Effectiveness of Foundations of Educational Technology Course on ICT Knowledge, Attitude and Confidence of In-service Teachers and Teacher Education

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Research Report

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DECLARATION

I declare that this research entitled "**Effectiveness of Foundations of Educational Technology Course on ICT Knowledge, Attitude and Confidence of In-service** Teachers **and Teacher Education**" has been taken up as a part of the **PAB 20.25: PM e-Vidya Continuous Professional Development (CPD) through** NISHTHA - Educational **Technology.**

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CHAPTER 1: INTRODUCTION

1.1   Introduction

Enhancing the skills and knowledge of teachers in using Information and Communication Technology (ICT) is of utmost importance in the current era of digital advancements, as technology is swiftly reshaping the field of education. In order to properly incorporate technology into the classroom, teachers must acquire the requisite abilities to proficiently utilise ICT technologies for educational purposes. This encompasses a mastery of fundamental ICT skills, such as operating computers and software, as well as more sophisticated abilities like generating digital content and administering online examinations. Capacity building programmes seek to augment teachers' ICT proficiencies, empowering them to adapt to emerging technology, increase their pedagogical approaches and ultimately enhance student learning results. Such initiatives are essential to bridge the digital divide and ensure that all students have access to quality education in the digital era.

In this chapter the information given is related to Concept and Current Status, ICT Competency Framework for Teachers; UNESCO ICT Competency Framework, Competency for Teachers: Australia, Digital Teaching Professional Framework: UK, Digital Teaching Professional Framework: UK, Capacity Building of Teachers on ICT Competencies, National Initiative for School Heads and Teachers Holistic Advancement (NISHTHA), NISHTHA Educational Technology, Learning Strands of NISHTHA Educational Technology, Levels of Educational Technology, Rationale of the Problem, Statement of the Problem, Operational Definitions, Objectives, Hypotheses and Delimitations of the study are given in different captions.

1.2   Concept and Current Status

Globalisation, as a phenomenon characterised by enhanced connectivity and exchange of information, heavily depends on the availability and utilisation of ICT. The emergence of a "networked" society generates a need for digital communication and grants convenient access to specialised knowledge and different methods of practice. ICT has a significant influence on the work of teachers and their capacity to engage in professional development. ICT provides convenient access to educational resources and opportunities for professional growth, requiring teachers to dedicate more time to keep up-to-date in their sector. ICT also enhances teacher connectivity in areas with adequate technological infrastructure to geographically remote pupils or communities.

The 2030 Agenda for Sustainable Development recognises the capacity of ICTs to expedite advancement, narrow the gap in digital access and bolster inclusive Knowledge Societies. ICTs play a vital role in attaining the 17 Sustainable Development Goals, which encompass several areas such as education, gender equality, infrastructure, reduced inequities, peace, justice and strong institutions. Technology offers inventive methods for learners to acquire information and engage in society. Having a strong understanding of digital citizenship is crucial in the modern era. Implementing ICT in classrooms has the potential to revolutionise

teaching methods and give students more control over their learning. Teachers must possess the necessary skills and knowledge to effectively incorporate ICT into their teaching, with the goal of promoting equal access and high-quality education. In addition, it is imperative to utilise information and communication technology (ICT) to assist learners in cultivating essential abilities for the Knowledge Society, such as critical thinking, intricate problem-solving, cooperation and socio-emotional skills. Effective utilisation of ICT investments requires teacher training and continuous professional growth.

Education systems globally, in both advanced and emerging countries, are under growing pressure to integrate ICT into their curricula. The purpose of this shift is to provide pupils with the essential knowledge and abilities required for the future's knowledge-based society. Since the 1990s, there have been several educational programmes and research projects that have concentrated on incorporating ICT into schools. These endeavours have examined many approaches, such as establishing technological systems in schools and implementing advanced ICT-based tools for educational purposes. Policy-makers worldwide anticipate that the integration of ICT in schools will result in substantial educational and pedagogical advantages for both students and teachers. This transformation implies a transition from conventional, instructor-focused teaching to learner-focused, collaborative learning settings. Nevertheless, in reality, numerous schools persist in employing existing curricula and teaching approaches, often failing to fully exploit and effectively incorporate technology into their classrooms. Despite advancements in ICT infrastructure in schools and increased availability of ICT at home for students and teachers, there is still a deficiency in successfully integrating ICT tools into instruction.

Several initiatives have been implemented in countries including those inside the European Union (EU), Australia, the UK, India and several South Asian countries. These programmes strive to improve instructors' capacity to proficiently utilise ICT in both instructional and learning endeavours. ICT teacher preparation programmes are crucial for accomplishing significant and comprehensive educational improvements. The emphasis on 21st-century competencies highlights the significance of teachers and their ongoing professional growth through innovative teaching methods, such as problem-based and cooperative learning. The advancement of ICT has generated fresh demands in terms of teachers' obligations and their capacity to tackle and adapt to difficulties and modifications.

The 2015 Qingdao Declaration, emanating from the International Conference on ICT and Post-2015 Education, stands as a pivotal document highlighting the imperative of enhancing teachers' professional development to seamlessly incorporate ICT into the educational landscape. It unequivocally stresses the necessity of redefining the conventional role of teachers and substantially improving their training and professional growth initiatives to adeptly integrate ICT into the fabric of education. The declaration posits that the successful integration of ICT into education requires a holistic reevaluation and transformation of various educational components. This includes but is not limited to, the redefinition of the role of teachers, enhancement of their training and professional growth and the cultivation of a culture of excellence in several key areas. These include staff and student support, curriculum and course design, course delivery mechanisms, as well as strategic planning and overall

development. Furthermore, the declaration outlines a commitment to ensure that educational institutions are well-equipped and prepared to effectively leverage ICT for educational purposes. This includes extending the advantages of training and professional development programs to all teachers, irrespective of their geographical location or institutional affiliation. Moreover, these institutions are envisioned to serve as the vanguard for spearheading technology-driven advancements in the realm of education, thereby ensuring that educational practices remain contemporary and relevant. Additionally, the declaration pledges comprehensive support to teachers in their utilisation of ICT for educational purposes. This includes initiatives to encourage and recognize teacher creativity, as well as the establishment of networks and platforms for teachers to collaborate, exchange valuable insights and share effective strategies with their peers and other stakeholders. This collaborative approach seeks to harness the collective wisdom and experiences of educators worldwide, thereby fostering a rich and dynamic educational environment conducive to innovation and excellence.

UNESCO also emphasises the importance of ICT skills in teachers, seeing them as crucial for properly utilising digital resources in the classroom. These skills empower educators to create captivating and dynamic classes, adapt teaching methods to cater to the varying requirements of students and foster collaboration and communication among students. In addition, ICT competencies enable instructors to effectively access and utilise a diverse array of educational resources that are accessible online, hence improving the quality and pertinence of their teaching materials. By incorporating ICT skills into their teaching, educators can establish dynamic and inventive learning settings that promote critical thinking, creativity and digital literacy in students.

India excels globally in information and communication technology and other advanced fields like space exploration. The Digital India Campaign is driving the nation towards becoming a digitally empowered society and a knowledge economy. Education will play a pivotal role in this transformation, with technology being a key driver for improving educational processes and outcomes. The relationship between technology and education is bidirectional, with each influencing the other at all levels. The rapid advancement of technology, coupled with the innovative spirit of tech-savvy educators, entrepreneurs and student innovators, will undoubtedly impact education in various unforeseen ways. Emerging technologies such as artificial intelligence, machine learning, blockchain, smart boards, handheld devices and adaptive testing tools will not only change what students learn but also how they learn. These advancements will require extensive research in both technological and educational fields to harness their full potential. India's leadership in information technology and space exploration, coupled with the Digital India Campaign's efforts, is transforming the nation into a digitally empowered society and knowledge economy. Education will play a crucial role in this transformation, with technology being a key driver for improving educational processes and outcomes. The relationship between technology and education is bidirectional, with each influencing the other at all levels. The rapid pace of technological development, combined with the innovative nature of tech-savvy educators, entrepreneurs and student innovators, will undoubtedly impact education in various unforeseen ways. Emerging technologies such as artificial intelligence, machine learning, blockchain, smart boards, handheld devices and adaptive testing tools will not only change what students learn but also

how they learn. These advancements will require extensive research in both technological and educational fields to harness their full potential.

1.3 ICT Competency Framework for Teachers

ICT has become a fundamental aspect of education today, transforming traditional teaching methods and creating opportunities for novel and interactive learning experiences. Teachers must possess a high level of ICT competency in order to fully utilise technology and improve their teaching effectiveness and student engagement. Teachers' ICT proficiency comprises a wide array of skills and knowledge. Essentially, it entails proficiency in efficiently using diverse digital tools and technology. This encompasses expertise in utilising computers, tablets, interactive whiteboards and other ICT devices, along with a thorough understanding of software applications pertinent to education, such as learning management systems, multimedia tools and instructional software. Nevertheless, ICT competency extends beyond mere technical skills. It also requires the skill to effortlessly incorporate ICT into teaching methods in order to improve learning results. This encompasses the ability to create and implement ICT-integrated classes that accommodate various learning styles, encourage critical thinking, foster creativity and collaboration among students and enable personalised learning experiences. In addition, ICT proficiency also includes the capacity to analyse and utilise digital resources for educational objectives. This encompasses the ability to locate, choose and modify digital content and resources that are educationally effective and in line with learning goals, as well as the capacity to guarantee the ethical and responsible utilisation of ICT in the classroom.

Teachers must engage in continuous professional development in order to improve their ICT skills. This encompasses engagement in training programmes, workshops and online courses specifically designed to emphasise the integration of ICT in education. These programmes not only facilitate the acquisition of new skills and information by teachers, but also offer them the opportunity to interact and exchange best practices with their colleagues. Ultimately, proficiency in ICT is a crucial determinant of the achievement of contemporary education. Proficient teachers in ICT have the ability to construct innovative and captivating learning environments that equip students with the necessary skills to tackle the demands of the digital era. Thus, it is imperative for educators to consistently enhance their ICT skills and knowledge in order to fulfil the changing requirements of education in the 21st century.

UNESCO also highlights the crucial importance of digital competencies and Artificial Intelligence (AI) in revolutionising education to address the demands of the 21st century. UNESCO recognises the capacity of AI to augment the calibre of education through the customisation of learning experiences, enhancing the availability of education and assisting teachers in delivering efficient instruction.

Many countries are actively involved in improving teachers' proficiency in ICT. This commitment is motivated by the acknowledgment of the transformative capacity of ICT in education. These countries seek to better overall educational outcomes by investing in teachers' ICT skills and expertise, with the goal of improving the quality of teaching and learning and preparing students for the digital future. European Schoolnet which is a network that facilitates

cooperation between schools in Europe, providing complimentary online courses for the professional development of teachers and school leaders. It offers top-notch MOOCs (Massive Open Online Courses) for primary and secondary education. The organisation is backed by 32 Ministries of Education from various European countries, with the objective of spearheading educational innovation on a European scale. European Schoolnet creates educational materials in multiple languages to support instructors in their instruction, promoting collaborative learning and collaboration among educators throughout Europe.

