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Research Article

ICT readiness of secondary school teachers: Mongolian case study

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ABSTRACT

Information and communication technology (ICT) can be effectively used in education and training to improve the quality of classroom learning, to encourage student creativity, to expand student collaboration and to introduce innovation to education rather than as a tool for delivering learning content. This document aims to determine and evaluate the ICT readiness of teachers at secondary education schools in Mongolia. One thousand nine hundred seventeen teachers from more than 150 secondary schools participated in the survey. This study aimed to evaluate five skills of teachers: (1) the assessment of teachers' ICT application competence, (2) the review of ICT competencies in teaching and learning, (3) the duration of ICT usage in lessons, (4) classroom setup, and (5) the use of ICT to support the learning of children with disabilities. An online survey was conducted using the UNESCO ICT readiness survey questionnaire. In this questionnaire, subject matters such as the teacher's general information; the use of ICT in education; the school's ICT infrastructure; ICT at the level of education policy; teachers' ICT skills; ICT used in teaching-learning; organization and management; and teachers' professional skills were included. A total of 1,917 teachers attended the survey, about 7% of the total number of secondary school teachers in Mongolia. Of these, 32 percent (608 teachers) were aimag center schools, 0. 2 percent (5 teachers) were teachers, 42 percent (809 teachers) were the capital city and 26 percent (495 teachers) were soum teachers. The research shows that secondary school teachers are ready to use ICT daily. Teachers are interested in improving their technology, ICT-related pedagogical knowledge, and skills to effectively use ICT and digital technologies in their teaching and learning activities. Therefore, acquiring the knowledge and skills to implement ICT in the curriculum in teacher training and teacher professional development programs is necessary.

Keywords: information and communication technology, ICT readiness, use of ICT in training, ICT knowledge and skills of teachers, Mongolia

INTRODUCTION

Information and communication technology (ICT) plays a vital role in preparing students to live in the modern world of an information-driven society, improving educational quality and efficiency, and making learning more exciting and unconventional. Since the beginning of the information age, ICT has maintained a crucial role in improving education quality. Policymakers recognize and realize the significance of ICT integration into the education system (UNESCO, 2003). The need to incorporate ICT into education is increasing in all countries. It aims to promote the practical use of ICT in education, whether it relates to teacher training, the development of pupil's skills, or using educational software (Uyanga, 2013). Both teaching and using ICT in primary and secondary education are essential in building the ICT knowledge and skills required for future learning.

Integration of ICT in education refers to the use of computer-based communication that is incorporated into daily classroom instructional processes. Coincident with preparing students for the current digital era, teachers are seen as the key players in using ICT in daily classrooms. This is due to the capability of ICT to provide a dynamic and proactive teaching-learning environment (Arnseth & Hatlevik, 2010). Adequate and proper use of ICT in education depends on teachers' ICT knowledge and competence. Therefore, regarding the immediate development of society, teachers' acquisition of ICT theory, methodology, knowledge and skills has gained significant importance (Tsedevsuren, 2019). However, teachers may not be ready to integrate technology without adequate knowledge and skills to utilize technology to support the curriculum (Al-Awidi & Aldhafeeri, 2017).

The Asia-Pacific regional strategy on using ICT to facilitate the achievement of education 2030 programs defines that "on the quality of teaching and teaching practices, member states to develop competency standards for teachers towards ICT-integrated transformative pedagogies and establish learning spaces and communities of practices to support teachers and share innovations" (So et al., 2018, p. 15).

These days, ICT has penetrated all economic and social sectors of Mongolia. The Government of Mongolia pays more effort and attention to integrating ICT into the public sector and government service delivery. The current government reforms have a significant ICT component, including developing a master plan for ICT, addressing ICT policy, infrastructure, hardware, software, Internet and communication, human resource development and capacity building, content development, and others. Significantly, the Government pays attention to the education sector development, education quality, equality of education and teacher development. One of the objectives of the General Law on Education of Mongolia is to improve the general education system to the international benchmark levels and to provide quality education to Mongolian citizens. The law defines the importance of ICT knowledge and skills for citizens to learn vocational guidance, skills, innovation, lifelong learning and knowledge and skills to compete in the international labor market, in line with the goal to build skilled Mongolians knowledge-based society (Parliament of Mongolia, 2023).

As ICTs continue to develop rapidly and globalize, it is essential for everyone to use technology safely, efficiently, ethically and responsibly. Teachers play a crucial role in fostering the development of such responsible citizens. Regardless of the subject taught, teachers must guide and advise students on using ICT effectively and according to their needs. Thus, the teachers have mastered ICT to a certain extent by their profession and teaching methods (UNESCO, 2018). This issue is being addressed by developing and implementing teacher ICT competency standards. Such examples can be seen in many countries around the world and Asia. Reviewing the inclusion of teacher's ICT competence ideas into ICT policy documentations adopted by international organizations, other countries of the world and Mongolia in the field of education, it was observed that there is a need for further development of clear concepts, policies, and regulations on teachers' ICT competence (UNESCO, 2021).

Research studies show that we need to consider the level of ICT knowledge and skills of young people in the digital age and pay attention to their ICT education. "Although most young people seem ready to interact with technology, there is still a large share of youth with low proficiency levels" (OECD, 2016, p. 2). "Some of 82% of middle-schoolers couldn't distinguish between an ad labeled "sponsored content" and a real news story on a website, according to a Stanford University study of 7804 students from middle school through college" (Shellenbarger, 2016). "By not doing the work necessary to help youth develop broad digital

competency, educators and the public end up reproducing digital inequality because more privileged youth often have more opportunities to develop these skills outside the classroom" (Boyd, 2014, p. 180).

