

To cite this article: Benita Bharati (2025). ENHANCING INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) USE IN LEARNING GEOGRAPHY, International Journal of Education and Social Science Research (IJESSR) 8 (6): 274-303 Article No. 1173, Sub Id 1816

ENHANCING INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) USE IN LEARNING GEOGRAPHY

Benita Bharati

Researcher, Teacher

Changzamtog Middle Secondary School, Thimphu Thromde, Ministry of Education and Skills Development.

DOI : <https://doi.org/10.37500/IJESSR.2025.8613>

ABSTRACT

This study aimed to examine how the use of Information and Communication Technology (ICT) enhances students' learning of Geography. Despite the fact that ICT offers enormous potentials in education, the use of ICT in learning Geography among students of Changzamtog Middle Secondary School is still in its early stage of development. Geography which is a spatial science, is still learnt using traditional methods by many students in spite of the fact that Geography provides varied opportunities for the use of ICT facilitates to investigate, organize, analyze and present geographical information in multiple ways. The study employed the pragmatism paradigm and explanatory sequential research design. Using purposive sampling strategies, the quantitative and qualitative data for the study were collected through a survey questionnaire and focus group discussions, respectively. The quantitative data were collected through survey questionnaire involving 91 class ten students of Changzamtog Middle Secondary School, of which 16 were purposively selected for the focus group discussions. The survey questionnaires were administered in the first phase, and after analyzing the survey data, the semi-structured guiding questions were designed, and focus group discussions were conducted in the second phase. The qualitative data were analyzed using descriptive and inferential statistics in the Statistical Packages for the Social Sciences (SPSS 22), while the qualitative data were thematically analyzed with color coding and drawing themes. The collation of quantitative and qualitative findings indicated that the use of ICT benefited students and enhanced their knowledge and skills in learning Geography. The challenges faced by students in using ICT are inadequate resources and facilities, a lack of students' and teachers' digital competency, technological literacy, and affordability. The recommendations from the students to make full use of ICT in learning are adequate digital infrastructure and facilities, support for economically disadvantaged students, digital literacy, and enhancement of ICT capacity. Further, students suggested recommendations to address those challenges.

KEYWORDS: enhancing, information and communication technologies, digital competency, competent, teaching-learning

Chapter I

Title: Enhancing Information and Communication Technology (ICT) use in learning Geography.

1.1 INTRODUCTION

Globally, Information and Communication Technologies (ICT) are now at the center of education reform in line with the technological development of the 21st century. ICT-supported education in promoting the acquisition of knowledge and skills will empower students for lifelong learning (Musyoki, 2016, p.2). In this digital era, the use of ICT in the classroom is important for students to learn and apply the required 21st-century skills (Rahaman & Bhattacharyya, 2019). Further, technological advancement in this digital age requires teachers to be inquisitive and innovative in integrating ICT in teaching and learning. ICT enhances higher-level thinking skills as it provides various online learning platforms that allow students to self-regulate their learning and help them learn better. Furthermore, students' creativity can be optimized while learning Geography using ICT as it provides innovative ways to meet a variety of learning needs. However, many classes at Changzamtog Middle Secondary School had continued to rely on traditional methods of learning where students mostly use text books, that limited opportunities for students' engagement and critical thinking in learning Geographical concepts. In addition, students' experiential and exploratory learning was impeded when there was minimal hands-on practice. Given these considerations, the research was appropriate and contextually applicable.

1.2 Context of the Study

The study was carried out by the researcher to address the need for enhancing students' learning outcomes in Geography for the Changzamtog Middle Secondary Students through the purposeful use of ICT. Geography is one of the subjects which accommodate new technology into instructional methodologies (Gamira, 2019, p. 21). Therefore, students need to use ICT in more creative and productive ways in order to make learning more meaningful and effective. ICT-integrated curricula and interdisciplinary digital pedagogy facilitate collaboration among educators and learners. It provides learners with personalized and active learning experiences through the use of digital resources (Ministry of Education, 2019). However, the students of CzMSS were observed not making maximum use of ICT in learning Geography. Many students relied on text book information and that narrowed the learning of geographical concepts and skills. Further, it had limited the enhancement of essential 21-st century skills that are vital for students learning. On the other hand, the use of ICT in learning Geography was found to be interesting and engaging promoting self-regulated learning in constructing and applying understanding of Geographical concepts.

The study addressed this gap by enhancing the use of ICT in learning Geography where students learn independently, collaboratively and acquire geographical skills and knowledge. Similarly, Ionescu (2018) reported that the use of digital platforms in geography education led to increased student motivation and a deeper understanding of complex geographical concepts. Furthermore, the use of ICT

in learning elevates the subject skills of learners as it provides various online materials and resources to gather authentic geographical data and information sources. The geospatial technologies optimize learners' creativity and critical skills, which further strengthen geographical thinking and knowledge. The findings and results from the study carried out would not only benefit the students and teachers of CzMSS but it would have positive impacts to all the secondary teachers and students across the country.

1.3 Problem Statement

Despite the fact that ICT offers enormous potentials in education, the use of ICT by students of Changzamtog Middle Secondary School (CzMSS) in their learning is in its emerging stage. Geography which is a spatial science, is still taught and learnt using traditional methods of teaching learning in spite of the fact that geography provides varied opportunities for the use of ICT facilitates to investigate, organize, analyze and present geographical information in multiple ways. According to Earle (2002), an important part of Geography in secondary education consists of abstract knowledge, and therefore, it is crucial for teachers and students to use appropriate information technologies to convey geographical information. However, it was noticed that students used minimal use of ICT in learning Geography.

Despite all challenges, it is essential to incorporate ICT in learning to meet the requirements of the fast-changing world. The focus and intention of education in the present days is more of learner-centered and the pedagogy preferred for 21st century education is experiential and experimental learning. Further, teachers must have knowledge and skills to use digital tools to help students to achieve academic standard. Since the quality of professional development of teacher education depends on the extent of ICT integration in teacher education programs, it is essential for the teachers to possess adequate pedagogical knowledge and skills of ICT so that they create engaging and interactive classrooms. Having access to ICTs benefits not only in academic achievement but also in developing diverse skills that are essential in learning Geography. As stated by Tondeur et al. (2007), ICT use helps to pursue higher-order thinking and problem-solving skills, fosters collaborative learning and flexible learning opportunities, and access to the range of reading materials.