There are many ICT competency frameworks available for assessing the expertise of instructors in ICT. These frameworks are useful tools for evaluating and improving teachers' ICT skills, assuring their ability to successfully incorporate technology into their teaching methods. The UNESCO ICT Competency Framework for Teachers is a widely used framework for assessing teachers' ICT competencies. It offers a complete set of criteria and recommendations for this purpose. The ISTE Standards for Educators, published by the International Society for Technology in Education, are another commonly utilised framework. These criteria delineate the competencies and expertise that educators must possess in order to proficiently utilise technology to augment the process of learning and instruction. The topics covered include digital citizenship, innovative design and the use of digital tools for cooperation and communication. In addition, some countries and companies have created their own ICT competency frameworks customised to suit their unique educational environments and requirements. These frameworks frequently mirror local goals and difficulties, guaranteeing that educators possess the aptitude and understanding required to address the distinct requirements of their classrooms and students. ICT competency frameworks are essential for directing the professional growth of teachers and ensuring they are adequately equipped to utilise technology effectively in order to improve learning outcomes. These frameworks assist teachers in evaluating their existing abilities, recognising areas that need improvement and taking appropriate measures to expand their ICT capabilities by offering explicit criteria and guidance.

1.3.1   UNESCO ICT Competency Framework

Technology plays a crucial role in the attainment of the Sustainable Development Goals (SDGs). The UNESCO ICT Competency Framework for Teachers (ICT CFT) is a framework developed by UNESCO in collaboration with industry leaders and global experts to outline the necessary skills and knowledge teachers need to effectively teach with ICT. The framework has been updated three times, with the latest version incorporating the Agenda 2030 for Sustainable Development and addressing inclusive education. The ICT CFT Version 3 focuses on the importance of teachers possessing ICT skills and the capacity to cultivate these skills in their students. It also emphasises the use of ICT tools to facilitate collaborative, problem-solving and creative learning in students, as well as fostering innovation and engagement as active members of society. The ICT CFT is recommended to be incorporated into all three stages of teacher professional development: pre-service, in-service and ongoing support. Pre-service training includes training in pedagogy, subject matter knowledge, management skills and the use of teaching tools, while in-service training provides structured face-to-face and distance training opportunities. The ICT CFT is a training program for teachers on the use of

ICT in education. It targets various stakeholders, including teacher-training personnel, educational experts, policy-makers and support personnel. The program emphasises the need for teachers to use teaching methods appropriate for evolving Knowledge Societies and enable students to generate new knowledge using ICT. Implementing the ICT CFT requires strong leadership from government, teacher education and professional development organisations and head teachers and school principals.

The ICT CFT Version 3 serves as a comprehensive guide for teacher training, supporting the effective use of digital technology in educational settings from primary to tertiary levels. It is designed to align with national and institutional objectives, providing a framework for policy formulation and capability enhancement in the rapidly evolving field of educational technology. This framework identifies digital competencies and guides the development of policies, curriculum design and educator training. It also aims to enhance educators' capacity to use technology in their professional practice. The ICT CFT Version 3 categorizes digital skills into three tiers of increasing complexity, essential for education and instruction, management of educational institutions, ongoing professional growth and adapting classroom methods to meet institutional or national objectives as outlined in policy. The successful implementation of the ICT CFT requires a supportive environment, including strong leadership from government, teacher educators, in-service teacher development professionals, head teachers and school administrators. The UNESCO ICT CFT framework outlines 18 competencies and 64 specific objectives that teachers should strive to achieve. These skills cover areas such as understanding national priorities in ICT in Education policies, leveraging ICT to enhance the curriculum, implementing effective assessment strategies, adopting innovative teaching methods, managing schools and classrooms and engaging in continuous professional development.

The six aspects of teacher's professional practice addressed are:

- Understanding ICT in Education
- Curriculum and Assessment
- Pedagogy
- Application of Digital Skills
- Organisation and Administration
- Teacher Professional Learning
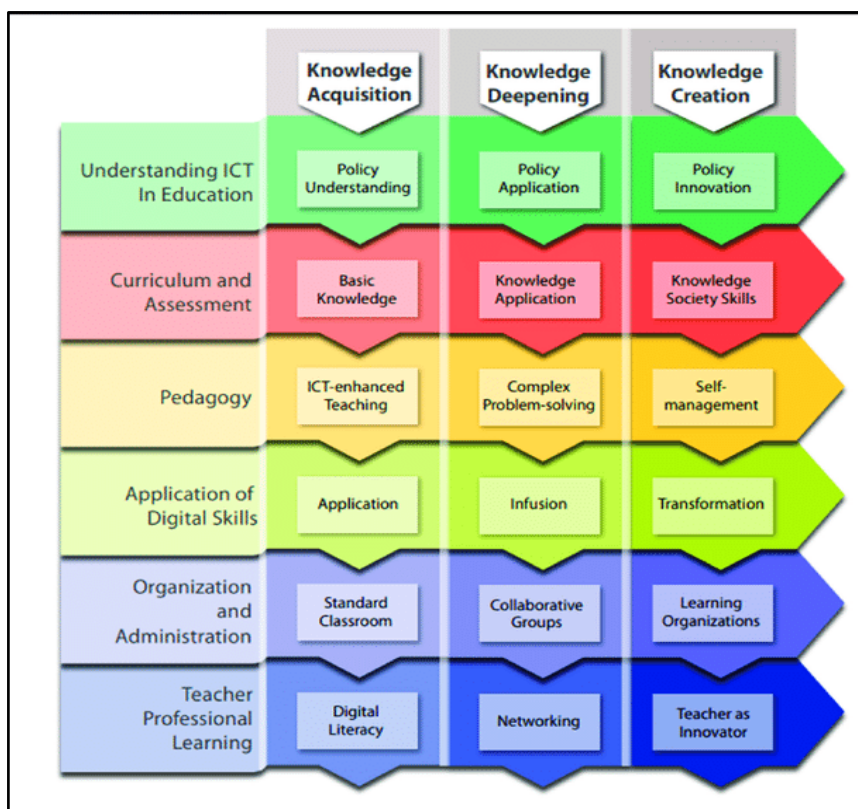
Figure 1.1: UNESCO ICT Competency Framework for Teachers (ICT CFT) Version 3

The successful integration of ICT into the learning environment hinges on teachers' capacity to restructure learning methodologies, seamlessly incorporate technology with pedagogy, foster socially active classrooms and promote cooperative interaction, collaborative learning and group work. Many educators will need to acquire a different set of skills beyond their current expertise. Future teaching skills will involve developing innovative ways to use technology for enhancing the learning environment, promoting knowledge acquisition, deepening understanding and fostering knowledge creation. Teacher professional learning stands as a crucial component in this educational advancement.

1.3.2   Competency for Teachers: Australia

The National Framework for Professional Standards for Teaching is a key initiative in the field of education in Australia and overseas. It provides a structure and language for defining professional standards, promotes quality teaching by outlining essential knowledge, skills and attributes and gives teachers a tool to outline a continuum of abilities and responsibilities central to professional excellence. The framework also identifies knowledge, skills and behaviours needed to assist practising teachers in their chosen career path, raises the quality of education in Western Australian schools and provides direction for tertiary institutions and professional development providers in developing programs that ensure the development of quality teaching.

The framework is based on five generic dimensions of teachers' work, which are dynamic and not related to length of service. Classroom teachers assume roles beyond the classroom, such as working collaboratively with colleagues and other members of the school

community. Teachers develop their knowledge, skills and practices throughout their professional lives and there are essential attributes that people wishing to enter the teaching profession should have to be effective teachers. The Curriculum Framework guides teachers as they develop and implement their teaching and learning programs, guided by the Department's values of learning, excellence, equity and care. As teachers become familiar with the competencies of each phase, they can determine the types of professional learning activities that best address their individual needs.

1.3.3 Digital Teaching Professional Framework: UK

The Education and Training Foundation (ETF) has developed a competency framework for teachers and trainers in the Further Education (FE) and Training (TVET) sector. The framework, developed in collaboration with Jisc, focuses on the benefits of good pedagogy supported by technology to enhance learning. It includes seven elements: planning your teaching, approaches to teaching, supporting learners to develop employability skills, subject-specific and industry-specific teaching, assessment, accessibility and inclusion and self-development. The framework is designed to support teachers, tutors, trainers, assessors, lecturers, or instructors working in any part of the FE and TVET sector, including mainstream FE provision, adult and community learning, work-based learning and offender learning. It also provides a framework for managers and HR staff to support staff development plans. The framework helps make clear how digital technology can enhance teaching and learning, gives practical ideas and can be used as freestanding resources or worked towards certified digital badges. It also aids HR staff by providing a strategic framework for using digital skills strategy and staff development plans.

The framework covers stages 1 through 3: exploring, developing, leading and planning. Stage 1 involves using online search strategies to identify relevant resources and content, designing and adapting activities, supporting learning and support activities and communicating and collaborating with colleagues. The framework also encourages reflection on and re-designing communication strategies to contribute to developing a coherent vision or strategy for using digital technologies effectively and responsibly for communication.

1.4 Capacity Building of Teachers on ICT Competencies

In the realm of digital education, the adoption of cutting-edge technologies necessitates a paradigm shift in the roles of educators, ushering in new pedagogies and approaches to teacher education. The seamless integration of Information and Communication Technology (ICT) into the learning environment hinges upon the capacity of teachers to reimagine the structure of learning, skillfully amalgamate technology with pedagogy, cultivate socially engaging classrooms and foster cooperative interaction through collaborative learning and group work. Many educators will find themselves in need of acquiring a fresh set of skills that extend beyond their current competencies. The teaching skills of the future will encompass the ability to pioneer innovative ways of leveraging technology to augment the learning environment. This entails not only facilitating knowledge acquisition but also fostering deepened understanding and the creation of new knowledge. In this digital era, teacher professional learning emerges as a critical component, serving as the linchpin for educational improvement.

Continuous development and adaptation to evolving technological landscapes will be imperative for educators to remain effective and responsive to the dynamic needs of their digitally-driven classrooms. A 'digital teacher' is conceptualised as an individual who proficiently employs technology to fulfil educational needs, actively engaging as both a creator and consumer of educational content.