In addition to the fundamental knowledge and skills related to ICT in general education, it is crucial to utilize ICT for finding, analyzing, and processing information, as well as for communicating, collaborating, and engaging in continuous learning. The use of ICT in education aims to enhance the quality of knowledge in the classroom and to better align with student's desires, interests, opportunities, and learning conditions. Therefore, the ICT environment within the school, along with teacher's attitudes, approaches, and proficiency in using ICT for educational purposes, plays a vital role in this process.

The school's ICT infrastructure is essential in implementing ICT in training. Therefore, let us examine some data to clarify the availability of school infrastructure and technology. These include

(1) in the 2021–2022 academic year, all 695 public schools were connected to the Internet. Internet average speed is 23.2 Mbs (Ministry of Education and Science of Mongolia, 2024),

(2) the number of children per computer in 2023 was 23.6, and

(3) the ratio of children to innovative technology was 25 to 1, and the ratio of teachers to innovative technology was 2 to 1 in 2022 (Ministry of Education and Science of Mongolia, 2023).

The successful integration of ICT into the classroom will depend on the ability of teachers to structure the learning environment in new ways, merge new technology with new pedagogy, develop socially active classrooms, and encourage cooperative interaction, collaborative learning, and group work. Thus, it requires a different set of classroom management skills. The teaching skills of the future will include the ability to develop innovative ways of using technology to enhance the learning environment and to encourage technology literacy, knowledge deepening and knowledge creation. Teacher professional learning will be crucial to educational improvement (UNESCO, 2018).

In recent years, Mongolia has taken various measures to enhance the ICT knowledge and skills of secondary school teachers. However, there has been no specific research on teachers' ICT knowledge and readiness. Therefore, we conducted this study to assess the ICT readiness of teachers in Mongolia. This research proposes several benefits, such as improving the ICT curriculum in teacher training schools, increasing the effectiveness of professional development for teachers, and supporting their overall development.

Research Problematization and Contributions

Teachers' understanding and ability to use ICT effectively in teaching have become indicators of effective technology-driven instruction. This study is unique and significant as it is the first to survey teachers' knowledge and ability to use ICT in teaching. It encompasses 7 percent of all teachers in general education schools in Mongolia and is grounded in the UNESCO ICT competency framework for teachers (ICT-CFT). The results of this survey are also presented in the study. The findings of this study provide a foundation for policymakers and implementers to create and implement new policies regarding the integration of ICT in the education sector. Additionally, these results can guide the development of programs aimed at enhancing the knowledge and skills of secondary school teachers in using ICT for teaching, as well as organizing training and activities in this field.

LITERATURE & PREVIOUS RESEARCH REVIEW

Concerning the views presented on the required ICT knowledge, it is essential to explore teachers' ICT knowledge status. There seem to be two significant problems identified in the literature, which can be considered complementary. The first one is that many teachers do not have adequate technological knowledge of how to use a device in terms of its software, hardware, affordances and constraints. The second is that knowing various technological devices, although important, is not enough. Instead, teachers also need knowledge of how to use ICT devices as instruments that can enhance teaching and learning, which a majority of teachers do not know how to do (Naicker, 2017). E-learning is often not learner-centered (Cutri & Mena, 2020), making it crucial to focus on the quality of blended and online learning, as well as student satisfaction, alongside the satisfaction of schools and teachers. The successful implementation of e-learning relies heavily

on the ICT skills of teachers (Maphalala & Adigun, 2021), and it is essential for both students and teachers to actively participate in this process.

The use of technology in education is increasing worldwide due to its numerous advantages (Koehler & Mishra, 2009; Wahyu et al., 2020). As technology becomes more prevalent, it is employed to reduce classroom instructional time (Kaizer et al., 2020), enhance communication between teachers and students (Liu et al., 2020), increase student engagement and participation (Alokluk, 2018; Ghosh et al., 2019), and improve students' academic achievement.

Traditional teaching methods are increasingly considered ineffective in the learning of digital technology era, prompting educators to reconsider and modernize their instructional approaches. The integration of technology into teaching practices has thus become essential, supported by theoretical frameworks such as the Technology Acceptance Model (TAM) (Davis, 1989), the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003), and Technological Pedagogical Content Knowledge (TPACK) (Mishra & Koehler, 2006).

These theories provide insight into teachers' capabilities to effectively use ICT in various learning environments, such as traditional classrooms, blended learning, or online courses. Research on these technologies has been limited in developing countries like Mongolia, partly because they are not yet widely adopted in teaching and learning practices. Among these theories, TAM is most frequently applied to explain teachers' intentions to use technology (Tarhini et al., 2015).

To effectively integrate technology into the classroom, teachers must possess a solid understanding of the pedagogical content related to these tools (Mishra & Koehler, 2006; Widyasari et al., 2022). To assist teachers in acquiring TPACK knowledge and skills, policymakers and educational stakeholders need to understand their behavioral intentions regarding technology use (Chai et al., 2011; Joo et al., 2018) in the classroom. Due to the low adoption of these technologies in Mongolia's educational practices, there is relatively little research in this area.

In particular, there is a need to acquire the knowledge and skills necessary to leverage digital technologies to enhance student learning, making it more productive, interesting, collaborative, and independent, and to apply them in teaching and learning.

For example, it has been studied that integrating technology into teaching through the TPACK model can positively influence higher education lecturers' teaching practices, self-confidence, and autonomy. Moreover, educators' technological competencies can be significantly improved through structured training, rationally defining the ease of use of technology, its benefits, and facilitating conditions, and by supporting it from the administration (Al-Adwan at al., 2024b).