However, a little is known about teachers and students' competence in the use of ICT in their daily teaching and learning in CzMSS. Therefore, there is an urgent need to study students' use of ICT including their perceptions of benefits and challenges of using ICT in learning in Geography. In addition, the study will also provide recommendations to enhance the use of ICT in learning.

1.4 Significance of the Study

This finding of the study would help Geography teachers and students of Changzamtog Middle Secondary School, to understand the importance of enhancing the use of ICT in teaching Geography. In addition, it will help the School Principal, Vice Principals and all the teachers to know the importance of enhancing the use of ICT in teaching Geography. School Principals, Dzongkhag

Education Officials (DEOs), Officials conducting Transformative Educational Research and Assessment Development (TEARD) Programs, Officials of the Department of School Education (DSE) to plan and implement curriculum frameworks and to enhance professional development programs for teachers on various teaching learning strategies integrating the use of ICT to make teaching learning effective. At a national level, the findings of this study would have Ministry of Education for more information with students' benefits, challenges, recommendations and for further strategic planning so that we enhance student centered learning and meet the requirements of 21st century students. The findings of this study besides adding to the existing knowledge and will pave ways for future researchers to venture into research and scholarly exercises in enhancing the use of ICT in teaching Geography across all levels of classes in the school.

1.5 Objectives of the Study

1. To analyze the benefits for students on enhancing the use of ICT in learning Geography.
2. To explore the challenges on enhancing the use of ICT in learning Geography.
3. To Evaluate students' recommendations on enhancing the use of ICT in learning Geography.

1.6 Research Questions Primary Question

How can we enhance the use of ICT in learning geography?

Sub- Research Questions

1. What are the benefits of using ICT in learning Geography?
2. What challenges do students face in using ICT in their learning Geography?
3. What are students' recommendations to enhance the use of ICT in learning Geography?

Chapter II: Literature Review

2.1 Information and Communication Technology and Geography Education

The digital age has brought about transformative changes in various fields, including education. With the rapid development and integration of digital technologies, educators are increasingly exploring innovative ways to enhance teaching and learning experiences. Geography, an academic discipline inherently connected to the understanding of spatial relationships and physical environments, is particularly well-suited to benefit from digital tools. Technologies such as interactive maps, 3D simulations, and augmented reality provide new avenues for students to engage with geographical content, offering more immersive and dynamic learning experiences (Marinescu, 2022; Popovici, 2023). Additionally, the use of ICT tools helps the students to access information available in the digital space effectively. As Brush et al. (2008) have stated, ICT is used as a tool for students to discover learning topics, solve problems, and provide solutions to the problems in the learning process. ICT makes knowledge acquisition more accessible, and concepts in learning areas are understood while engaging students in the application of ICT. In today's digital era, technology and information are developing very rapidly and have entered the world of education.

Similarly, this study is grounded in Lev Vygotsky (1978) theory of social constructivism, in which he argues that the role of the teacher is to help the learner acquire knowledge and skills that would be difficult for the learner to acquire without the help of the teacher. Constructivism requires a teacher who acts as a facilitator whose main function is to help students become active participants in their learning and make meaningful connections between prior knowledge, new knowledge, and the process involved in learning (Rice and Wilson, 1999).

According to Earle (2002), an important part of geography in secondary education consists of abstract knowledge, and therefore it is crucial for teachers to use appropriate information technologies to convey geographical information to students. Technological advancements have also influenced disciplines, in many ways, for instance, in geography; Geographical Information Systems (GIS), satellite images, and cartography have changed to teach geography in particular. Satellites are located in almost every part, possible to collect and report data on what is happening on the earth's surface with a high degree of accuracy. (Olson et al., 1997, p. 571) argues that "printing, photography, aircraft, satellites, and plastics have all major influences on the process of map making and geographic information." The technological advancements mentioned above and digital methods of collecting geographical data such as remote sensing, mapping, and satellite images have necessitated engagement with various forms of digital technology when teaching and learning the subject content. The nature of the subject and the way data is collected demands that concepts should be taught using various ICT tools such as videos, images, simulations and pictures. According to studies cited by Yadav (2013) learners perform better in geography where multimedia has been used. Consequently, the need for teachers to integrate ICT in the teaching of geography is crucial. Similarly, Kozma (1991) insists that good pedagogy is enhanced by the planned and effective use of various forms of digital technology available to the teacher.

Further, Rice and Wilson (1999) concurred, the use of multimedia improved results in geography as teachers and students are actively involved in the construction of knowledge. They go on to emphasize the central role played by the teacher's pedagogy and agree with Clark (1994) that it is not technology alone that makes a difference but the way, teacher engages that technology in teaching to simplify concepts. While technology plays a key role in teaching and learning process, it is the teacher's pedagogical value that actually makes a great difference (Ncube, 2018, p. 2-3). The emphasis is not only on technology making the difference but the way that technology is used to help the teaching and learning process. The teacher is central to the effective use of ICT in geography. Therefore, teachers need to acquire skills, knowledge and willingness to integrate ICT in their teaching. Furthermore, teachers determine the relevance and pedagogical value of the ICT tools to be used (Rice and Wilson, 1999).

In addition, application of modern media and multimedia implies changes in teaching at all levels of education and facilities. Accordingly, the application of new media in teaching geography influences the changes in the organization of teaching and in the character of the acquired knowledge. The internet

increases access to authentic geographical data and information sources (Taylor, 2003). The geography teacher is expected to bring practical examples, provide audio-visual materials and very important, close the gap between the learner knowledge of the world and the examples expected in class. Some concepts in geography are so abstract and beyond the cognition of many learners therefore, teachers need to make these difficult concepts simpler by bringing teaching and learning aids that simulate reality.

As stated in Becta (2004), ICT enhances graphical, statistical spatial analysis skills and mapping skills. It also promotes geographical knowledge and geographical enquiry skills. Teaching and learning Geography are drastically aided by the use of GIS (Audet & Paris, 1997). Additionally, GIS software can enable teachers to focus more closely on teaching geographical skills, in addition to developing a sense of location and place (Keiper, 1999). Further, GIS software enhances spatial awareness and decision-making skills (Audet and Paris, 1997; Taylor, 2003; West, 1999). Similarly, digital photography allows teachers to record pupils' work undertaken on field trips and other learning outcomes not readily recorded in traditional ways (Storey, 2002). ICT enables teachers to engage and motivate pupils on geographical concepts to a greater degree (Halocha, 2002; Taylor, 2003). Furthermore, Phuntsho (2017) stated, some subjects like Geography, English, science and mathematics can be studied excessively comprehensive with ICT facilities. Thus, the learning outcomes and achievements are directly related to the use of ICT facilities. Aligning with this context the researcher aimed to examine as how ICT enhanced the learning of Geography.