In the present day, new circumstances have emerged that allow technology to exert a profound influence on education for everyone. Technology is now widely accessible, with even inexpensive mobile phones capable of unprecedented interactions with the world. Our students are interconnected and prepared, yet it is our teachers who need assistance in understanding when and how to effectively utilise ICTs in teaching and learning, thereby enhancing students' experiences. However, instigating change in education is a complex process; it seldom occurs spontaneously. All components of the system - including access, teachers, administrators, learners and ICTs - are indispensable but individually insufficient to achieve the substantial systemic change needed. The training and ongoing professional development of educators are crucial components necessary for school transformation and the proper utilisation of ICTs. The absence of effective professional development for teachers is commonly viewed as a fundamental reason for the disparity between the potential achievements of learners and the actual challenges they encounter in classrooms worldwide.

The Centrally Sponsored Scheme of Restructuring and Reorganisation of Teacher Education was launched in 1987 as part of the National Policy on Education (NPE, 1986). The objective was to create a decentralised system for the training of teachers, which involved the creation of the District Institute of Teacher Education (DIET), College of Teacher Education (CTE) and Institute of Advanced Studies in Education (IASE). In 2010, the system was modified to tackle the difficulties that emerged due to the growth of educational institutions and the need for more teachers. The updated Guideline for the Restructuring and Reorganising of the CSSTE was published in 2012. The Samagra Shiksha is a comprehensive programme in the field of school education that seeks to enhance and improve the State Councils of Educational Research and Training (SCERTs) and District Institutes of Education and Training (DIETs) as primary organisations responsible for teacher training. The National school Policy, 2020 highlights the significance of teachers in the school system, reinstating a strong reverence for teachers and elevating the standing of the teaching profession. The strategy also highlights the importance of providing instructors with rigorous content and pedagogical training.

Teachers have a vital role in moulding India's future, as highlighted by the NEP-2020, which emphasises the importance of empowering teachers for the advancement of the nation. It is important for them to have a strong foundation in Indian values, languages, knowledge systems and customs, while also keeping up with educational advancements. Highly skilled educators possess a wider array of practical ideas, abilities and methods for instruction and evaluation, hence improving the overall quality of education. Teachers that are exceptional and enthusiastic and who promote excellence and innovation are crucial for attaining high standards. NEP 2020 in India recognizes the pivotal role that teachers play in the educational ecosystem. It acknowledges that teachers are not only responsible for imparting knowledge but also for moulding the future citizens of the country. The NEP emphasises the need for

continuous professional development (CPD) of teachers to ensure that they are equipped with the latest pedagogical approaches and skills to meet the diverse needs of students. According to the NEP 2020, teachers and head teachers are expected to participate in at least 50 hours of CPD opportunities every year. These opportunities are intended to be driven by the interests of the teachers themselves, allowing them to focus on areas that they feel will enhance their professional growth. The CPD opportunities are designed to cover a wide range of topics, including foundational literacy and numeracy, formative and adaptive assessment of learning outcomes, competency-based learning and various pedagogical approaches such as experiential learning, arts-integrated learning, sports-integrated learning and storytelling-based approaches.

The country possesses an extensive network of teacher training institutions (TTIs), including SCERTs and DIETs, which offer yearly in-service training to school teachers. The TTIs are distributed both vertically and horizontally, with the National Institute on Educational Planning and Administration (NIEPA) offering institutional assistance. State-level Teacher Training Institutes (TTIs) provide training modules and deliver specialised courses for educators and school instructors. DIETs offer professional development programmes at the district level. Block Resource Centres (BRCs) and Cluster Resource Centres are fundamental institutions at the grassroots level. The State Council of Educational Research and Training (SCERT) will serve as the central agency in the state for conducting teacher training under the Samagra Shiksha programme. The main areas of focus encompass enhancing the capacity of SCERTs/DIETs/BRCs/CRCs, delivering ongoing professional development, ensuring awareness of safety, health and environment, providing opportunities for self-improvement, promoting technology platforms for online training and acknowledging the significance of in-person learning. The School Leadership Development Programme (SLDP) seeks to augment leadership proficiency at the school level to facilitate the establishment and growth of institutions. The Scheme provides financial assistance for various interventions, allowing states to supplement or augment provisions from their own resources. Preference will be given to states and UTs that have restructured their SCERT and DIETs, as per MOE2018 Guidelines, for programmes and activities. The scheme includes five categories: establishing new DIETs, establishing new SCERTs, constructing and expanding existing TEIs, providing major and minor repairs and establishing special cells for SCERT (one-time grant). The scheme aims to enhance access and provide quality education conditions.

The National Initiative for School Heads and Teachers Holistic Advancement (NISHTHA) is a distinctive teacher training programme used as part of Samagra Shiksha. Its purpose is to transition from memorization-based learning to a more effective approach focused on developing competencies. The programme is offered to State and Union Territories (UTs) for the training of Resource Persons (RPs), with assistance from the National Centre for School Leadership (NCSL) of NIEPA. The training for Headmasters (HMs) is conducted by resource persons appointed by the states. Head Teachers require training in order to acquire the necessary skills for offering academic assistance and leadership. On the other hand, Educational Administrators require training to guarantee the effective execution of the RTE Act, oversee schools, put into action syllabi and establish a well-functioning system of academic and curricular support. Teacher educators require a comprehensive training programme that combines professional development and capacity building initiatives, as well

as a 10-day orientation/induction training for newly hired teacher educators. The program's objective is to inspire and empower teachers to include activities into classroom interactions, so ensuring active student participation and maximising their potential. The National effort for School Heads and Teachers Holistic Advancement is a unique effort, supported by the Government of India and incorporating academic institutions such as NCERT and NIEPA, aimed at transforming in-service teacher training.

1.4.1 National Initiative for School Heads and Teachers Holistic Advancement (NISHTHA)

NISHTHA is a capacity-building program designed to enhance the quality of school education through integrated teacher training. It focuses on developing competencies among all teachers and school principals at the elementary stage. Notably, NISHTHA stands as the world's largest teachers' training program of its kind, emphasising its scale and significance. The primary objective of this extensive training initiative is to motivate and equip teachers to effectively cultivate critical thinking skills in students. By empowering teachers with the necessary knowledge and tools, NISHTHA aims to create a learning environment that nurtures students' ability to think critically, analyse information and develop innovative solutions to complex problems. One of the key aspects of NISHTHA is the development of standardised training modules at the national level for implementation across all states and union territories (UTs). This approach ensures consistency and quality in teacher training, regardless of the location and enables a more cohesive and unified effort to enhance the quality of education across the country. NISHTHA represents a significant step towards improving the quality of school education in India by focusing on enhancing teachers' skills and fostering critical thinking among students.

The NISHTHA program, launched in August 2019, aimed to integrate stakeholders and target groups on a single platform. It trained nearly 17 lakh elementary teachers until March 2020, with a 6-day face-to-face training program. The program included text modules, videos, live sessions and interactive voice response systems. A blended mode of training will be adopted once the pandemic is over. The secondary NISHTHA 2.0 program, launched in July 2021, aims to train around 10 lakh secondary teachers, covering 68 modules. The program focuses on interactivity, foundational literacy and numeracy. A customised FLN package covering 12 modules was launched in September 2021. The expected outcomes include improved foundational literacy and numeracy, improved learning outcomes, training teachers to integrate ICT, transformation of principals into academic support and empowerment of teachers.

1.4.2 NISHTHA Educational Technology

The alignment of the initiative with the proposal outlined in the Education Budget 2022-23 underscores a strategic focus on advancing digital learning. The budget's emphasis on developing high-quality e-content in multiple languages for delivery through various digital platforms such as the internet, mobile phones, TV and radio, supported by digital teachers, reflects a commitment to enhancing accessibility to educational resources. This approach aims to ensure that a teacher can benefit from these resources across different platforms, catering to

diverse learning needs and preferences. To further empower teachers with digital tools and improve learning outcomes, the budget proposes the establishment of a competitive mechanism for teachers to create quality e-content. This recognition of teachers' pivotal role in content creation acknowledges their deep understanding of students' needs, enabling them to tailor content effectively. Involving teachers in the creation of digital resources not only enhances the relevance and quality of the content but also fosters a sense of ownership and engagement among educators. The budget's focus on incorporating ICT tools into education highlights the need for a systematic, level-wise training program to equip teachers with the skills to become proficient digital educators. This training program is essential to ensure that teachers can effectively integrate technology into their teaching practices and maximise its benefits for student learning. By providing teachers with the necessary training and resources, the budget aims to enhance the overall quality of education and prepare students for success in an increasingly digital age.

The National Education Policy (NEP 2020) emphasises the importance of a strong digital infrastructure in schools and higher education institutions, ensuring equitable access to digital resources for all students, regardless of socio-economic backgrounds. The policy aims to facilitate internet connectivity, provide digital devices to all students and create a more flexible and adaptive learning environment. Online and blended learning models are also emphasised, recognizing the significance of digital platforms in content delivery, assessment processes and fostering flexibility in learning approaches. The policy emphasises the use of online resources, digital materials and other technological tools to disseminate information and conduct assessments. The NEP also emphasises the creation of high-quality and interactive electronic content (e-content) in regional languages, addressing linguistic diversity and catering to diverse linguistic backgrounds. The policy aims to make educational resources accessible and effective in facilitating learning, breaking down language barriers and promoting inclusivity.

Teacher training in educational technology is also emphasised, with comprehensive training programs designed to equip teachers with the necessary skills and knowledge to effectively utilise digital tools and platforms in the educational process. The policy also emphasises the integration of technology into teacher education programs, preparing future educators to be well-versed in the effective use of technology to meet the evolving needs of modern education. The National Education Policy (NEP) emphasises the potential of adaptive learning platforms and artificial intelligence (AI) in revolutionising the education sector. AI can offer personalised learning experiences, tailoring educational content to suit individual students' needs and abilities. This aligns with the goal of fostering inclusive and equitable education systems that accommodate diverse learning requirements.

To successfully integrate ICT into teaching and learning, it's essential to reconsider the role of teachers in planning and implementing technology to enhance education. Educational systems must regularly update teacher preparation and professional development, ensuring all educators can effectively utilise technology in teaching - according to UNESCO. Integrating ICTs in teacher education programs supports high-quality teaching and learning, advocating for a shift in existing pedagogical and content practices. Leveraging the potential of new

technologies, especially digital tools, is crucial for effective teaching in today's world. Educational communities need to move beyond technology literacy, fostering innovative practices that integrate technology, pedagogy and content. A well-researched roadmap aligned with national and institutional goals is vital, to create a "Digital Teacher".

To bridge the existing gap and empower teachers and school administrators with the necessary skills to embrace the role of a digital teacher, NISHTHA Educational Technology is introduced.