The continuous use of technology in teaching is fundamental to effectively integrating technology into teachers' teaching practices. Under such conditions, teachers are more likely to integrate technology into teaching and implement it continuously and effectively, and some research results indicates that such integration positively changes teaching practices (Al-Adwan at al., 2024a). These studies demonstrate that technology can be effectively integrated and create continuous use.

Tsedevsuren and Purevdorj (2011) conducted a study in 2011 on ICTs in the education sector, especially on the government's policy on introducing the education sector and its implementation. These studies show that the government supplied the required equipment to schools as part of the policy to introduce ICT in the education sector. However, its use is insufficient and has a minor effect on the quality and access to education (Tsedevsuren & Purevdorj, 2011).

Some professors at the Mongolian State University of Education (MSUE) and the National University of Mongolia (NUM) surveyed students' ICT knowledge and skills in the teacher training program (Tsedevsuren et al., 2014). The survey results show that teachers and students have low self-esteem and lack self-confidence in acquiring knowledge and skills to use ICT in training and information processing.

By developing a consistent growing teachers' ICT competence and its application methodology and applying it to teaching practice, it would be possible to improve students' and teachers' ICT competence and enhance their achievements. The theoretical novelty and practical applicability of the research claims to be the following (Munkhtuya et al., 2017):

Table 1. Content of the questionnaire

Category	Description
General information	Teachers' age, gender, education, working experience, and subject
Knowledge of ICT	
Using ICT in teaching	Openness and approach to the use of ICT in educational activities
Schools' ICT infrastructure	Availability of ICT environment, equipment, and tools in schools and classrooms
Education policy regarding ICT	National and school-level ICT policies and their implementation and teachers' participation in them
Using ICT in teaching and learning	
Teachers ICT skills	Use of software tools, Internet and communication tools in training
Using ICT in teaching and learning	Use of ICTs to support student independence and collaboration, and support communication between teacher-student, student-student and other participants' engagement in learning.
Organization and administrative work	Use of ICTs in classroom organization and support students with special needs
Teachers professional training	Use of ICTs for professional development needs, ICT training needs and coverage

1. The teachers' ICT competence level has been identified, and issues of integrating it into teaching practice have been analyzed.
2. Based on the research studies of modern theories, conceptual framework, scholarly works, international standards, and documentation related to the teacher's ICT competence and with the use of UNESCO recommendations, the invariant model for developing teacher's ICT competence and its framework has been proposed within the current research.
3. The methodology for applying the invariant model for developing teachers' ICT competence has been piloted. Application of this methodology will contribute to the training of ICT-competent teachers and educators.
4. There has been an attempt to bring teacher education programs and ICT-competent teachers' practice closer to the international requirements.

Research on ICT infrastructure in schools, Internet usage and availability of ICT tools and equipment shows that the general education sector's ICT infrastructure is relatively well developed (Munkhbaatar & Dunjinnamdag, 2017). A few methodological and research papers on using ICT in primary education have also been published (Tsedevsuren, 2016).

RESEARCH DESIGN & METHODOLOGY

The primary objective of this study is to define and assess the current state of ICT readiness among secondary school teachers in Mongolia, utilizing a sample survey method (**Table 1**). The research aims to

(1) identify teachers' ICT knowledge, including their understanding of ICT policies, school infrastructure, and their use of ICT in teaching and daily activities,

(2) assess teachers' ICT skills and identify their needs,

(3) examine the ways in which teachers use ICT in various context, including education and learning, administrative tasks, and professional development, and

(4) conduct a UNESCO ICT readiness survey electronically and perform statistical analysis on the collected data.

This study was conducted as a questionnaire survey from October to December 2020. Teachers from over 150 secondary schools were invited to participate in the survey. The survey was completed online using the UNESCO teacher ICT readiness survey. This questionnaire includes sections covering general information about teachers, the use of ICT in education, ICT infrastructure of schools, education policy related to ICT, teachers' ICT skills, the implementation of ICT in teaching-learning, administrative tasks, and professional training for teachers.

We organized the study in the following stages:

1. **Preparation:** Following UNESCO ICT-CTF, we developed a survey questionnaire. This questionnaire was discussed with relevant stakeholders, checked for its consistency and compatibility, and finalized. Additionally, we determined the sample population.
2. **Survey collection:** We organized activities including providing information to teachers selected for the study, developing the survey questionnaire, delivering it online to participants. The survey was conducted over a two-month period.
3. **Survey analysis:** We reviewed the survey data and validated the responses of 1,917 participating teachers. The survey results were statistically analyzed using MS Excel and SPSS 22, and the research findings and results were presented.

The study employed a quantitative approach. The data was collected from 1,917 (male = 300, female = 1,617) in-service teachers who agreed to participate in this study from 17 provinces, 8 districts of Ulaanbaatar. **Table 2** shows the respondents' general information.

RESEARCH RESULTS

General Information

Administratively, Mongolia is divided into 21 aimags (provinces). Aimags are split into 330 soums (counties or rural districts) and 1,615 bags (villages). The capital city of Mongolia, Ulaanbaatar City, has nine districts, which are 152 sub-districts. Thirty thousand, four hundred teachers (24,879 are female) were teaching at 871 (80% are state-owned schools, 20% are private schools) general education schools nationwide in the 2021–2022 academic year (Ministry of Education and Science of Mongolia, 2024).