2.2 Benefits of Using Information and Communication Technology

The use of ICT tools helps the students to access information available in the digital space effectively. As Brush et al. (2008) have stated, ICT is used as a tool for students to discover learning topics, solve problems, and provide solutions to the problems in the learning process. ICT makes knowledge acquisition more accessible, and concepts in learning areas are understood while engaging students in the application of ICT. Further, ICT enhances, student-centered and self-directed learning. Students are now more frequently engaged in the meaningful use of computers (Castro, 2011). Through the access of information online, students are able to build new knowledge. They become more capable to interpret and critically analyze information from various sources. ICT promotes creative learning environment. It develops students' new understanding in their areas of learning (Chai et al., 2010). Furthermore, a researcher of the University of Central Florida reported that social media create an opportunity to the students for collaborative learning and also allowed the students in sharing the resource materials to the colleagues (Gikas & Grant, 2013). ICTs and Internet use provide new ways of communication that simplify social interaction among people and learning. Further, people can communicate and learn from one another from a distant place, country and continent through various social networking platforms (Khosravi, 2016). Therefore, ICT provides innovative ways to explore and learn anytime and anywhere. Learning through collaboration is encouraged through distance learning platforms as mentioned by Koc (2005). For example, a virtual conference classroom can have students from any part of the world with similar interest of studies. This creates opportunities to

analyze and explore ideas from different settings. Besides sharing diverse learning experiences from one another and reflect their learning, students acquire diverse knowledge.

ICT helps in focusing on higher level concepts to develop relevant skills rather than spending time on less meaningful tasks (Levin & Wadmany 2006). Additionally, McMahon's study (2009) shows, there were statistically significant associations of acquiring critical thinking skills and studying with ICT. Higher critical thinking skills were enabled by longer exposure to learning environment with ICT tools. Therefore, it is essential to integrate technology-based learning in schools at all levels of education system. The use of ICT tools facilitates students' learning skills and broadens their knowledge. Creativity can also be enhanced in ICT based learning platforms. Every day new multimedia tools are added for their discovery that helps to learn through games and similar entertainment facilities. (Gee 2007, 2011). Learning and teaching quality are greatly advanced with the use of ICT enabling student's autonomy, capability and creativity. In summary, as Reid (2002) has indicated, ICT offers students more time to explore and understand concepts beyond the course content. The use of ICT also changes the teaching and learning relationship by disrupting the traditional teacher centered approach.

2.3 Challenges of Using Information and Communication Technology

The diffusion of ICT is still a growing phenomenon in the education sector. It is not surprising that, although it is a leading exercise, its integration within the educational sector is faced with numerous challenges. Gebremedhin and Fenta (2015) have admitted that ICT integration into education is faced with numerous challenges. Similarly, they identified the challenges as a shortage of resources or technological tools, lack of technical support, poor ICT preparation for teachers and lack of encouragement for teachers which may have negative implications on the teachers' perceptions towards the use of ICT in teaching and learning. Ghavifekr et al. (2016) found significant challenges associated with the use of ICT tools in teaching and learning. The findings are the implementation of ICT in teaching and learning is faced with limited accessibility and poor network connection, limited technical support, limited time and lack of teachers' competency. With the intent of using ICT, Khokhar and Javaid (2016) stated that teachers are faced with challenges such as ICT devices being restricted to classroom teaching. Equally, in some research papers, teachers have expressed time constraint as one of the inhibiting factors using ICT in teaching and learning. Becta's study (2004) found that constraints due to additional time required for locating internet advice, prepare lessons, practice using technology and troubleshoot technical glitches result in lack of time for teachers to complete a task.

In the same vein, Goktas et al. (2009), reveals that the majority of the educational stakeholders believes that lack of in-service training, appropriate software and hardware, are the main barriers for integrating ICT in teaching and learning. In addition, Tondeur et al., (2008) stated that school-related policies, such as an ICT support, ICT plan, and ICT training have a significant effect on the class use of ICT. This implies that school policies can often be underdeveloped and underutilized, and consequently lead teachers to use only a limited number of ICT devices in their classrooms. Further, modern

technologies are obligating teachers to learn how to use them in teaching and thus, increasing opportunities for the teachers' training needs (Jung, 2005). The challenging part is, some teachers may not be willing to learn the modern technologies. This may be due to the lack of updated skills and knowledge to use in their lessons. In addressing these challenges, Sife et al. (2007) advocate that teachers lack of awareness goes along with attitude. The teacher's competence to integrate ICT into pedagogical practice is a direct challenge to a teacher's confidence (Becta, 2004).

Similarly, Jamtsho and Bullen (2018), in their study Distance education in Bhutan, improving access and quality through ICT use have stated the similar challenges related to Bhutanese context. Furthermore, designing of ICT incorporated lesson require skills, knowledge and strategies. The blending of pedagogy, technology and content in accordance with the individual aspect needs a special care and designing. Sonmez et al. (2018) states, technological literacy for learners and educators are utmost importance. Thus, there is an urgent need to address barriers that prevent the integration of ICT in the school curriculum to make the most use of the ICT facilities.

Chapter III: Methodology

3.1 Introduction

This chapter frameworks the research methodology used in the study. It includes research paradigm, research approach, research design, sampling strategies, participants and sample size, data collection procedure, reliability and validity of instruments. Further, it presents data analysis procedures, data triangulation and presentation, ethical consideration and communication strategies of the study findings.

3.2 Research Approach and Design

This study used a Mixed-method approach as represented in Figure 1''(a)'' . It specifically used explanatory sequential mixed methods research design as shown in Figure 1''(b)'' . The intent for this approach is that the quantitative data and results provide a general picture of the research problem; more analysis, specifically through qualitative data collection, is needed to refine, extend, or explain the general picture (Creswell, 2015). Creswell et al. (2011) stated that this design consists of first collecting quantitative data and then collecting qualitative data to help explain or elaborate on the quantitative results. Figure 1 shows the conceptual map of research design.