1.4.3 Learning Strands of NISHTHA Educational Technology

In order to achieve the goal of 'Digital teacher', NISHTHA Educational Technology offers six learning strands, designed to steer the journey towards enhanced expertise in utilising technology for educational purposes. These strands are crafted to foster the development of skills essential for navigating present and upcoming educational technologies. They underscore the importance of harnessing technology for understanding and mastering its applications, managing ICT infrastructure, using technology to surmount challenges and acquiring insights to proficiently lead in technology-driven educational environments. These six strands encompass:

1. **Connecting with the World**

   ICT tools provide teachers with internet-enabled access to diverse information and resources, enhancing their teaching methods and benefiting student learning. The curriculum emphasises critical evaluation and utilisation of online materials for professional development. It covers internet basics, search techniques, ethical use and safety measures, ensuring teachers can navigate, select and incorporate digital resources effectively in their education practices.

2. **Connecting with Each Other**

   ICT tools facilitate diverse ways of keeping people connected, with synchronous and asynchronous modes fostering interactivity and community formation. This connectivity allows collaboration for common causes and breaks teachers' isolation, promoting professional growth. Essential skills include creating and managing email, handling attachments, joining forums, engaging in discussions, using video/audio conferencing, social networking, blogging and understanding cyberbullying and social issues for effective and responsible online engagement.

3. **Creating with ICT**

   ICT tools are viewed not as an end goal, but as a means to foster creativity and expression. They encompass various media forms, enhancing communication experiences. Easy interaction methods expand learning possibilities. Teachers' proficiency with diverse tools and techniques broadens imaginative expression. Treating computers solely as information devices limits their potential. Access to a range of tools enhances communication skills and interactive teaching-learning experiences. Teachers must master tasks like managing media, data processing and

using audio-video tools. Proficiency in programming and device control adds versatility to teaching, offering a broader range of engaging activities for students.

4. **Interacting with ICT**

ICT is rapidly evolving, with an expanding range of devices and processes. Computers have become simpler in interface but more versatile in handling complex tasks, impacting daily life. Understanding ICT systems and tools is crucial for identifying teaching opportunities and making informed educational tool choices. The modern computer is an integrated communication medium, requiring a broad conceptual understanding for effective use. Key skills include connecting devices, internet setup, software installation, file management and basic troubleshooting and repair, emphasising virus protection and safety measures.

5. **Possibilities in Education**

ICT has revolutionised education with diverse applications, including interactive software and online resources. Critical user discernment is vital, emphasising substance over glamour. This strand acts as a bridge between educational goals and dynamic ICT developments, involving exploration of open educational resources, research on ICT utility, familiarity with virtual environments, web resources and productive tool use for teaching and professional growth.

6. **Reaching Out and Bridging Divides**

Despite widespread availability, ICT accessibility isn't universal. Techniques like portability and open resources enhance access, but language barriers and isolation persist. Awareness and resource creation can bridge divides, particularly for the physically challenged. The theme involves building digital communities, shared agendas and local language tools, along with exploring assistive technologies and collaborative possibilities.
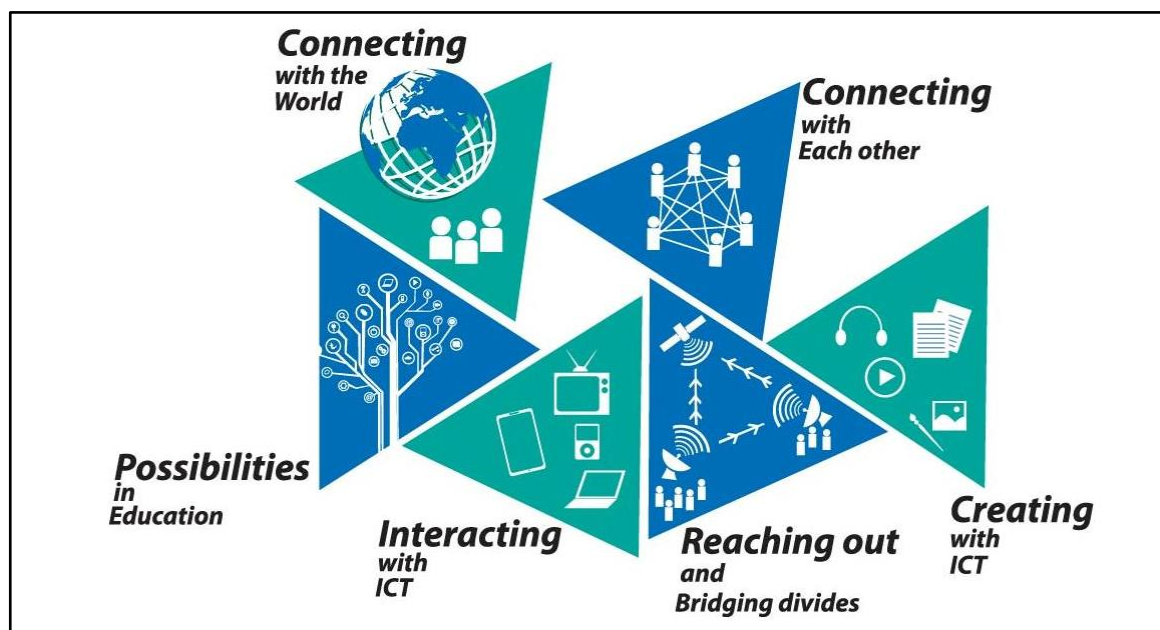
Figure 1.2: NISHTHA Educational Technology Learning Strands

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The ultimate goal of NISHTHA Educational Technology is to prepare teachers and teacher educators to use digital technology and transform into **Digital Teacher.** In alignment with the UNESCO competency framework, the primary focus of the three levels of NISHTHA Educational Technology for teachers is to make them:

a. As Prosumer of technology

b. To Infuse digital Technology into Teaching and Learning Process

c. To Create digital ecosystem for transforming education with digital technology

These levels encompass a comprehensive range of competencies that educators require to seamlessly incorporate ICT into their professional practices, thereby facilitating students in achieving curricular objectives. The competencies outlined at these levels are designed to empower teachers with the necessary skills and knowledge to effectively leverage information and communication technologies in the teaching and learning process.

1.4.4   Levels of Educational Technology

The Level 1 course- Foundations of Educational Technology serves as an introductory stage, aiming to cultivate a broad understanding of educational technology among participants. Teachers are equipped with the fundamental skills required for basic ICT utilisation in educational settings. This includes proficiency in using essential tools, navigating digital platforms and ensuring a basic understanding of how technology can support educational objectives. This level is aligned with the four learning strands of NISHTHA ET i.e., connecting with the world, connecting with each other, creating with ICT and interacting with ICT.

Level 2 - Integration of Technology in Teaching Learning and Assessment focuses towards more advanced competencies, emphasising the effective integration of content, technology and pedagogy. This level is aligned with all the six strands of NISHTHA Educational Technology. The overarching goal is to elevate the quality of education by improving learning outcomes through the seamless incorporation of technology into teaching practices. Moreover, this course seeks to empower teachers with the necessary skills to create high-quality digital content, ensuring that they can adapt to the evolving landscape of educational technology.

The Level 3- Transforming Education Through Technology course marks a significant progression in the professional development of teachers. At this stage, the objective is to transform educators into responsible digital citizens who are well-versed in addressing contemporary issues such as cyber safety and bridging the digital divide. The educator will possess the capability to establish a digital environment within their classrooms. They will be adept at making informed decisions regarding the choice of digital tools and actively contribute to enhancing students' competencies. Additionally, they should be proficient in conducting classroom-based trials and pilot studies of digital pedagogy. Beyond these concerns, Level 3 aspires to empower teachers as techno leaders, enabling them to design, develop and manage their own digital ecosystems. This level also aims to prepare teachers for active contributions at both the state and national levels, positioning them as influential figures in the realm of educational technology. Ultimately, the Level 3 course envisions teachers as key players in

shaping the future of education, not only within their classrooms but also on a broader societal scale.

1.5   Rationale of the Problem

Teachers' attitudes and proficiency levels are frequently mentioned as obstacles to the implementation and efficient utilisation of ICT in teaching. Although there is a strong focus on improving ICT capabilities, the results of these efforts are more noticeable in students' proficiency in ICT skills rather than their ability to effectively utilise these talents in other sections of the curriculum. Recently, there have been several efforts from both the scientific community and educational policy authorities to train teachers in incorporating ICT into their regular teaching methods.

The NISHTHA Educational Technology programme has implemented a three-level systematic course to provide teachers and school administrators with the necessary skills to become digital educators and close the existing gap. The proposed curriculum is both contemporary and essential in providing educators with the necessary skills to handle the intricacies of digital teaching methods. The Foundations of Educational Technology Course (Level - 1) aims to augment the ICT proficiencies of teachers, acknowledging the crucial significance of technology in contemporary education. Due to the swift progress of technology, educators need to adjust to emerging patterns and use information and communication technology (ICT) into their instructional methods to establish lively and captivating learning settings. This course focuses on the necessity for teachers to possess expertise in using ICT tools, in line with worldwide patterns that underscore the significance of ICT in education. The course aims to enhance teaching effectiveness and prepare students for the digital economy by providing instructors with the necessary skills and knowledge to effectively utilise ICT. Moreover, the course is in line with National Education Policy (NEP 2020) that prioritises the incorporation of ICT in education, showcasing the government's dedication to enhancing the standard of education. This course offers teachers valuable professional development opportunities and fosters lifelong learning, assuring their continued competitiveness in the education area and their contribution to improving the overall quality of education.

1.6   Statement of the Problem

The present study aimed to study the effect of the teaxhing of Foundations of Educational Technology course which is a Level 1 course in NISHTHA Educational Technology on the ICT competencies of the in-service teachers and teacher educators. Hence the study is entitled as:

EFFECTIVENESS OF FOUNDATIONS OF EDUCATIONAL TECHNOLOGY COURSE ON THE BASIS OF REACTION TOWARDS ICT KNOWLEDGE, ICT AND CONFIDENCE IN USING ICT OF IN-SERVICE TEACHERS AND TEACHER EDUCATORS OF INDIA

1.7   Operational Definitions

The study employs the following operational definitions for its variables and population:

1.7.1   Foundations of Educational Technology Course:

This course is a Level-1 course of the NISHTHA Educational Technology training. The course has 12 modules consisting of ICT basics sessions.

1.7.2   ICT knowledge:

In this study, knowledge of ICT was defined as the familiarity, awareness, or understanding of facts, information, descriptions of ICT concepts, tools and the use of ICT for teaching and learning. ICT Knowledge consists of eight dimensions i.e., hardware & software, operating system, working with word processor, working with images, working with audio & video, working with spreadsheets, internet browser & browsing and working with email.

1.7.3   Attitude towards ICT

In this study, "attitude towards ICT" refers to the positive or negative attitude towards ICT's capabilities in the teaching and learning process, the skill of using ICT, and the social aspects related to the use of ICT in education. ICT attitude consists of four parameters i.e., handling ICT tools, managing the use of ICT to learn and teach, solving the issues arising during the use of ICT.