The survey covered 17 aimag/provinces, including Arkhangai, Bayan-Ulgii, Bulgan, Govisumber, Darkhan-Uul, Dornogovi, Dundgovi, Zavkhan, Orkhon, Uvurkhangai, Umnugovi, Sukhbaatar, Selenge, Tuv, Uvs, Khovd, and Khentii and eight districts of Ulaanbaatar City, including Songino-Khairkhan, Sukhbaatar, Khan-Uul, Baganuur, Bayangol, Bayanzurkh, Nalaikh, and Chingeltei. A total of 1,917 teachers participated in this survey, about 7% of the total number of secondary school teachers in Mongolia. **Table 2** shows the respondents' characteristics.

Of the respondents, 42% (809 teachers) are from Ulaanbaatar city, 32% (608 teachers) are from the aimag center's schools, 26% (495 teachers) are from soum schools, and 0.2% (5 teachers) are from bags. Out of the total 1,917 teachers surveyed, 1,617 (84%) are female and 300 (16%) are male. Additionally, 99.2% of the participants are from public schools, while 0.8% (16 teachers) are from private schools. In the survey of 1,917 teachers, the following experience levels were reported: 25% have worked for four years or less, 27% for 5–10 years, 32% for 11–20 years, 12% for 21–30 years, and 4% for more than 30 years. Among these teachers, 41% are teaching methodologists, 19% are leading teachers, 1% are consulting teachers, and 39% are classified as young teachers. In terms of age distribution, 35% of the teachers are under 30 years old, 36% are between 31 and 40 years old, 21% are aged 41 to 50 years, 7% are 51 to 60 years old, and 1% are over 61 years old. This data indicated that the proportion of young teachers in secondary schools is relatively high.

Regarding the professional degree, 0.1% of them have a doctoral degree, 20% have a master's degree, 73% have a bachelor's degree, and 7% have a higher education degree, and the remaining 0.2% answered "others". That shows that soum and local schools employ non-teaching staff in subjects that require specific skills, such as music, technology, and physical education. About 33% of the respondents teach grades I–V, 36% teach grades VI–IX, 28% teach grades X–XII, and 3% answered "others". Other respondents included non-teaching staff, such as the training manager, school director, and social workers.

As presented in **Table 3**, approximately 30% of the teachers are primary school teachers, 13% are foreign language teachers, 9% are specialize in Mongolian language and literature teachers, and 8% are mathematics teachers. Furthermore, 12% of the teachers are natural sciences, which include physics, chemistry, biology and geography, while 7% teach history and social sciences teachers. This distribution indicates that our survey teachers from a wide range of subject areas. **Table 3** provides a detailed overview of the subjects taught by the respondents.

Table 2. Demographic profile of respondents

Demographic profile	Demographic profile	Number of respondents	Percentage (%)
Gender	Male	300	16
	Female	1617	84
Age	Under 30	671	35
	31–40	690	36
	41–50	403	21
	51–60	134	7
	61 and above	19	1
School location	Capital city	809	42.2
	Aimag center	608	31.7
	Soum	495	25.8
	Bag	5	0.3
School type	Public school teachers	1901	99.2
	Private school teachers	16	0.8
Education	Higher education	132	6.9
	Bachelor	1400	73
	Master	383	20
	Doctor	2	0.1
Working year	4 years or less	479	25
	5–10 years	518	27
	11–20 years	613	32
	21–30 years	230	12
	More than 30 years	77	4
Teachers' professional degree	Consultant teacher	19	1
	Leading teacher	364	19
	Methodologist teacher	786	41
	Without a teacher's professional degree	748	39
Teachers' teaching experiences	Grades I–V	632	33
	Grades VI–IX	690	36
	Grades X–XII	536	28
	Others	57	3

Table 3. Subjects taught by the teachers

Lesson	Number of teachers	Percentage (%)
Primary education	573	29.9
Physical education	101	5.3
Biology	63	3.3
Foreign language	250	13.0
Geography	43	2.2
Design and technology	100	5.2
Music	48	2.5
Fine arts	20	1.0
Mathematics	159	8.3
Mongolian language and literature	183	9.5
Informatics	74	3.9
Special needs education	2	0.1
History and social sciences	131	6.8
Physics	79	4.1
Chemistry	69	3.6
Other	22	1.1
Total	1,917	100

About 93% of the respondents answered that they had an academic education to teach the subject, while 7% answered "no". Teachers who responded that they did not have an academic education show the reality of teaching different subjects due to teachers' low workload in bag and soum schools.

Table 4. The assessment of teacher's ICTs application competence

Competencies	Responses		
	n	P	M
a) Word processing (using software such as MS Word or OpenOffice writer)	1,453	75	5.50
b) To prepare a presentation (using software such as MS PowerPoint or OpenOffice Impress)	1,435	74	5.42
c) Spreadsheet development (using software such as MS Excel or OpenOffice Calc)	1,435	74	5.25
d) To save and organize files and folders	1,416	73	5.63
e) To use the school management system	1,453	75	5.26
f) To read, write and send emails	1,416	73	5.71
g) To use chat applications and other social applications	1,434	74	5.78
h) To search and use materials and tools for education and training on the Internet	1,435	74	5.79
i) To evaluate the reliability of the information on the website	1,435	74	4.94
j) To evaluate the connection between the digital application and the content used in the learning process	1,435	74	4.82
k) To download and install the software	1,415	73	4.92
l) Using video conferencing applications (Skype, Facebook Video Chat, Google Chat, WebEx, etc.)	1,415	73	4.83
m) To work with shared folders and files online (Google Drive, Dropbox, etc.)	1,415	73	4.53
n) Computer image editing and other graphics editing	1,416	73	4.53
o) Audio and video recording (e-books, digital history, video, animation, etc.)	1,415	73	4.39
p) Learn to use new ICT applications and tools on your own	1,415	73	4.42

Note. n: Number of teachers; P: Percentage (%); M: Mean

ICT Skills

Digital technology allows students and teachers to interact with the curriculum through the use of a wide range of digital devices, including desktop computers, laptops, digital cameras, mobile phones, and smartboards (Purcell et al., 2016).