Further, this design helped the researcher to explain confusing, contradictory, or unusual survey responses of the students to reveal explanatory details. The measurement of students' views and opinions on the use of ICT constituted the quantitative data, and the data collected from the Focus Group Discussion (FGD) constituted qualitative data.

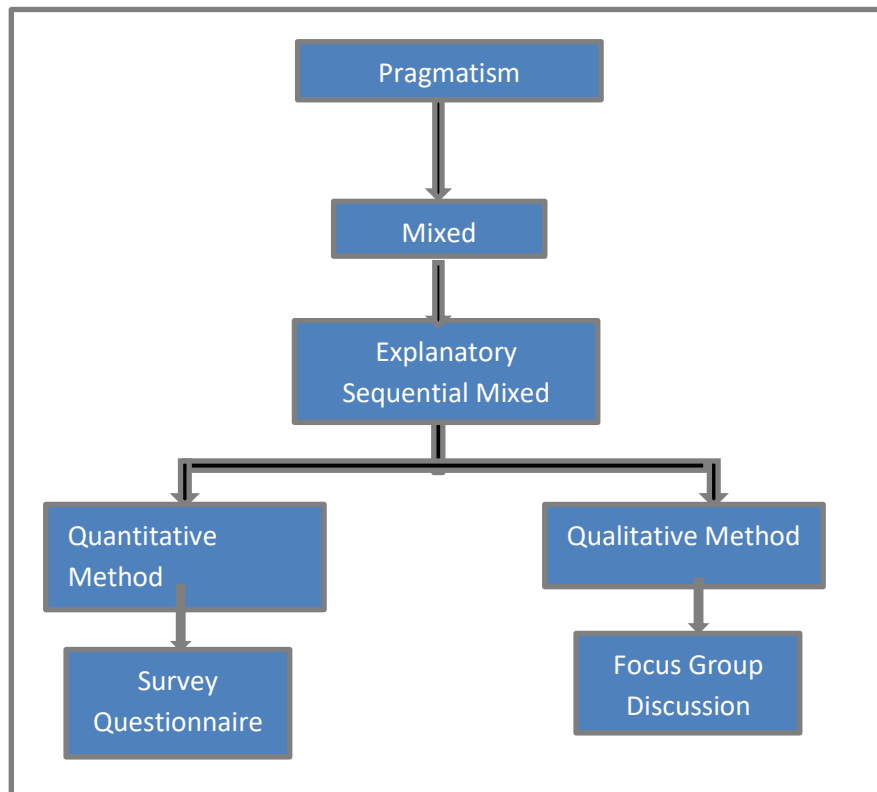


Figure 1 “(a)”: Conceptual Map of Research Design
Source: Creswell and Creswell (2015)

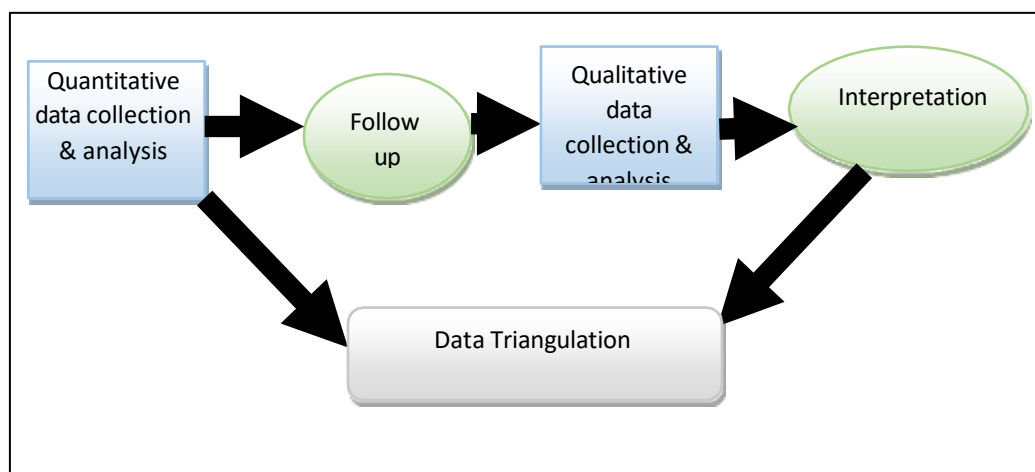


Figure 1 “(b)”: Explanatory sequential mixed method, adapted from Creswell and Plano Clark (2011)
Source: Adapted from Creswell and Plano Clark (2011)

3.3 Sample Size

3.3.1 Quantitative Data

The study collected survey questionnaire data from 91 class ten students learning Geography as one of the subjects. Table 1 shows the survey participants by gender. There were 38 males and 53 females. The study sample comprised a higher proportion of female participants (58.2%) compared to male participants (41.8%) out of a total of 91 students.

In addition, Table 2 shows the survey participants by age group. The sample consisted of 72.5% participants aged 12 – 15 years and 27.5% aged 16 – 19 years, indicating a higher representation of respondents in the 12 – 15 age group.

Table 1: Survey Participants by Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	38	41.8	41.8	41.8
	Female	53	58.2	58.2	100.0
	Total	91	100.0	100.0	

Table 2: Survey Participants by Age Group

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	12-15	66	72.5	72.5	72.5
	16-19	25	27.5	27.5	100.0
	Total	91	100.0	100.0	

3.3.2 Qualitative Data

The purposive sampling technique was preferred by the researcher to collect qualitative data. The criteria for the purposive sampling are gender and a mixed group of high and low achievers. In total,

there were 91 participants in the study of which 16 students were purposively selected for the focus group discussions. There were four FGD groups. Each FGD group consisted of 4 students. In total 91 students participated in the research and the study area is highlighted in Figure 2.



Figure 2: Study Area

Source: Author (2023)

3.4 Data Collection Tools

3.4.1 Quantitative

According to Creswell (2014), an instrument is a tool for measuring, observing, or documenting quantitative data that contains specific questions and response possibilities that is developed in advance of the study. Therefore, highly structured, closed questions are useful in generating a frequency of the response agreeable to statistical treatment and analysis (Cohen et al., 2019). In this study, the closed-ended part of the questionnaire was developed using a 5-point Likert scale, where 1 – Strongly Disagree, 2 – Disagree, 3 – Neutral, 4 – Agree, 5 – Strongly Agree. The data, in this study, were collected through self-made questionnaires. Furthermore, choosing self-made questionnaires for this study was motivated by Phellas et al. (2011), who justified self-made questionnaires as a cheap and easy method to work on it.

