engines, software for data analysis, and other tools related to ICT integration. The findings reflect what was found in [Soulignavong and Vongsouangtham \(2022\)](#) study regarding the ICT needs and workshops to foster teachers' performance and proficiency in using ICT tools.

The final point of the discussion focuses on possible suggestions for improving ICT development in the Lao teacher education institutions. As previously presented, what should be focused on to address this includes there should be the motivation of teachers to study ICT so that the problem can be reduced and solved. What is important to note here is that there should be an educational ICT curriculum for education students to undertake. This can help address the problem of ICT or computer teacher shortage in the long term. Also, encouraging in-service teachers to study ICT is another solution to address the issue. However, in-service teachers have already been overloaded with teaching and administrative work. To achieve this goal, there should be a strategic plan so that each teacher education institution can put this into practice. The point here is related to an investigation by [Rana \(2020\)](#) who pointed out a lack of a focused strategy for ICT development and instruction which was a contributing factor for improving ICT in most educational contexts. Another important point to discuss concerning ICT development in the Lao teacher education institution is to conduct ongoing in-service professional ICT training.

Although many teacher educators have mastered the basic ICT skills, as the findings show, they needed to be updated and learn new ICT tools in their professional and social lives. In other words, professional training should be carried out in conjunction with other forms of ICT development activities such as improving ICT facilities and maintaining existing materials. Another important point to discuss here is to conduct follow-up activities on the use and integration of ICT tools in the teaching of the teachers after participating in the ICT professional training. A lack of this can hold back the advancement of ICT development as many teachers go back to their classroom without adopting or changing their attitudes toward new things even in the face of contradictory ways. The point discussed here is also consistent with a study by [Amhag et al. \(2019\)](#) who found that one of the challenging issues regarding the effectiveness of ICT development and training is a lack of follow-up activities on ICT application and this study is related to [\(Sayasine & Loipha, 2018\)](#) who investigated the situations of ICT improvement in Lao PDR.

## 5. CONCLUSION

This mixed methods research was carried out to conditions of ICT integrating/applications in the Lao teacher education context where it is under-researched. To achieve the objectives, both quantitative and qualitative methods were employed to collect and analyze the data. The statistical results indicated a significant result in terms of ICT infrastructure, ICT facilities, ICT personnel, needs for ICT training, and suggestions for improving and developing ICT works in Lao PDR. Specifically, the results indicated that the conditions of using ICT were neither poor nor excellent, suggesting that there were areas of improvement. The findings from the semi-structured interviews also reveal important themes regarding the need to conduct training on ICT tools such as how to use applications (e.g., Zoom) in teaching, how to format documents, and use software in running statistical analysis. The suggestions for developing and improving ICT works include providing ongoing training on how to use ICT, creating operation rooms, providing ICT tools for classroom instructions, and upgrading teacher skills in ICT.

## 6. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. Authors confirmed that the paper was free of plagiarism.

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