Teachers rated their ability to use ICTs on a scale from 1 to 7. A score of 1 indicates a poor level of knowledge, while a score of 7 indicates a high level of proficiency. **Table 4** shows the weighted average of the teachers' scores.

The following skills are rated 5.25 and above: word processing (MS Word or OpenOffice writer), presentation (MS PowerPoint or OpenOffice Impress), spreadsheets (MS Excel or OpenOffice Calc), storage and organization of files and folders, school management system, reading, writing, sending emails, chat and other social applications, searching and using materials and tools for education and training on the Internet. It indicates that teachers have relatively good knowledge and skills in using the Office, the web, social networks and e-learning materials. Moreover, the following skills are rated between 4.39 and 4.94: use digital applications; evaluate the information's reliability on the website; download and install software; use video conferencing applications (Skype, Facebook Video Chat, Google Chat, WebEx, and others); use online folders and work with files (Google Drive, Dropbox, and others); image processing, graphics editing, audio/sound and video recording (e-books, digital history, video, animation and others); and learning new ICT applications and tools. It indicates a moderate ability to evaluate information reliability, exchange and organize information and process easy multimedia skills.

The Use of ICT in Teaching and Learning

Teachers rated their ICT competency in learning and teaching on a scale of 1 to 7. **Table 5** shows the weighted average of the teachers' scores. For example, discussing with students about cyber rights, security, personal protection, and ethics has an average rating of 4.77, while using appropriate social networking sites for teaching purposes is 4.64, which are the highest. In particular, there are also the following aspects: supporting students in sharing their views with others through online surveys, blogs and other social media; using online assessment tools; communicating with parents, guardians and others using a variety of ICT tools/applications. However, skills such as the use of ICT in teaching methods to stimulate students' critical thinking, problem-solving skills and creativity are considered insufficient. This highlights the need for teachers to improve their knowledge and skills in using ICT in learning and teaching.

Table 5. The assessment of ICT competencies in teaching and learning

ICT-based work	Responses		
	n	P	M
a) To use multimedia (video, animation, or simulation) in learning activities	1,434	74	4.31
b) To conduct student experiments and learning activities using digital tools	1,416	73	4.25
c) To use digital tools/games to stimulate student participation	1,416	73	4.23
d) To help students share their ideas with others through online surveys, blogs, and social media	1,416	73	3.87
e) To communicate with external experts (e-mail, forums, video conferencing, etc.) online	1,416	73	4.08
f) To instruct and assist students in conducting online research	1,435	74	4.21
g) To use ICT teaching methods to encourage students' critical thinking, problem-solving skills, and creativity	1,416	73	4.15
h) To organize collaborative activities/projects with students using a variety of ICT tools	1,396	72	4.37
i) To use online assessment tools (submit tests, assignments and presentations, etc.)	1,435	74	3.97
j) To use online forms and surveys to help students evaluate themselves and their partners	1,396	72	4.34
k) To discuss with students the rights, security, privacy, and ethics of their cyberspace	1,415	73	4.77
l) To use social networking sites for teaching purposes	1,414	73	4.64
m) To communicate with parents, guardians and others through a variety of ICT tools/applications	1,435	74	4.13

Note. n: Number of teachers; P: Percentage (%); M: Mean

Table 6. Duration of ICT usage in lesson

Duration of ICT usage in lesson	Number of teachers	Percentage (%)
Less than 10%	249	13
10–30%	536	28
31–50%	354	19
51–70%	198	10
71–100%	86	4
I don't use ICT	12	1
Non-response	482	25
Total	1,917	100
Use of ICT in teaching activities		
According to school regulations	575	30
According to teachers policy	287	15
Guidelines developed with students	287	15
I don't use any procedures	268	14
Non-response	498	26

Table 7. Classroom setup using ICT

Answer	Number of teachers	Percentage (%)
Reorganize the classroom setup as needed, sometimes in a different place (outdoors or in another room)	315	16
Keep their previous setup	340	18
Depending on the type of activities that students do, reorganize the classroom setup	731	38
Non-response	531	28
Total	1,917	100

Table 6 shows the extent to which ICT is used in the classroom. Therefore, out of the 1,917 teachers, 13% responded "less than 10%", 28% responded "10–30%", 19% responded "31–50%", 10% responded "51–70%", and 4% responded "71–100%". About 1% answered that they don't use ICT in their lessons, and 25% did not respond (**Table 6**). More than 70% of the teachers surveyed use ICT to some extent.

Organizational and Administrative Tasks

In terms of classroom organization flexibility (**Table 7**), 38% of respondents reported that they adjust the classroom adjust on the type of learning activity. Additionally, 16% mentioned that they reorganize according to the lesson requirements and occasionally move to different locations, such as outdoors or to another classroom. This indicates that teachers are flexible in their classroom arrangements, adapting based on the type and organization of the lesson.