1.7.4   Confidence in using ICT

In this study, "confidence in using ICT" refers to the ability to handle ICT tools, manage their use in the teaching-learning process, and resolve issues related to integrating ICT and pedagogy. ICT confidence consists of three parameters: technical aspect of handling ICT, pedagogical usability of ict, social & ethical aspects related to ICT, professional use of ICT

1.8   Objectives

The following were the objectives:

- To compare mean scores of ICT knowledge and its' dimensions separately of teachers before and after Teaching Foundations of Educational Technology Course.
- To compare mean scores of Attitude towards ICT and its' dimensions separately of teachers before and after Teaching Foundations of Educational Technology Course.
- To compare mean scores of Confidence in using ICT and its' dimensions separately of teachers before and after Teaching Foundations of Educational Technology Course.
- To study the influence of Gender, Teaching Experience and their interaction on ICT knowledge of teachers taught Foundations of Educational Technology Course by considering their Pretest scores of ICT knowledge as covariate.
- To study the influence of Gender, Teaching Experience and their interaction on Attitude towards ICT of teachers taught Foundations of Educational Technology Course by considering their Pretest scores of Attitude towards ICT as covariate.

- To study the influence of Gender, Teaching Experience and their interaction on Confidence in using ICT of teachers taught Foundations of Educational Technology Course by considering their Pretest scores of confidence in using ICT as covariate.

1.9 Hypotheses

The following hypotheses were formulated for this research:

1. There is no significant difference in mean scores of ICT knowledge of teachers before and after Teaching Foundations of Educational Technology Course.

2. There is no significant difference in mean scores of Hardware and Software dimension of ICT knowledge of teachers before and after Teaching Foundations of Educational Technology Course.

3. There is no significant difference in mean scores of Operating System dimension of ICT knowledge of teachers before and after Teaching Foundations of Educational Technology Course.

4. There is no significant difference in mean scores of Working with word processor dimension of ICT knowledge of teachers before and after Teaching Foundations of Educational Technology Course.

5. There is no significant difference in mean scores of Working with Images dimension of ICT knowledge of teachers before and after Teaching Foundations of Educational Technology Course.

6. There is no significant difference in mean scores of working with Audio and Video dimension of ICT knowledge of teachers before and after Teaching Foundations of Educational Technology Course.

7. There is no significant difference in mean scores of Working with spreadSheet dimension of ICT knowledge of teachers before and after Teaching Foundations of Educational Technology Course.

8. There is no significant difference in mean scores of Internet, Web Browser and Browsing dimension of ICT knowledge of teachers before and after Teaching Foundations of Educational Technology Course.

9. There is no significant difference in mean scores of Working with an email dimension of ICT knowledge of teachers before and after Teaching Foundations of Educational Technology Course.

10. There is no significant difference in mean scores of Attitude towards ICT of teachers before and after Teaching Foundations of Educational Technology Course.

11. There is no significant difference in mean scores of Technical Aspects of ICT dimension of Attitude towards ICT of teachers before and after Teaching Foundations of Educational Technology Course.

12. There is no significant difference in mean scores of Pedagogical Usability of ICT dimension of Attitude towards ICT of teachers before and after Teaching Foundations of Educational Technology Course.

13. There is no significant difference in mean scores of Social and Ethical aspects of ICT dimension of Attitude towards ICT of teachers before and after Teaching Foundations of Educational Technology Course.

14. There is no significant difference in mean scores of Professional use of ICT dimension of Attitude towards ICT of teachers before and after Teaching Foundations of Educational Technology Course.

15. There is no significant difference in mean scores of Confidence in using ICT of teachers before and after Teaching Foundations of Educational Technology Course.

16. There is no significant difference in mean scores of Handling of ICT Tools dimension of Confidence in using ICT of teachers before and after Teaching Foundations of Educational Technology Course.

17. There is no significant difference in mean scores of Managing the use of ICT dimension of Confidence in using ICT of teachers before and after Teaching Foundations of Educational Technology Course.

18. There is no significant difference in mean scores of Solving the issues that arise during the use of ICT dimension of Confidence in using ICT of teachers before and after Teaching Foundations of Educational Technology Course.

19. There is no significant influence of Gender, Teaching Experience and their interaction on ICT knowledge of teachers taught Foundations of Educational Technology Course by considering their Pretest scores of ICT knowledge as covariate.

20. There is no significant influence of Gender, Teaching Experience and their interaction on Attitude towards ICT of teachers taught Foundations of Educational Technology Course by considering their Pretest scores of Attitude towards ICT as covariate.

21. There is no significant influence of Gender, Teaching Experience and their interaction on confidence in using ICT of teachers taught Foundations of Educational Technology Course by considering their Pretest scores of confidence in using ICT as covariate.

1.10 Delimitations of the study:

- Sample was selected on the basis of criterion.
- Due to limited resources, five participants from each institution were targeted.
- Both male and female teachers as well as teacher educators were taken for the study.

CHAPTER 2: REVIEW OF RELATED LITERATURE

2.1   Introduction

The integration of Information and Communication Technology (ICT) into education has become increasingly imperative in today's digital age. As educators strive to enhance teaching and learning experiences, the Foundations of Educational Technology course emerged as a crucial component in equipping in-service teachers and teacher educators with the necessary skills and competencies. This review of related literature explored the effectiveness of such a course in augmenting ICT knowledge, fostering positive reaction towards technology integration and instilling confidence among educators. By examining previous studies, this review aimed to provide valuable insights into the effect of Foundations of Educational Technology course on the professional development of educators, ultimately contributing to the advancement of ICT integration in educational settings.

2.2   Studies related to capacity building of Teachers on their ICT competencies

The body of research surrounding the capacity building of teachers in enhancing their ICT competencies serves as a critical exploration into the professional development initiatives within the educational landscape. These studies delve into various interventions, training programs and pedagogical approaches aimed at empowering educators with the requisite skills to effectively integrate technology into teaching practices.

The effect of capacity building programs on the job productivity of teachers in public senior secondary schools in the Port Harcourt Metropolis of Rivers State was examined by Blessing and Dikeogu (2024). To guide the investigation, three research questions and three hypotheses were developed. A descriptive survey research design was used in the study. Two hundred and forty two Principals and Teachers (37 Principals and 2005 Teachers) working in public senior secondary schools in the Port Harcourt Metropolis of Rivers State made up the study's population. The Taro Yemen algorithm was applied to determine the 371 responders sample size. However, the sample for the study was chosen using stratified random sampling technique. A structured questionnaire intended to elicit replies from the research questions in a four-point grading system served as the instrument for data collection. Three professionals validated the instrument. The 0.70 dependability coefficient was established through the application of Cronbach Alpha. The study topics were addressed using the mean and standard deviation and the formulated hypotheses were tested at the 0.05 level of significance using the z-test analysis. The study examined how teachers' job productivity in public senior secondary schools in Rivers State's Port Harcourt Metropolis is impacted by in-service training, workshops and ICT training. The study concluded that in order to improve instructors' capacity building and instructional productivity, workshops have to be held at least once a year.

Ahmad and Ali (2023) investigated the "Role of ICT in capacity building: A teacher perspective." The study aimed to study three key areas: 1) Teachers' perspectives on using ICT for professional development; 2) Teachers' beliefs regarding the use of ICT in the teaching and learning process; and 3) Teachers' obstacles to integrating ICT in the classroom. This study

employed survey methodology. The 316 Certified Teachers (CTs) in the Malakand area were the intended audience. Using the Proportionate Stratified Random Sampling Technique, 32 CTs were selected as a sample from the accessible population. The information gathered via questionnaires was arranged, condensed, examined and evaluated. The study suggested that there should be adequate funding for ICT infrastructure, adequate training in ICT, awareness of the obstacles instructors encounter when teaching ICT and ICT space in the curriculum.

Agyei (2021) followed up with a sample of 4945 Science, Technology, English and Mathematics (STEM) teachers from six Sub-Saharan African nations—Kenya, Tanzania, Uganda, Ethiopia, Ghana and Nigeria for this study. An instructional digital professional development program was offered to the teachers with the goal of enhancing their ability to integrate ICT into curriculum and organisational procedures in schools. This study aimed to assess the influence of the ICT-instructional professional development program on the degree and calibre of teachers' application of program concepts from capacity building to teaching practices in the classroom. Semi-structured survey tools and diaries used to document events and activities during the implementation period were used to gather data for the study. The results showed that although the instructors were generally satisfied with the training program's content and procedures, there appeared to be a lack of necessary conditions during the implementation phase to facilitate the transfer of the training's concepts to the school level. The study discussed the implications for efficient professional development in incorporating ICT into curriculum practices and school administration that had a long-term effect on teaching and learning, especially in Sub-Saharan areas and other similar situations.

One of the educational issues facing teacher preparation in the development of teachers' digital competency as a result of the introduction of information and communication technology into the classroom. Based on this, Garzón Artacho et al. (2020) evaluated how teachers in the Andalusian community of Lifelong Learning developed their digital competence (Spain). To that end, a transversal and quantitative work design was employed, utilizing a sample of 142 educators from several local schools. The findings indicated that teachers lacked proficiency in all five digital domains, particularly in producing digital material. It was also made clear that the aspects of communication and collaboration, as well as content creation, were directly related to prior information and communication technology (ICT) training. Finally, the research conducted here demonstrated the youth and lack of experience of the teachers involved in preservice ICT training. To sum up, the formation of digital teaching competency remains a challenge for the educational system and needs to be addressed. It should also remain a crucial aspect of current teachers' training because it is a necessary foundation for fostering innovative teaching practices and the only way to create an area-wide teaching innovation panorama.

Acquiring digital competencies is an essential aspect of educating future teachers. Nevertheless, this is an intricate procedure that encompasses a variety of diverse tactics. Furthermore, there is less knowledge regarding the integration of these approaches in preparing future teachers for the use of educational technology. Hence, Howard et al. (2021) studied the connections between various approaches used to enhance digital proficiency in the training of future teachers. The association rules analysis was carried out on a dataset consisting of 931

pre-service educator observations throughout their training, which encompassed six techniques. The findings indicated the presence of four clearly defined groups of related techniques, which unveiled a novel and comprehensive approach for enhancing digital competence in teacher training. To enhance the development of digital capabilities among preservice teachers, it is essential to establish tactics that foster multi-directional and dynamic partnerships. The study explored potential avenues for future research.

Rana and Rana (2020) studied of the use of information and communication technology (ICT) in teaching and learning activities in Nepalese higher education The government of Nepal's ICT education strategy highlighted the need for teachers to enhance their ICT competencies and proposed that using ICT would change traditional teaching models to ones that were student-centered. The case study revealed that there was no clear plan in place for putting the ICT education policy into practice, funding ICT infrastructure and supporting university staff members' professional development so they could include ICT into teacher education. In this instance, an international organization provided funds to the university's Faculty of Education to establish ICT infrastructure and offer ICT training to staff members, teachers and other faculty members. This was because the project involved using ICT in education but neither the government nor the university were sponsoring it. It was suggested that in order to put the strategy into effect, more long-lasting systems for supplying teachers with ICT resources and teaching them how to use it in the classroom must be created.