3.4.2 Qualitative

There were set of guiding questions for FGD, and all questions were open-ended. The open-ended questions provided participants with the opportunity to express their views regarding the subject of this study. Further, it allowed the participants to express their views and formulate their answers

without any constraints (Phellas et al., 2011). The trustworthiness of the content of the FGD data were maintained following the four components of trustworthiness. The process of member checking among the students via the Telegram group was convenient and feasible for the researcher and the students. Focus group participants consisted of 16 geography students of class 10 (8 males and 8 females). They were categorized into four focus groups, considering the gender, age, and academic performance (high and low achievers) and among the students, 50% were males and 50% were females.

3.5 Pilot Study

Pilot study was carried out by the researcher to determine the validity and reliability of the instruments and it was felt crucial as the survey questionnaires were self-made. The instruments were piloted to the students of one of the schools in Thimphu Thromde. The pilot study contributed in finding recurrence and inappropriate items in the survey questionnaire. It guided the researcher to carry out the coding system which in turn led to evaluation and improvement of the questionnaires as stated by Srinivasan and Lohith (2017). Moreover, researcher gained skills, knowledge and experience in using the instruments prior to the main study. The piloted data collected was analyzed and the result was verified and used to modify the questionnaire.

3.6 Reliability and Validity of Instruments

The validity and reliability of the instrument is critical for the research to be authentic (Creswell, 2014). The construct validity of the study is assured in consultation with the senior teacher who has a sound knowledge in research. The researcher used various strategies to maximize the reliability and validity of the data collection instruments which consequently impacted the overall quality of the study. The survey questionnaire and FGD guiding questions were vetted by multiple experts to ensure their reliability and validity, and confirmability and trustworthiness. The instruments were pilot-tested with required size of homogeneous participants. Cronbach reliability test was run on survey items and those items with the alpha value of less than 0.7 was either deleted or modified. The internal consistencies of the questionnaires were measured using Cronbach Alpha coefficient (Huck, 2004). Initially the result of the Cronbach Alpha coefficient for some themes was less than 0.6 indicating a weak result reliability of the test. As a result, few items were modified which yielded a more positive Cronbach Alpha coefficient of 0.7 and more for all the themes. To maintain the authenticity, originality and reliability of qualitative data the researcher applied member checking process to avoid or decrease the incidence of incorrect data and incorrect interpretation of data.

3.7 Data Collection Procedure

Data collection duration was from 1st to 18th December 2024. Before the researcher started to collect data, approval was sought from concerned administrators and parents as most students were below the age of 18. The researcher obtained office ethical clearance letter from the principal of the school (Refer Appendix A) and the approval letter from the parents who participated in the study (Refer Appendix B) to collect data. After their approval, prior to employing survey questionnaires and the conduct of

FGD, the researcher briefed participants on the purpose of the research, and their right to withdraw from the research if they wish to.

3.8 Data Analysis

The data analysis process involved analyzing the survey questionnaire and FGD transcriptions. The raw data gathered in the research process were analyzed and interpreted. Data analysis according to (Cohen et al., 2007, p. 461) involves organizing, accounting for and explaining the data, which means making sense of the data in terms of the participants' definitions of the situation, noting patterns, themes, categories and regularities.

3.8.1 Data Triangulation

Data triangulation is used for multiple data sources to develop a comprehensive understanding of phenomena (Patton, 1999). The use of mixed method allows triangulating the data from different sources adding credibility to the findings. Triangulation helps to promote more comprehensive understanding of the phenomenon under study and to enhance the rigor of a research study (Heale & Dorothy, 2013). In this study, the use of different tools for data collection was to overcome the weakness and intrinsic biases that one type of method offers on the other. Data were collected from different sources to test validity through the convergence of information. In this study, data were collected from two sources; survey questionnaire and focus group discussion. As the study carried out explanatory sequential mixed method, the FGD questions were framed after the analysis of survey questionnaire. The data collected from the first source (survey questionnaire) was tested for consistency, validity and credibility with the second source focus group discussion so as to attain the best result for the study.

3.8.2 Data Presentation

In this study, the quantitative data on students' use of ICT in their learning of Geography, the benefits of using ICT in learning were presented using tables with Mean and Standard Deviation. Further the qualitative data on opportunities, challenges and students' recommendations to enhance the use of ICT in learning Geography were presented using rich textual narratives and interpretations.

3.9 Ethical Considerations

All ethical issues that need to be addressed in the whole process of this research were dealt and adhered stringently as per the ethical or research code of conduct and regulations of the Royal University of Bhutan, 2014. A consent from the Principal, ICT teachers, parents and students to conduct this research were sought. All participants for the research were explained in detail the purpose of the research and their role as research participants and selected with a formal consent letter duly signed with an assurance to protect their identity with the use of pseudonyms.

The ethical consideration during data collection is considered important. It is important to respect the site in which the study takes place and respect by availing permission before entering a site, with

minimal disturbance at the site during a study, and by viewing oneself as a guest at the site (Creswell, 2014). The researcher sought and obtained permission from the relevant authorities before carrying out this study. Participants for both survey and FGD were based on voluntarism. The researcher had briefed the participants about their rights to withdraw at any point of time during the data collection. Participants were also briefed on the confidentiality of their participation followed by writing their discussions.

Furthermore, pseudonyms were used, where necessary, to represent students in the research narratives. The data collected from the participants were stored safely under lock and key or password protected both during the study period and after the study. Researcher provided contact number and email address at the end of the consent letter for any issues.

Chapter IV Results and Discussions

The results and discussions are presented theme wise as follows.

4.1 Research question 1

4.1.1 Benefits of using ICT to enhance students' learning in Geography

Table 3: Use of ICT in Enhancing Students' Subject Knowledge

S. N	Items	N	Mean	SD
1	The use of ICT enhances my knowledge of time and space	91	3.71	0.95
2	The use of ICT enhances my knowledge of the physical environment	91	3.48	1.00
3	The use of ICT enhances my knowledge of people and the environment	91	3.71	1.00
4	The use of ICT enhances my knowledge of essential geographical skills	91	3.74	0.95
5	The use of ICT helps me to remain updated with the latest and emerging geographical knowledge	91	3.75	1.02
6	The use of ICT makes my understanding of geographical concepts easier	91	3.85	1.05
7	The use of ICT makes my understanding of geographical processes and relationships easier	91	3.67	1.06

Overall Mean	3.70	1.00
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The overall ($M=3.70$, $SD=1.00$) shown by table 2 indicates that using ICT optimizes subject knowledge of students. All the items in this theme have a Mean of greater than 3, which implies that all learners agree on the theme. Corresponding to the questionnaire data, the FG data suggested similar views of learners in this theme. FG 1 stated:

ICT helps us learn in different ways, making both the teachers and students work easily. It helps us to learn by providing access to large quantities of information and places, people, and the environment.