Table 8. The use of ICT to support the learning of children with disabilities

Answer	Number of teachers	Percentage (%)
Yes, but rarely. Because such technology is not enough	234	12
Yes, but rarely. Because I don't have enough knowledge about those technologies	127	7
Yes, always	153	8
No, I don't know about those technologies	141	7
No, I do not teach students with disabilities	729	38
Non-response	533	28
Total	1,917	100

Table 9. ICT competency assessment for professional learning

ICT-based competencies	Responses		
	n	P	M
I regularly visit educational websites to improve my skills	1454	75	4.99
Attend web seminars and online training	1435	74	4.21
Reflect in their teaching methodology	1416	73	4.92
Share innovations in ICT use in education with school staff and partners	1434	74	4.71
Join a virtual space to share experiences with other schoolteachers	1415	73	4.28
Help and advice partners and colleagues on the use of ICTs in education	1435	74	4.51

Note. n: Number of teachers; P: Percentage (%); M: Mean

Out of the 1,917 teachers surveyed, 30% reported using ICT according to school regulations, while 15% utilized their own policies. Another 15% followed guidelines developed in collaboration with their students. In contrast, 14% indicated that they did not use any procedures, and 26% did not respond to the survey (see **Table 6**). It shows that the development and implementation of ICT guidelines for schools and classrooms are inadequate.

As shown in **Table 8**, 12% responded that using technology to help children with disabilities was insufficient, 7% said that they do not know enough about technology, 8% answered that they use technology regularly, 7% stated that they do not know how to use technology, 38% responded that they do not teach students with disabilities, and 28% did not respond. The low number of "yes, always" is because students with disabilities study in special needs schools.

Professional Learning

Technology should be integrated into teacher preparation programs so that teachers can see technology in use and be taught how to teach the pedagogical methods that facilitate student learning in their classes (Hennessy et al., 2005). Teachers rated their ICT competency for professional learning activities on a scale of 1 to 7. **Table 9** shows the weighted average of the teachers' scores. Teachers responded to the questions with an average of 4.21 to 4.99, indicating they lacked these skills. In particular, the average response score for webinars and online training is 4.21, and the average score for integration with other teachers in virtual space is 4.28. These indicate a lack of knowledge and limited opportunities.

About 38% of the respondents answered that they had information in in-service training on using ICTs, 9% answered "no", 27% answered that they did not know well, and 26% did not respond (**Table 10**). It shows that teachers lack such information.

Regarding the participation in a survey to identify ICT needs in education (**Table 10**), 37% answered "yes", 35% answered "no", and 26% did not answer, showing that a survey on ICT training needs is rarely conducted, and teachers' involvement in the research is not good enough.

To a question on participation in ICT-related national-level training in the last 24 months (**Table 11**), only 32% responded that they had participated, which shows that ICT-related national-level training is insufficient.

However, 67% of the respondents said that they had attended ICT-related school-level training in the last 24 months, indicating that ICT-related training is more common at the school than at the national level (**Table 12**).

Table 10. Participation in a survey to identify ICT needs in education

Participation in a survey	Number of teachers	Percentage (%)
Yes, a professional educational institution	313	16
Yes, the government	58	3
Yes, school	276	14
Yes, non-governmental educational institutions	86	4
No	665	35
Others (please specify)	23	1
Non-response	496	26
Total	1,917	100
Information dissemination on in-service training		
Yes, had information	729	38
No	172	9
Did not know well	517	27
Non-response	496	26

Table 11. Participation in ICT-related national-level training in the last 24 months

Answer	Number of teachers	Percentage (%)
5–15 hours	523	27
16–40 hours	73	4
More than 40 hours	28	1
Not participated at all	803	42
Non-response	490	26
Total	1,917	100

Table 12. Participation in ICT-related school-level training in the last 24 months

Answer	Number of teachers	Percentage (%)
1–4 hours	846	44
5–15 hours	328	17
16–40 hours	81	4
More than 40 hours	34	2
Not participated at all	576	30
Non-response	52	3
Total	1,917	10%

Table 13. The need for in-service teacher training in ICT

No	Need for in-service teacher training in ICT	Number of responses
1	Preparation of multimedia learning materials	781
2	Develop innovative methodologies using ICT (project-based learning, computer-assisted collaborative learning, etc.)	793
3	School system	823
4	Use ICT in student assessment	835
5	Integrate ICTs with specific areas of your research	843
6	Use social media in teaching and learning	845
7	Teaching ICT as a subject	861
8	Find, modify, and evaluate material from the Internet	884
9	Basic ICT knowledge (word processing, presentation preparation, spreadsheet, etc.)	947
10	Others (please specify)	–

According to **Table 13**, the three most needed training for teachers were “preparing learning multimedia materials”, “developing innovative methods using ICT (such as project-based learning, computer-based collaborative learning)”, and “using the school system”. Also, teachers need training on “using ICT in student assessment”, “integrating ICT into the subject”, “using social networking in teaching and learning”, “teaching ICT as a subject”, and “finding, modifying and evaluating materials from the Internet”. However, the ICT basic training rank shows teachers have relatively good ICT knowledge and skills (**Table 13**).

Besides, the teachers listed the following training in the “other” option. These include the development of ICT-based innovative methodology, use of electronic journals, online training and methods for conducting online training using ICT, preparation of e-learning and training materials, use of social media in teaching and

Table 14. Effects of in-service training on teaching activities

Training and teaching activities	Effects (%)				N-RT
	NE	SE	ME	HI	(%)
Read journal information, research, and study information	6	28	43	18	5
Training/workshop	6	23	42	23	6
Educational conferences and seminars	4	22	41	27	6
Observations at your school	3	17	45	29	6
Observations at other schools	5	23	43	23	6
Online and offline participation in teachers' forums (exchange of knowledge and materials, etc.)	6	23	44	21	6
Instructed by a senior teacher or experienced person	4	17	40	32	7
Independent or joint research on topics of interest to you in your field	3	16	40	35	6
Others (please specify)					

Note. NE: No effect; SE: Some effect; ME: Moderate effect; HI: High impact; N-RT: Non-response rate

learning, use of ICT in extracurricular activities, use of educational websites and classroom information processing applications.