Ghavifekr and Rosdy (2015) examined how well instructors believed that ICT integration supported the teaching and learning process in the classroom. A total of 101 instructors from ten public secondary schools in Kuala Lumpur, Malaysia, were randomly given a survey questionnaire. With SPSS (version 21) software, the data for this quantitative study were analysed using both descriptive and inferential statistics. The findings revealed that ICT integration benefited both teachers and pupils greatly. Findings showed that one of the key elements in the success of technology-based teaching and learning was teachers who were well-prepared with ICT tools and resources. Additionally, it was shown that teacher professional development training programs were crucial in improving the calibre of learning for children. Future research must take into account additional facets of ICT integration, particularly from a management perspective with relation to policy formation and strategic planning.

Finding the connection between teacher competency and 21st century abilities was the aim of research done by Sulaiman and Ismail (2020). In addition, they looked at how each dimension of teacher competency affects variables that predict teachers' abilities in the twenty-first century. Participants in the study comprised 242 secondary school teachers from Peninsular Malaysia's TS25 Cohort 1 North Zone. Additionally, quantitative methods was employed in the study. The study used two instruments: teacher competency variables based on the Ministry of Education Malaysia's Malaysian Teacher Standards (2009) and 21st century skills variables based on Partnership For 21st Century Skills' in Teacher Educator framework (2010). The study's analysis found that teachers' professional competence and 21st century skills were positively correlated. According to the findings, school administration and development, professional development, pedagogy, information and communication technology (ICT) and personal traits all significantly contributed to 21st century competencies.

Casillas Martín et al. (2020) studied how young students assessed their own digital competency. A descriptive quantitative methodology that was non-experimental was utilized, with data being gathered via an electronic survey. One of the most important findings was that these students self-reported that they had a positive attitude toward information and communication technologies (ICT), handle them moderately and know very little about them. It became evident that they lacked the necessary digital proficiency to be referred to as "digital natives" and that they were not be able to use ICT effectively for their future academic or professional endeavours.

2.3   Studies related to the development and/ or usage of ICT competency frameworks for Teachers

Research on the development and implementation of ICT competency frameworks for teachers has become increasingly important in modern education settings. As technology becomes increasingly prevalent in all areas of life, educators are responsible for both incorporating it into their teaching methods and acquiring the essential skills to do so proficiently. ICT competency frameworks are important tools that outline the specific knowledge, abilities and attitudes that educators must possess in order to effectively use digital resources in teaching. Gaining a comprehensive understanding of the development, application and consequences of these frameworks is crucial for educational policymakers, administrators and instructors. This knowledge will help them effectively traverse the challenges of modern teaching and learning environments in the 21st century.

Information about pre-service teachers' ICT proficiency as future Vietnamese educators was gathered for the study by Thao et al. (2024). The study polled 1698 fourth-year teaching students (pre-service teachers) from 10 provinces across 3 regions of Vietnam using the UNESCO ICT competency framework. The findings showed that while pre-service teachers in Vietnam had a solid understanding of ICT policy concerns in the classroom, they still required ICT skills to support successful teaching and learning methods when it came to the issue of ICT exploitation to support curriculum implementation and assessment. Gender and training specialisation also differed significantly in certain areas, such as the use of ICT in administration and organisation and the use of digital skills. Zhao (2024) studied factors affecting teachers' ICT competency based on the ICT competency framework for teachers. Using empirical data from secondary school teachers in Hebei Province, China—both in urban and rural settings—a prediction model of teachers' ICT ability was constructed. The findings were that there was a new digital divide between teachers in urban and rural areas and that the influence of these disparities in the digital environment and digital literacy on teachers' ICT competency varied. Teachers' ICT proficiency was also impacted by their age and subject. In the modern day, teachers' ICT competency may be enhanced by beginning with knowledge production, acquisition and deepening.

The objective of the study conducted by Rojas-Osorio et al. (2024) was to studied how university professors saw their own level of digital competency. This study was cross-sectional, descriptive, quantitative and non-experimental. 122 academics from a single private university in Peru made up the sample. Additionally, a strong correlation was found between gender and networking methodological strategy understanding. When it came to digital competence, the

teacher's age was the most significant element that affected their knowledge of and proficiency with communication and information tools. There was minimal engagement in projects and groups to innovate and explore teaching themes with ICT and a sizable portion of teachers did not take part in training activities or evaluate their ICT-based teaching practices.

The digital proficiency of faculty members at public universities was assessed by Mugizi et al. (2023). The TPACK model and the UNESCO (2018) ICT Competency Framework for Teachers served as the foundation for the academic staff's digital competency. Course design, technical proficiency, communication proficiency and time management proficiency were used to gauge digital teaching competency. A self-administered questionnaire was used to gather data from a sample of 327 academic staff members out of a population of 2225 academic staff members from four public institutions in Uganda, using the survey method The data were analysed using structural equation modelling (PLS-SEM), partial least squares structural equation modelling and descriptive statistics. According to descriptive results, there was a high level of competency in course design, technical, communication and time management. The four measures were suitable indicators of digital competency, according to PLS-SEM. It was found that public university academics had the digital competencies required for the successful digitalization of education and that technical, communication, course design and time management competencies were suitable benchmarks for digital teaching competencies. Naidoo and Lautenbach (2023) studied how a professional development program for teachers affected their usage of digital tools in the classroom. Its specific goal was to determine the effect that teacher professional development (TPD) had on the acquisition of the knowledge and abilities required for a shift in teaching methods involving the use of digital technology. The purpose of the research strategy was to characterise the knowledge, skills and attitudes (KSA) of teachers toward the use of ICTs for teaching and learning before the TPD and to determine the degree to which the TPD altered the KSAs of teachers on ICT. The results indicated that following the TPD, there was an increase in abilities but also a shift in expertise and teaching methods. These findings revealed that TPD positively affected teachers' use, expertise and practice modification in the classroom when it was developed with adult learning principles and education theories and frameworks at its core.

Tomczyk and Fedeli (2021) conducted a thorough analysis of the most significant and extensively debated theoretical frameworks pertaining to teachers' digital literacy (DL). The objective was to highlight the distinctions and overlaps among the most widely used theoretical frameworks for deep learning. The various notions' visibility (citability) determined the choice of theoretical frameworks. The five most often referenced theories for comprehending the phenomenon of ICT adoption in education at various stages of formal and tertiary education were included in the study review. Concepts including TPACK, DigCompEdu, UNESCO, NETS-T and DigiLit Leicester were summarized and contrasted in the study. The findings were: 1) There was not a single, universal method for assessing DL in instructors; 2) The regions and degrees of DL were largely well-defined in the aforementioned theoretical frameworks; 3) The majority of the concepts presumed measurement through self-declaration, forgoing measurement through practical actions; 4) Every notion made it abundantly evident that teaching procedures and DL were inextricably linked; 5) Because of the unique characteristics of the profession, DL among teachers varied from DL among other professional

groups; 6) Variations in how the most widely accepted theoretical frameworks were developed could be attributed to the variety of definitions for digital literacy and the differing perspectives on the development of computerization in education; 7) The integration of DL with methodological components (content, methods, forms), teacher and learner development and other common features of the frameworks under analysis; and 8) The chosen frameworks had their own instruments for measurement.

In order to develop an information technology competence framework and the prerequisites for employing instructors' information technology competence in online teaching at training institutions, Chi et al. (2020) provided a theoretical framework. This study's parameters were sample space (n = 342) and 42 expert opinions in order to identify an information technology competence framework with the necessary skill sets and criteria for effectively organizing online instruction. In order to transform people's perspectives and prepare teachers for the online teaching trend that was currently being driven by digitalization, this study addressed the topic of teaching and building information technology competency. Thus, including an IT competency framework into online instruction had numerous implications for the training process that enhanced students' ability to learn.

Cabero-Almenara et al. (2020) considered national and worldwide Teacher Digital Literacy proposals. Expert opinion was utilized to evaluate the 7 most popular international competency frameworks. The best candidate for a Teacher Digital Literacy t-MOOC was chosen. Seven criteria were used to choose these experts to determine the expert knowledge coefficient. This approach verified sample viability. This study included 412 people—155 specialists and 257 non-experts. After one round of expert judgement, the European Framework of Digital Competence for Teachers DigCompEdu was deemed the most suitable reference for the formative t-MOOC, followed by INTEF. This was expected as the former inspired the latter. This did not question the validity of different competency frameworks, only judge preferences.

Over time, numerous frameworks, models and literacies were developed to assist teacher educators in developing the digital skills of their students. These skills enabled them to effectively utilize new and emerging technology in their future classrooms. Typically, these efforts aimed at improving students' proficiency in utilizing educational apps and digital information, as well as understanding the effective combination of pedagogical, content and technological knowledge that supported the integration of digital resources into teaching, ultimately enhancing learning outcomes in specific subjects. In teacher education schools, courses that focus on developing these capacities were often taught as separate entities. Alternatively, it was assumed that these capabilities were acquired through the integration of technology in other disciplines or through required assessments. Nevertheless, extensive research indicated that the current emphasis on subject-specific technical and information skills was insufficient in equipping students with the wide range of knowledge and abilities required in modern classrooms and beyond. Falloon (2020) introduced a conceptual framework that gave an enlarged perspective on teacher digital competence (TDC). This text advocated for a shift away from current narrow and limited views of technical and literacy skills. Instead, it promoted a more comprehensive and inclusive understanding that acknowledged the growing

complexity of knowledge and abilities that young people required to navigate diverse digital environments in an ethical, safe and productive manner. The text explored the consequences of the framework, focusing on its multidisciplinary character and the necessity for all faculty members to actively and intentionally contributed to achieving its goals. Mtebe (2020) implemented the UNESCO ICT-Competency Framework for Teachers to examine the proficiency of educators in utilizing ICT within the classroom setting. Using both qualitative and quantitative research methods, the study was carried out in 20 schools in Morogoro and Pwani (10 schools in each region) with 91 instructors in total. The study discovered that while teachers' proficiency with ICT facilities in daily operations was excellent, their proficiency with ICT integration in the classroom, including curriculum and evaluation, was low. Additionally, their pedagogy had a low mean score when compared to other UNESCO ICT-CFT domain elements. These results suggest that while there were a number of initiatives aimed at providing ICT facilities in schools, enhancing Internet connectivity and creating digital content, there should be sufficient emphasis placed on ensuring that teachers possessed the necessary knowledge and abilities to successfully integrate ICT into the classroom.