Further, FG 2 added:

ICT enhances access to diverse resources, makes learning interactive and engaging. ICT makes learning engaging and accessible, and it also helps with digital skills. Tools like videos, simulations, and interactive apps make complex concepts easier to understand and often more enjoyable to learn.

Furthermore, FG 3 emphasized:

ICT helps in learning fun by making information easy to access, more engaging through videos and apps, and encouraging teamwork with online tool. We can browse different sources in order to broaden our view on the concept of geography.

The findings revealed that ICT enhances the subject knowledge of learners as it broadens their view of the concept of geography. ICT is beneficial as it provides easy access to vast resources and educational materials online, enhancing educational knowledge acquisition. Additionally, video lessons enhance content visualization as ICT enhances the content knowledge of students, and most importantly, they are learner-centered. In this way, students' understanding of geographical concepts becomes easy. Likewise, Jones et al. (2010) emphasized that the use of videos, which include both visual and audio elements, facilitates active interactions between students and the topic, ensures that the content is more meaningful, and strengthens learning by allowing associations between the material in the videos and other situations. Overall, it makes education more flexible and efficient, and prepares students for the digital world.

4.1.2 ICT enhances Students' Subject Skills

Table 4: Use of ICT in Enhancing Students' Subject Skills

S. N	Items	N	Mean	SD
1	The use of ICT enhances my critical and problem-solving skills	91	3.54	1.16
2	The use of ICT enhances my creativity and innovation skills	91	3.70	0.96
3	The use of ICT enhances my communication skills	91	3.44	1.04
4	The use of ICT enhances my social skills	91	3.45	1.13
5	The use of ICT enhances my lifelong learning skills	91	3.69	1.14
6	The use of ICT enables me to use essential geographical skills in my daily life	91	3.54	0.96
7	The use of ICT enhances my collaborative skills	91	3.53	0.96
8	The use of ICT enhances my numerical skills	91	3.62	1.07
9	The use of ICT enhances my literacy skills	91	3.65	1.03
10	The use of ICT enhances my spatial analysis skills	91	3.52	0.94
Overall Mean			3.57	0.94

The learners have agreed with the overall Mean ($M=3.57$, $SD=0.94$) as indicated by table 3, that the use of ICT enhances geography skills in learning. The second item, "The use of ICT enhances my creativity and innovation skills," has the highest mean of greater than 3, which implies that using ICT in learning enhances learners' creativity and innovation skills in learning geography. Similarly, the qualitative data findings revealed that using ICT in learning geography enhances subject skills. All the learners asserted that using ICT in learning geography enhances creative thinking, lifelong learning skills, collaborative skills, spatial skills, and communication skills. FG 1 added, "We can work together on projects, share findings, and utilize online tools to analyze geographic data, which enhances our critical thinking and problem-solving skills." Additionally, FG 1 and FG 2 added:

We agree that ICT plays a crucial role in enhancing essential geographical skills by providing access to advanced tools like Geographic Information Systems (GIS), interactive maps, and satellite imagery. The qualitative and quantitative data indicated that ICT promotes subject skills of learners as it enhances critical and collaborative thinking, spatial analysis skills, communication skills, and lifelong learning skills.

Further, the results showed that ICT helps in understanding geographical concepts easily by offering interactive tools, dynamic maps, and simulations. These resources make abstract ideas more visual and

engaging, simplifying complex topics and making learning exploratory and experiential. For instance, digital simulations can model geographical processes such as erosion or climate change, enabling students to visualize and understand these complex phenomena in a way that static images and text cannot (Clark & Mayer, 2016). Further, studies have shown that integrating digital technologies into geography education can significantly improve student engagement and academic performance. For example, Liu et al. (2014) found that students who used digital tools for geography lessons demonstrated higher levels of engagement and achieved better learning outcomes compared to those who relied solely on traditional methods. Similarly, Ionescu (2018) reported that the use of digital platforms in geography education led to increased student motivation and a deeper understanding of complex geographical concepts. The geospatial technologies optimize learners' creativity and critical skills, which further strengthen geographical thinking and knowledge.

4.1.3 Use of ICT on Students' Learning Outcomes

Table 5: Use of ICT on Students' Learning Outcomes

S. N	Items	N	Mean	SD
1	The use of ICT makes my learning of geography interesting	91	3.82	1.08
2	The use of ICT promotes collaborative learning among us in class	91	3.75	1.07
3	The use of ICT creates student-centered learning	91	3.69	1.08
4	The use of ICT enables self-paced learning	91	3.67	0.97
5	The use of ICT enhances learning engagements	91	3.66	1.01
6	The use of ICT enhances my learning motivation and productivity	91	3.63	1.04
7	The use of ICT improves my knowledge retention	91	3.65	0.96
8	The use of ICT makes me an independent learner	91	3.69	1.08
9	The use of ICT reduces disruptive behaviors among us in the class	91	3.16	1.14
10	The use of ICT prepares me to deal with the fast-emerging world	91	3.74	1.03
Overall Mean			3.65	1.05

The quantitative results, reflected by table 4 as overall Mean score of (M=3.65, SD=1.05), suggested a relatively high level of agreement among students on the theme that using ICT in learning geography enhances students' learning.

Similarly, the qualitative data demonstrated that the use of ICT enhances students' learning. Digital tools can be tailored to meet the individual needs and learning styles of students, providing personalized learning pathways and adaptive feedback. This personalized approach helps students to progress at their own pace and achieve their full potential (Brusilovsky & Millán, 2007). Additionally, it encourages students to be independent learners and prepares them to deal with the fast-emerging world.

Further, FG 3 added:

The Internet provides real-time data, multimedia resources, and interactive platforms, and ICT simplifies complex concepts, enhances engagement, and fosters a deeper, more practical understanding of geography. Integrating digital technologies into education helps students develop these critical skills and prepares them for the demands of the modern workforce (Voogt et al., 2013).