Teachers named the most influential topics in their teaching as independent or collaborative research, senior supervision, self-observation, action research, and workshops (**Table 14**). However, they say that reading research materials, participating in online and offline forums, training/workshops and observing at other schools affect teaching.

Other forms of professional development are experience sharing, research and development, and learning a new methodology. Teachers highlighted problems and issues that should be addressed in the future, including:

(1) the need to attend ICT training as they want to continue their education and professional development,

(2) the frustration because they asked to provide the same information on paper after submitting it electronically,

(3) the lack of projectors and screens in the classrooms because the school does not have access to the Internet, requiring teachers to use their home Internet to obtain information for lessons, and

(4) shortage of ICT tools (telephones, landlines, laptops, and the Internet) to primary school children in the rural areas, since teachers have laptops.

DISCUSSION

The study's results, which evaluated teachers' readiness to use technology in the learning of the digital technology era based on the UNESCO ICT-CFT, indicate that their attitudes toward using technology are generally positive. Specifically, it can be concluded that the teachers who participated in our study possess relatively good foundational digital skills. They demonstrated proficiency in standard technological tools such as word processing, presentation software, spreadsheets, file management, email and chat applications, online information searching, evaluating web content, determining content relevance, downloading applications, and using electronic conferencing systems. Additionally, their skills in sharing files and folders, and working with images, audio, and video information were above average. However, the lowest self-assessment score was related to their ability to learn and adopt new technological tools independently. This indicates that they have a limited understanding of ICT tools' underlying general principles and features, depending on the information processing characteristics. One contributing factor is that many teachers have not systematically studied the knowledge and skills to use ICT in teaching and learning; instead, they have acquired their skills independently, which is an obstacle to integrating ICT into their teaching content and methodologies.

However, teachers' knowledge and skills in ICT use in their teaching are above average; they are still not considered sufficient, which is further supported by the assessment of basic understanding of ICT use. In technology-driven education, teachers' ICT competencies are critical, as they form the foundation for effectively using ICT tools in their teaching and learning (Ghavifekr & Rosdy, 2015). Specific skills such as using ICT to foster students' critical thinking, problem-solving, and creativity; communicating with parents,

guardians, and others through various ICT tools; facilitating learning discussions and online assessments; and supporting students in sharing their ideas with others via standard tools such as blogs are relatively poor. ICT offers opportunities for teachers to access diverse information sources, allows them to innovate traditional teaching methods, and enhances classroom teaching. Furthermore, it is vital in supporting teachers' professional growth and lifelong learning (Albion et al., 2015). Despite these potential benefits, there is limited evidence that teachers fully utilize these opportunities.

"ICT fosters a more dynamic and interactive classroom learning environment" (Alharbi, 2014). Teachers' efforts to adapt their classroom organization to accommodate technology-based learning, depending on the specifics of the classrooms, indicate that teachers have a relatively good attitude and interest in using technology for teaching. Teachers play a key role in developing innovative teaching models and introducing ICT into the classroom (Schibeci et al., 2008), so their attitude towards supporting the adoption of ICT is essential for successful implementation. However, depending on teachers' foundational knowledge and skills in ICT, there are significant challenges in incorporating ICT into their lesson content and teaching methodology. In addition, the absence of a national repository of electronic didactic materials, an inadequate ICT environment, and insufficient management understanding and support limit the use of technology in teaching. These limitations also restrict opportunities for teachers to participate in online and virtual training, collaborate with peers from other schools, and participate in shared digital learning communities. Furthermore, teachers rarely shape policies related to introducing and using new technologies in education.

ICT teacher training is more commonly organized at the school level, with higher participation rates than at the national level. Given that ICT is a transformative force in modern education and significantly impacts the learning environment (Abbas et al., 2025), continuously developing teachers' ICT knowledge and skills is vital. Teachers need to improve their competencies in e-learning, digital content creation, e-assessment, and the integration of ICT in teaching and research. Teacher collaboration plays a crucial role in supporting continuous professional development. Seminars, discussions, and classroom observation of technology-integrated teaching practices are valuable for fostering constant learning and improving ICT implementation.

It is essential to further develop policies and regulations related to ICT in the education sector and schools, as well as to effectively disseminate and implement this information. While teachers are interested in using ICT in their teaching and possess a basic understanding of ICT applications, they often lack the knowledge and skills necessary to leverage ICT effectively to enhance instruction and support student learning. Additionally, there is a shortage of technology-based learning environments and opportunities for teachers to integrate ICT into their teaching practices. There is a growing demand for more ICT and electronic resources to facilitate lessons and classroom training. Furthermore, current criteria for assessing ICT skills and knowledge in teacher training programs, as well as for evaluating ICT-related job performance, are insufficient. The study highlights the urgent need to inform teachers promptly about policies and decisions regarding the integration and implementation of ICT in education and society. This can be achieved through systematic training, advice, and guidance. It is crucial to establish the necessary infrastructure to develop and implement policies that support educational quality through ICT and to train and prepare teachers accordingly. Teachers' basic ICT skills are relatively high. Therefore, to enhance the quality of classroom teaching, it is essential to improve their skills further to support students in knowledge creation, collaboration, and independent work. Additionally, the Ministry of Education of Mongolia should focus on establishing assessment criteria for the basic knowledge and skills required for ICT teachers, including indicators for teacher performance and grading criteria.