Ogundolire (2020) conducted a study to help Federal College of Education TVET pre-service teachers in Lagos State acquire ICT-based teaching competencies. The framework, which was based on three concepts—knowledge creation, knowledge deepening and technology literacy—was adopted by UNESCO. The framework was provided by theories of engagement and competency. The four stages of the design-based approach, which used mixed techniques, were analysis, development, iteration and reflection. These phases were completed in a span of sixteen weeks. A multi-phase sampling technique was applied. The Federal institution of Education (Technical), Akoka was specifically chosen as an institution of education in Lagos State with sufficient technical and vocational resources. In their last year, when most of the courses were taken, fourteen 200 level pre-service teachers were enumerated and purposefully chosen. The UNESCO training module and the scales for knowledge creation (α=0.94), knowledge deepening (α=0.87), technology literacy (α=0.98) and skill acquisition (r=0.72) were the instruments utilized. A focus group discussion was conducted with participants from TVET classes. While content analysis was performed on qualitative data, quantitative data were subjected to descriptive statistics and paired samples t-test. Male participants made up the bulk (92.9%) of the sample. The TL (85.0%), KD (78.5%) and KC (73.1%) of pre-service instructors were high. When it came to ICT creativity, pre-service teachers scored well on ease of use (76.3%) and engagement (71.0%). Between the levels of ICT use, there was a significant difference (t =5.302; df=13). Before training, the mean level of ICT use was ($\bar{x} = 80.07$), whereas after training, it was ($\bar{x} = 142.50$). The pre-service teachers exhibited a high level of skill knowledge (71.4%), work standard (57.2%), autonomy (71.4%), coping with complexity (57.1%) and context perception (78.5%). Pre-service teachers lack ICT abilities despite preparation. They also created lesson plans based on ICT that were utilized to teach technical drawing. They believed that using ICT tools was pertinent and tied to reaching TVET goals. Following the training, they displayed the development of useful talents and inventiveness. At Federal College of Education Akoka, Lagos, the UNESCO framework for acquiring ICT proficiency for technical and vocational education was successfully implemented. Atman Uslu and Usluel (2019) proposed a conceptual framework for classifying

ICT use in education and developed and tested a structural model to explain technology integration using teacher- and school-related criteria. A conceptual framework classified educational ICT use from an instrumentalist standpoint. The framework structured and technology integration indicators were well-defined. School variables included access, technical support, administrative assistance and professional development, whereas teacher variables included beliefs and ICT competence. These variables were used to test a structural equation model. Data was obtained from 403 primary and secondary teachers. The model explained 70% of technology integration variance, confirming predictions.

Syahid and Nugraha (2019) looked for information on the kinds of ICT training resources that were suitable for primary school teachers' requirements as well as the creation of an effective ICT training curriculum framework. In this study, a descriptive survey design was used. Thirty primary school teachers from twelve different regions in Sumedang Regency, West Java, comprised the sample. The study's findings provided a general picture of the divide between teachers who were proficient in using ICT and those who required practice to improve their proficiency. An ICT training curriculum structure suitable for elementary school teachers' needs was created by this research in an effort to bridge this gap.

Tsankov and Damyanov (2019) analyzed the structure of teachers' digital proficiency by identifying the key qualities that ensure their comprehensive practical expertise. The empirical study evaluated the digital competence of future pedagogical specialists who were trained in the field of pedagogy. It also highlighted their ability to solve practical tasks using information and communication technologies. There were suggestions to reconsider the education of future pedagogical specialists and the professional qualification of current teachers in relation to their digital competence.

Instefjord and Munthe (2016) discussed digital competence in the Norwegian teacher education curriculum. An analytical framework based on Zhao, Pugh, Sheldon, Byers, Krumsvik, Mishra and Koehler was created. Teachers' digital competency included technology proficiency, pedagogical compatibility and social awareness. National guidelines, curricular requirements and program descriptions from 19 teacher education institutes were analyzed utilizing this approach. Results showed that curricular documents did not emphasize technology. There were few binding learning outcomes for technology integration, demonstrating that digital competence was still not considered essential to teachers' professional competence. This study clarified the concept of "teachers' digital competence" to help teacher educators understand which knowledge they incorporated into their curricula, its purpose and the best ways to teach pre-service teachers.

Maende and Opiyo (2014) suggested an ICT Competency Framework for Teachers (ICT-CFT), which was utilized by the government to carry out its ICT-in-Primary-Schools Project and examined common elements of effective ICT training for teachers. They evaluated Kenya's existing ICT competency levels among primary school teachers through a comparative review of contemporary literature on the use of ICT in education. Based on the necessity of a long-term national ICT Competency Framework for Teachers (ICT-CFT) for the nation, the researchers emphasised the significance of incorporating ICT-integrated curriculum into all

teacher preparation programs. They also described how primary school teaching professionals might adopt ICT more widely if a sustainable national ICT-CFT were to be implemented.

2.4   Studies related to effect of trainings on ICT competencies for Teachers

The use of ICT into education has been crucial in recent years, since it has influenced contemporary teaching methods and improved learning results. Studies that concentrate on training programs designed to facilitate ICT competencies among teachers attracted considerable attention in this field. These studies explored several topics, such as the development and execution of training programs, the effect of teaching methods and the efficacy in facilitating instructors' technology skills. By conducting thorough research and analysis, these studies provided important insights to the continuing discussion on the integration of educational technology. They guide methods to equip educators with the essential skills to effectively utilize and take advantage of ICT in the classroom.

The ongoing development of ICTs and shifting from teaching with ICT to solving with it required teachers to possess competencies and transfer them to skills that go beyond basic ICT literacy, competence and skills, namely 21st-century digital competence and skills. Rahimi and Mosalli (2024) placed pre-service EFL teachers' 21st-century digital competency into a DIGIGLO framework to attain this goal. Thus, 472 Iranian pre-service teachers completed the study questionnaires. Based on reflecting model results, the eight DIGIGLO framework areas were validated in Iranian EFL. The formative model also showed that only four areas of DIGIGLO—professional engagement, empowering learners, learning and teaching and digital environment-shaped EFL teachers' 21st-century digital skills to identify suitable ICT tools to design, edit, present and solve language learners' problems—were included. These four categories also helped EFL pre-service instructors develop critical-thinking digital abilities to gather student feedback and customize their ICT use to their needs. ElSayary (2023) studied whether the effect of the upskilling training course improved teachers' digital competence beyond the expected intermediate level indicated in the World Bank Report of 2021, which mentioned approaches for the Digital Skills Action Plan. This study's upskilling training program consisted of ten weeks of instructor-led, blended learning training. Long-term objectives of the training included fostering greater competency in a range of knowledge, skills and attitudes, including digital citizenship; teamwork and communication; critical thinking, solving problems and decision-making; innovative thinking and creativity; and technology use as a tool. Utilizing both quantitative and qualitative data, a sequential mixed-method approach was adopted. It was decided to use an online survey using closed-ended questions to get quantitative information from teachers. Using the Zoom conference meeting platform, instructors' focus group talks yielded the qualitative data. Teachers in grades K–12 from a number of national nonprofit educational institutions in the United Arab Emirates (UAE) were taking part. The study's findings demonstrated how well the upskilling course enhanced instructors' digital competency, or their ability to build knowledge and abilities. Educators possessed a constructive outlook on technology use, which facilitated cooperation, education and efficiency, ultimately enhancing their digital proficiency. Consequently, this helped the kids build their digital abilities, which enabled them to overcome obstacles in this ever-

changing world—especially in light of the COVID-19 pandemic and its dependency on technology.

As technology has an impact on every aspect of life in today's society, it was essential to support upcoming preschool and primary school teachers' advancement in digital competence in order to create a population that was digitally literate and to advance social progress through education. The implementation of a financed teaching innovation project created in collaboration with students pursuing degrees in primary school education and preschool education at the University of Valencia in Spain was described by Gabarda Méndez et al. (2023). Developing digital competency from a cross-cutting viewpoint was the primary goal of their study. The findings validated the participants' progress in every domain of digital proficiency and the influence of gender on the acquired outcomes. Teachers' Digital Competence (TDC) was a crucial prerequisite for the successful incorporation of technologies in education and it was influenced by individual and situational factors. Various frameworks and tools were developed to assess TDC. Nevertheless, there was a limited amount of study on digital skills in vocational education and training (VET). Cattaneo et al. (2022) conducted a study with vcx three main objectives. Firstly, it aimd to assess the current level of digital competence among 1692 Swiss VET teachers. This assessment was conducted using a validated questionnaire that took into account the specificities of VET. Secondly, the study seeked to identify any differences in digital competence based on the profiles of VET teachers, such as their educational background or area of expertise. Lastly, the study aimed to determine whether personal and contextual factors had a similar impact on digital competence in VET as they did in other educational settings. The results affirmed the authenticity of the 10-dimensional design of the TDC assessment tool. The findings suggested that VET teachers had comparable level of digital competence to teachers in other educational areas, with some variations in certain sub-competences among different profiles. Furthermore, the use of multiple regression analysis emphasized the significant influence of human factors such as attitude towards technology and frequency of digital tool use on the development of TDC. The teachers' workload, which was seldom taken into account in prior studies, was also a significant issue. Among the elements related to the setting, curriculum support had the most significant influence on TDC, but its impact was the modest compared to the personal factors.

Fernández-Batanero et al. (2022) presented a comprehensive analysis of the existing research on digital competences and teacher professional development between 2008 and 2018. The objective of this study was to study research patterns and prospective avenues for future research on this topic. The approach employed adheres to the PRISMA Statement Guidelines for conducting Systematic Reviews and Meta-analysis. The sample consisted of 21 studies after applying criteria for inclusion, exclusion and topical relevance in the Scopus and Wos databases. The chosen studies highlighted the significance of digital competence as a key obstacle that instructors currently faced. These studies primarily employed qualitative research methodologies. One of the main findings was that the majority of the chosen studies indicated a deficiency in teacher training and inadequate instruction in ICT.

The study done by Lucas et al. (2021) had two goals: (i) to offer a valid and reliable tool to assess teachers' digital competency using the DigCompEdu, or European Framework for the Digital Competence of Educators and (ii) to study the relationship between the digital competence of in-service teachers and contextual and personal factors. The study was conducted on 1071 in-service teachers. The factorial structure of the instrument was validated and three distinct methods were used to examine the relationship between teachers' digital competency and environmental and personal factors: (i) simple linear regression, (ii) multiple linear regression and (iii) machine learning. The findings demonstrated that every analysis carried out supported the greater predictive power and predominance of personal characteristics over contextual ones. There were disparities in gender and age, but the most significant predictor of teachers' digital competence was the quantity of tools they utilized for instruction and learning, followed by simplicity of use, comfort level with digital technology and receptivity to new ideas. This study demonstrated the validity of the DigCompEdu framework and offered information that could enhance teacher preparation programs and influence practice and policy.