Further, FG 1 shared:

Using ICT makes it easier to understand geographical concepts by providing visual and interactive tools. Digital maps, 3D models, and online simulations help students see and explore geographical features like landforms, climates, and ecosystems in a way that's more engaging than just reading textbooks.

Furthermore, FG 2 added:

Instead of just reading from a textbook, we can use tools like Google Earth or GIS to explore real place. It's like bringing the world into the classroom! This finding aligns with the study by Mayer (2014), which noted that providing interactive and visually rich learning experiences can capture students' interest and motivation, ultimately leading to improved learning outcomes.

The use of ICT promotes collaborative learning among students in class, with a mean of 3.75, indicating that ICT enhances collaborative learning among learners. It allows the learners to experience their learning processes, being interactive, enjoying, and having fun with technology. As stated by Rodrigues (2002, p.136-137), using technology to support collaborative learning, there will be not only human-machine interaction but also human-human interaction. Web-based learning context, for instance, allows the students to interact with other students mediated by a machine. UNESCO (2021) pointed out that information retrieval, individualized learning, group learning, and collaborative activities would be greatly enhanced in education through the use of the internet. Students learn collaborative skills and teamwork when they learn using ICT.

Research question 2:

4.2 Challenges Faced by Students in Using ICT in learning Geography

4.2.1 Unequal access, inadequate resources, and facilities.

The research findings showed that many students expressed their concern about many challenges that they are facing in using ICT in learning. It is evident from the qualitative data, as FG 1 shared, 'Not all students have access to devices or the internet.' On a similar note, FG 3 added, 'Some challenges in using ICT for learning include poor internet connection, lack of access to devices, and technical software issues. Addressing this digital challenge is crucial for ensuring that all students can benefit from technological advancements (Robinson et al., 2015). Students expressed the need of Geography laboratory with stable internet connectivity and adequate computers to learn GIS and other topics. Additionally, Empirica (2006) found that lack of access is the largest barrier and different challenges to using ICT teaching and learning.

4.2.2 Lack of Students' Digital Competency

The study findings indicated that many students lack digital competency. Similarly, FG 1 and FG 3 shared, 'Not all students have equal access to technology, such as computers, internet, or software, which can create a gap between those who have the tools and those who don't, as a result, many lack the necessary digital skills to use technology effectively, which can make learning with ICT frustrating.' This digital divide can exacerbate existing educational inequalities, particularly for students from underprivileged backgrounds (Robinson et al., 2015).

4.2.3 Technology Digital Literacy

The research findings indicated that there is a need for technology digital literacy for students, as FG 1 expressed the concern, "Students might get sidetracked by social media or other non-educational content while using devices." Additionally, FG 2 and 3 shared, "Sometimes, online platforms can be distracting, pulling attention away from learning." Congruently, Santoso and Lestari (2019, p. 253) mentioned that students need to be encouraged to have insight into technological literacy so that their learning competencies increase.

4.2.4 Economic Affordability

The qualitative data collected from the students revealed that one of the inhibiting factors in using ICT in learning is affordability. Some respondents shared, "We do not have internet access at home and need to use our data, which is very expensive for our parents." Additionally, FG 2 expressed:

Some of us do not have a computer or a laptop at home, and we do not own smartphones either, as our parents cannot afford them when we have many school-going siblings so sharing phone is challenging sometimes."

The study reflected that one of the inhibiting factors in using ICT in teaching and learning is affordability. The socio-economic status of the students' families has a direct correlation with online learning participation. (UNESCO, 2021). Further, online learning is directly influenced by the

availability and accessibility, like internet connections and data packages, which further depend on the financial resources of the family. Weak internet connection and sharing gadgets for those students who have more than one sibling in a family is a nightmare for online learning (Zhongren Ma, 2021).

Research question 3

4.3 Recommendations on Enhancing the Use of ICT in Learning Geography

4.3.1 Adequate Digital Infrastructure and Facilities

The study findings showed that the respondents shared many recommendations that need to be done on enhancing the use of ICT in learning Geography. Few students expressed their concern about the good support system by the schools and other stakeholders in providing adequate digital infrastructure and facilities. This is important to enable the teachers, students, and parents to enhance the use of ICT in teaching and learning. The computer labs in most of these schools are adequate only for delivering the existing ICT literacy curriculum, and students' access to computers and the internet is confined to ICT classes. Furthermore, multiple reports suggest that inadequate internet connectivity and computers are the major constraints to leveraging ICT in Education in Bhutan (Ministry of Education, 2020, p.10). One of the most important elements is the inadequate digital infrastructure in schools to carry out the teaching and learning process. Further, stable internet connectivity and the improvement in bandwidth are crucial to enhance the effective learning of students. Students suggested to create Geography laboratory in school, with enough computers and good internet connectivity. According to Fu (2013), adequate infrastructure is important for the effective use of technology. ICT has been attributed to bringing changes in teaching and learning, and in the educational field.

4.3.2. Enhancement of ICT Capacity

The technical qualities of individual teachers are considered as one of the factors influencing advancement in education. FG 1 and FG 2 expressed:

Teachers need to be provided with timely training and other ICT-related professional support. Some students and teachers lack the necessary digital skills to use technology effectively, which can make learning with ICT challenging.

Further, FG 3 expressed, "Teachers also need adequate training on how to use digital tools and resources effectively. With the right skills, they can incorporate interactive maps, virtual field trips, and geographic information systems (GIS) to make learning more engaging and hands-on."

The study findings revealed that teachers need to be provided with timely training and other ICT-related professional support to keep abreast of the updated information and knowledge on ICT. To achieve this goal, more professional development is required with a focus on increasing teachers' skills so that they are able to overcome apprehensions associated with using technology. Staples et al. (2005) state that schools are also highly recommended to offer their teachers workshops or training courses to improve their ICT skills and prepare them to encounter possible challenges while integrating

technology in order to improve teachers' professional development on ICT use. Similarly, Jamtsho and Marck (2007) have stated that teachers in our country encounter difficulties such as, lack of trained and competent ICT teachers, technical difficulties, low bandwidth, and other infrastructural capacity in teaching and learning. By embracing these advancements, educators can unlock new possibilities for student engagement and achievement, ultimately preparing students to navigate and succeed in an increasingly digital and interconnected world.