Any policy decisions regarding the introduction and implementation of ICT in the social and educational sectors should be promptly communicated to teachers through training and other forms. Recommendations and instructions related to the implementation should also be provided. Policies aimed at enhancing the quality of education through ICT, creating the necessary infrastructure for implementation, and empowering teachers should be comprehensively considered and enacted. Since teachers already possess a good foundation in ICT knowledge and skills, they should be empowered to use ICT to improve the quality of classroom teaching, facilitate student knowledge creation, collaboration, and independent work, as well as ensure overall teaching quality. Establish basic criteria for teachers' ICT knowledge and skills and incorporate them into teacher performance indicators and skill grading criteria.

Practical Implications

This pioneering work examines Mongolian secondary school teachers' attitudes toward using ICT in teaching. Its significance lies in laying the groundwork, methodologically and conceptually, for future research in technology-driven education. The survey questionnaire adapted from the UNESCO ICT-CFT framework provides a strong theoretical foundation and ensures alignment with internationally recognized standards for assessing teachers' ICT competencies and attitudes.

The practical implications of this study can be summarized in the following three points. First, it assesses the basic level of ICT knowledge among secondary school teachers using a standardized international framework and determines how teachers self-assess their competency level. Second, it measures teachers' attitudes toward using ICT in classroom teaching, revealing their overall positive attitude. Third, the study explores the current state of ICT infrastructure and environment in secondary schools and highlights the extent of teachers' active participation in integrating ICT into the education sector.

Finally, in the learning of the digital technology era where traditional teaching methods are becoming increasingly inadequate in addressing the demands of digital education, this study provides a foundational understanding of how secondary school teachers in Mongolia, including those from urban and rural areas and across various disciplines, perceive and engage with educational technology. This broad perspective underscores the value and relevance of the questionnaire study's findings.

CONCLUSION

In recent years, ICT has penetrated almost all sectors of the economy and society in Mongolia. There is now a greater emphasis on integrating ICT into the education sector. The current education reform includes a key focus on ICT, which involves developing a master plan its implementation in the education sector. This plan addresses various issues of ICT policy, infrastructure, hardware, software, human resource development, capacity building, and content development. The knowledge and skills of schoolteachers in ICT are essential for effectively incorporating. Therefore, we conducted this survey to assess teacher's readiness for ICT.

ICT is supposed to improve the internal efficiency of educational systems and enhance the quality of education in a technology-driven marketplace. Technology can foster student's interest in learning if it is properly used, and teachers can use it in the instruction of their respective subjects (Mndzebele, 2013). In addition, teachers' readiness and skills in using ICT play an essential role in using ICT in education. Teachers need sufficient ICT skills to implement the technology and to have a high confidence level to use it in a classroom setting. Besides, teachers require insight into the pedagogical role of ICT to use it meaningfully in their instructional process (Hennessy et al., 2005). Teachers need specific professional development opportunities to increase their ability to use ICT for formative learning assessments, individualized instruction, accessing online resources, and fostering student interaction and collaboration (Dunleavy et al., 2007).

When teachers are digitally literate and trained to use ICT, these approaches can lead to thinking skills, provide creative and individualized options for students to express their understandings and leave students better prepared to deal with ongoing technological change in society and the workplace (school education gateway). Successful integration of ICT in the teaching-learning process is highly dependent on the preparation of teachers (Singh & Chan, 2014). It is better if teachers are given time to learn and become comfortable with ICT so they explore its use and make the best use of it (Ghavifekr & Rosdy, 2015).

For the successful implementation of e-learning, teachers' knowledge and skills of ICT are necessary. That is because the teachers must guide and advise the students to gain understanding during the e-learning. To do this, the teacher must master ICT following his/her profession and teaching "UNESCO, Regional Information, 2018". This study identifies the realities of Mongolia's secondary school teachers' ICT core competencies and will contribute significantly to policy and implementation in building their capacity.

This study shows that secondary school teachers are willing to use ICT in their daily teaching activities. Teachers are intensely interested in improving their technological and pedagogical knowledge, as well as skills to use ICT and digital technology in teaching effectively. Therefore, teacher training and in-service teacher training programs require training for the knowledge and skills to implement ICT in the curriculum. The ICT

infrastructure of secondary schools is relatively well-established; 86.5% of all teachers have laptops, and there is a real need for ICT-based training, which increases the demand and practical importance of such activity.

Limitations and Future Work

This study has several limitations. First, it relied solely on a questionnaire survey, covering approximately 7% of all teachers in general education schools in Mongolia. This relatively small sample size may limit the generalizability of the findings. Second, the research questionnaire was designed to identify the ICT learning environment in schools, assess teachers' basic ICT knowledge, attitudes toward using technology in teaching, and identify professional development needs. While the questionnaire was based on the UNESCO ICT-CFT, its structure limited the ability to establish causal relationships from the responses. For future research, similar studies could be conducted among pre-service teachers to understand better their attitudes toward using ICT in teaching. Additionally, it is essential to examine the composition of the ICT environment in secondary schools and assess the readiness for blended and e-learning that is dominated by technology.

Therefore, future research should explore the broader impact of technology-driven teaching models such as the TAM, UTAUT, and TPACK framework on general and higher education. Moreover, there is a need to investigate further teachers' knowledge, skills, attitudes, and readiness to implement these models effectively in their teaching practices. An emerging area of research is integrating artificial intelligence into education. Future studies should examine its applications, effectiveness, and implications across all levels of education.

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