4.3.3 Economic Affordability:

The research findings indicated that the economically disadvantaged students need support so that they are able to use ICT tools and online platforms in learning effectively at home. Few of the students agreed on the theme and shared:

Few students do not have the right smartphone, computer, or laptop for the learning process. It was also known that some share their parents' phone with siblings, which did not support the required features in teaching and learning. The finding aligns with the results of UNICEF (2017) that stated, not having the right tool like computer or laptop makes the learning process painful and strenuous, as access is only through smartphones, that too are sometimes shared with parents. However, organizing extra classes on weekdays to help students to utilize school facilities and allowing them access to the ICT laboratory during weekends would help reduce the challenges related to affordability. This would prepare the learners for acquiring 21st-century skills and pedagogies to be globally competent as lifelong learners. It is the requirement in the Curriculum for schools in Bhutan for effective teaching and learning.

4.3.4 Digital Literacy for Students

The findings revealed that programs like media and technology literacy are very much required for the students. It has been posited that to make effective use of technology for learning; one needs to have a certain level of digital literacy. The European Framework for Digital Literacy (EFDL), an outcome of the DigEuLit project and initiated to recognize the importance of digital literacy, defines digital literacy as follows: Digital literacy is the awareness, attitude and ability of individuals to appropriately use digital tools and facilities to identify, access, manage, integrate, evaluate, analyses and synthesize digital resources, construct new knowledge, create media expressions, and communicate with others, in the context of specific life situations, to enable constructive social action; and to reflect upon this process." (Martin, 2006, p.155). Likewise, in our country, digital literacy programs are essential so that all are aware on the usage of electronic gadgets.

Chapter V Implications, Conclusions, Recommendations, Limitations, Area of Further Research and Acknowledgement.

5.1 Implication of the Study

1. The results generated from this study help policy makers to strengthen the use of ICT in learning Geography so that students are globally competent.

2. This study will help the principals, parents, teachers, students and other stake holders on the potential benefits of using ICT in learning Geography as well as teaching.
3. The impact of the outcome of the research to the audience can further encourage relevant stakeholders and agencies in using ICT in curriculum delivery.

5.2 Conclusion

In this digital world, students need to learn and acquire 21st-century skills. In general, the students have a positive attitude towards the use of ICT in learning Geography. ICT has immense benefits as it makes learning interactive, interesting, and meaningful. The various platform allows student-centered, creative, and flexible learning opportunities (Vandana Singh, 2019). However, from this study, it was revealed that the teachers and students are not adequately competent with skills and knowledge in using ICT for academic purposes.

Nevertheless, the use of ICT has brought about a tremendous change in the way teaching and learning are carried out in the geography discipline. The emerging new geographical knowledge is better learnt with the use of ICT. Further, students learn by browsing videos and acquiring the content, thus enhancing the geographical concepts. Likewise, students' analytical and creative skills are enhanced. Owing to the numerous benefits of ICT in teaching and learning resources and facilities like enough computers, laptops, projectors, cameras, software, and internet bandwidth, is still a challenge in some schools in the country. Further, to harness the potential benefits of ICT, adequate training on ICT skills and knowledge is felt important so that teachers' and students' digital competency is enhanced. However, few students felt that the affordability of smartphones and laptops is still remaining a challenge for economically disadvantaged families. Further, digital literacy needs to be enhanced in schools among students so that ICT is used effectively for teaching and learning.

Furthermore, enhancement of ICT capacity, such as Professional Development (PD) programs and related training on ICT, is felt essential so that teachers acquire adequate knowledge and skills in ICT to impart quality education to students. The participants in the study are only included from one school. The results may not be generalized to other secondary schools. Further research can be done on the same topic, including all the teachers of secondary schools across the country. Students, parents, and other relevant stakeholders can be included to obtain valid and authentic information. The other area for further research could be finding out appropriate PD programs and training for geography teachers on the effective use of ICT in teaching and learning.

The findings of this study, besides adding to the existing knowledge will pave the way for future researchers to venture into research and scholarly exercises in enhancing the use of ICT in teaching Geography across all levels of classes in the school.

5.3 Recommendations

Based on the findings of the current study, the researcher recommends the following possible directions:

1. The students' participants in the study are only included from one school. The results may not be generalized to other secondary schools. The future studies may include all the students of secondary schools across the kingdom. The findings from such studies would help the concerned stakeholders and relevant agencies to better understand the differences in the ideas from other secondary schools.
2. The participants in the study are students' and Geography teachers' views are not collected. The study would have greater impact with more valid information if teachers were included in the study.
3. Adequate ICT resource, facilities, teachers and students' digital skills and knowledge need to be considered so that quality education is imparted to students. Therefore, there is need for relevant agencies and stakeholders to look into the aforementioned issues. Further, the number of students and computer ratio need to be considered so that all students get equal opportunity to learn. There is a need of Geography laboratory in the school.
4. Education stakeholders Department of School Education (DSE), Thromde Education Office (TEO), Dzongkhag Education Office (DEO), Transformative Educational Research and Assessment Development (TEARD) programs, and schools Principals have to devise innovative measures to address the need for enhancement of ICT capacity such as, professional support and training for teachers to remain updated with emerging knowledge and skills of ICT so that students are benefitted. There is a need for digital literacy for students.
6. Curriculum specialists, curriculum planners and curriculum implementers may need to be more aware of the importance of using ICT in teaching and learning and make the necessary recommendations to policy makers and administrators.

5.4 Limitations of the Study

This study has some limitations. First, the sample size was comparatively small, which may limit the generalizability of the findings. Second, data were collected only from Changzamtog Middle Secondary School limiting the geographical scope of the study. Further, the self-made survey questionnaires may have introduced response bias. Furthermore, due to time constraint during data collection might have affected the completeness and profundity of the findings. In spite of these limitations, the study provides insights and future research with larger and more diverse samples from across the country could strengthen the results.

5.5 Area of Further Research

I would suggest that further research can be done on the same topic including all the students of secondary schools across the country. Teachers, parents and other relevant stakeholders can be included to obtain valid and authentic information. The other area for further research could be finding out appropriate PD programs and training for Geography teachers on the effective use of ICT in teaching and learning.

5.6 Acknowledgement

The researcher would like to extend her appreciation to students' participants for being a valuable part of this research. Further, I would like to thank the Principal, Vice Principals, Colleagues, and ICT teachers of Changzamtog Middle Secondary School, Thimphu Thromde for providing the necessary assistance from the school. Furthermore, the researcher would like to appreciate the help and support from the parents to complete this research.

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