ICT enabled individuals to access and exchange information using telecommunication technologies, hence facilitating their participation in the digital realm. Furthermore, ICT was constantly advancing and bringing about significant transformations in the field of education. Descriptive research was conducted by Fuente and Biñas (2020) to ascertain and articulate the extent of teachers' ICT proficiency in various skill areas. This was accomplished through the use of a standardized survey questionnaire that was adapted from the National Information and Communications Technology Competency Standards (NICS-Basic) of the Commission of Information and Communication Technology. The study used a purposive sample of seventy-two secondary teachers from a specific Integrated High School in the Philippines for the academic year 2018-2019. In order to achieve a complete data retrieval, the researchers directly conducted the survey questionnaire with the respondents. The statistical analysis of the results was conducted using the Statistical Package for the Social Sciences (SPSS) software, employing tools such as Frequency and Percentage, Mean, t-test and Analysis of Variance (ANOVA). The results indicated that teachers possessed an intermediate level of competency in various skill sets related to Information and Communications Technology. Furthermore, factors such as age, gender, greatest level of education and teaching position did not have a significant effect on the ICT competency of instructors. Nevertheless, the attendance of teachers in ICT-related seminars and training sessions on topics such as ICT foundations, spreadsheet, computer ethics and security was substantial. Suárez-Rodríguez et al. (2018) aimed to develop a fundamental model that linked teachers' ICT technological and pedagogical competences to their personal-professional and student-use of these technologies. The model also analyzed personal and contextual factors affecting this interaction. A secondary analysis study sampled 1095 Valencian Community male and female Primary, Secondary and Higher Education instructors. Two survey design studies acquired data via questionnaire. Teachers' ICT integration was optimally modeled using MIMIC. This model displayed a complex competence-use relationship. Personal-professional use and class use were influenced by technological capabilities and pedagogical competencies. Pedagogical competencies and personal-professional use affected classroom use. Personal and contextual factors affected the

four use and competency dimensions. This basic model of teachers' ICT competencies and educational resource use helped to comprehend the difficult process of incorporating ICT into classrooms.

Tondeur et al. (2017) aimed to create a self-report tool to assess preservice teachers' ICT skills. Experts helped construct this instrument's questionnaire items based on a detailed structure. The data came from 931 final-year pre service instructors in Flanders, Belgium. Confirmatory factor analysis was performed on a second subsample after exploratory factor analysis. Competencies to facilitate students' ICT use in class and ICT competencies for instructional design were identified. This two-factor structure was validated by confirmatory factor analysis. This dependable test suggested for assessing preservice teachers' ICT competencies.

2.5 Studies related to the factors (enablers or barriers) affecting the ICT competencies for Teachers

Gaining a comprehensive understanding of the complexities of ICT skills among educators is crucial in the current era of digital technology. Numerous studies explored the complex aspects that either support or hinder the development of ICT abilities among instructors. The purpose of these investigations was to uncover the factors that allowed educators to effectively utilize ICT technologies in educational environments, as well as the obstacles that impeded their ability to do so. By conducting thorough study and analysis, these investigations contributed to improving teacher training programs, developing curriculum and policy formulation. This ultimately lead to the development of a teaching force that was more skilled in using technology and more equipped to handle the changing needs of modern education.

Mulyanti et al. (2024) identified and examined the factors that influence the digital proficiency of teachers. These factors included personal characteristics of teachers (such as gender, age, experience, vocational background and attitudes towards technology) as well as the school context (including school status, accreditation, leadership support and curriculum support). The study methodology employed a quantitative approach characterized by a causal design. The study encompassed a collective of 444 educators from vocational high schools (SMK) situated in western Indonesia. The factors that impacted teachers' digital competence were their attitudes towards technology and their vocational specialization. Specifically, instructors who instructed vocational courses tend to possess superior digital competence compared to those who taught general foundational topics and local content. The provision of curriculum assistance greatly influenced the digital proficiency of vocational school instructors. Enhanced curricular support improved teachers' digital competence by facilitating successful lesson design, implementation of teaching and learning activities, including usage of digital-based practical resources. Age, gender, as well as school status did not determine a teacher's digital proficiency. The investigation's findings suggested that the government, particularly the Ministry of Education along with the director general of vocational education, should incorporate teacher digital competence into the evaluation of teacher performance. This should also be taken into account by school principals and related offices to enhance technology facilities and enhance the digital literacy of vocational teachers. This study differentiated itself from other studies by examining the factors that influenced the digital

competence of teachers in vocational education. The study especially examined the affect of school status and vocational school recognition, while considering the distinct blend of school-based and work-based education with a variety of teaching methods.

The Internet of Things (IoT) is a rapidly evolving concept that combines technology with education. However, it faced various challenges that hinder its integration into higher education institutions' e-learning platforms. Even though industrialized nations—the United Kingdom, the United States of America, China and Japan being notable examples - made significant strides in their utilization of the Internet of Things, the extent of its implementation in developing countries—specifically Jordan, Malaysia, Iran, Saudi Arabia, Iraq, along with Bangladesh—remained behind. There was a significant difference in the research on how the IoT was being incorporated into e-learning systems in economically disadvantaged countries. Wahshat et al. (2024) specifically examined the factors that were either enabling or impeding the implementation of the IoT in the e-learning field of Jordan's Higher Education Institutions (HEIs). As a preliminary step in this work, a thorough examination of existing research was conducted. The objective of this investigation was to ascertain crucial aspects that were implicated in the process of IoT deployment. Subsequently, they employed an inferential methodology to gather data from a sample of 306 participants who were currently enrolled in higher education institutions in Jordan. Their analysis revealed that the rate of IoT integration was greatly impacted by aspects that included accessibility, usability, technical support and individual capabilities. Furthermore, their research indicated that variables involving attitude, behaviour, financial readiness, reliability and training significantly influenced the adoption of the IoT. Conversely, the study suggested that factors such as class size, knowledge, available resources and course structure had a minimal impact on the rates at which HEIs adopted certain practices. Ultimately, this study offered concrete recommendations to enhance the incorporation of the oT into Jordanian HEIs. These proposals offered valuable insights that may be utilized by policy makers, governmental bodies and higher education institutions to address the issues associated with implementing IoT in the higher education sector.

The variables influencing students' various levels of digital competency at Vocational Training Institutes were examined by Barboutidis and Stiakakisis (2023). A series of laboratory tests were developed for the study. To investigate such factors, the study used parametric tests: the t-test, one-way ANOVA and Bonferroni. The results showed that: (1) age affected the DigComp area labeled "Communication and collaboration"; (2) educational level affected "Digital content creation"; (3) specialization affected "Communication and collaboration"; (4) possession and use of a PC affected both "Information and data literacy" and "Problem solving"; (5) possession and use of smartphones affected "Communication and collaboration"; and (6) uses the internet.

Although there have been significant attempts to assist instructors in incorporating ICT into their teaching, recent research indicated that teachers encounter significant obstacles when attempting to integrate ICT into their classroom practice. This matter gained increased significance due to the swift dissemination of the COVID-19 virus, resulting in the closure of schools worldwide for an indefinite duration and necessitating the implementation of remote digital learning alternatives. In light of this context, Pozas and Letzel (2023) aimed to analyze

the factors that influenced the future use of ICT by pre-service teachers and explored the varied outcomes of prior studies on the relationship between ICT use and gender. Using the 'will, skill, tool' framework, they analyzed the factors that influenced the future use of ICT by pre-service teachers (N=103) for teaching and learning. Multiple regression analyses were used to explore these factors. Their study examined the background characteristics of pre-service teachers, their attitudes and self-efficacy towards ICT, their digital competencies and their use of digital tools. The purpose was to investigate how these factors influenced their future use of ICT in the classroom. Additionally, they demonstrated that there were no disparities between genders in the potential incorporation of ICT among pre-service teachers. Nevertheless, men pre-service teachers exhibited a greater inclination towards embracing the usage of ICT compared to their female colleagues. Furthermore, the results indicated that the most influential factors in determining pre-service teachers' future usage of ICT were their attitudes and perceived proficiency in incorporating technology into their teaching methods. Ultimately, the outcomes yielded crucial insights into the training requirements of teachers. ICT integration had the potential to greatly enhance teaching and learning outcomes; however, the extent to which ICT was incorporated into educational practices depended on a number of factors. Four major characteristics that affected the ICT integration and interpersonal interactions of in-service teachers were investigated by Peng et al. (2023) using a quantitative methodology. Snowball sampling was used to gather information from 685 in-service teachers in the Chinese province of Henan. The study examined four factors—attitudes (AT), self-efficacy (SE), digital competence (DC) and use of digital tools (DTU)—from the Technology Acceptance Model 3 (TAM 3) and the Will-Skill-Tool model (WST model) using partial least squares structural equation modeling (PLS-SEM). The results showed that each of the four components had a significant effect on how in-service teachers integrated ICT. In this research, attitudes, digital skills and the use of digital tools played a mediating role. The study also looked at how these variables and ICT integration were influenced by gender, age and teaching experience. The results showed that instructors between the ages of 31 and 35 had better digital skills, digital tool use and ICT integration had teachers who were younger or older. Additionally, female teachers had greater levels of positive attitudes and digital competence than male teachers. In addition, compared to teachers with more than ten years of experience, those with less than three years of experience showed noticeably stronger attitudes, self-efficacy, digital competence and ICT integration.

The ongoing technological revolution permeated all social strata and the educational utilization of technology by instructors were ignored. 2.0 tools were implemented in numerous schools. To assess the digital proficiency of teachers, it was necessary to take into account various aspects, such as their knowledge and effective utilization of technology in education. Guillén-Gámez et al. (2021) determined if there were any disparities in the knowledge and utilization of ICT among teaching staff, particularly in relation to various 2.0 tools and modules on the Moodle virtual platform. This was accomplished by employing the t-test. The second purpose was to conduct a multiple linear regression analysis to determine the impact of gender, age and educational stage on the level of digital competence. In order to achieve this objective, a non-experimental, ex post facto research design was conducted with a sample of 81 teachers representing the community of Madrid, Spain. The results indicated that there existed

statistically significant disparities in the knowledge and utilization of 2.0 resources and Moodle Modules. Furthermore, the findings indicated that the factors of age and gender significantly influenced the prediction of the state of instructional digital competence among the teaching staff. However, the educational stage that they taught did not have any effect on this prediction.

Motivation was a crucial determinant of L2 learners' achievement and proficiency in the language acquisition process, which was a matter of great interest to educators and scholars. During the global health crisis, several English preparatory schools in Turkey were compelled to conduct their English as a Foreign Language (EFL) sessions online. This situation brought more focus on the issue of motivation. A qualitative case study was undertaken by Esra and Sevilen (2021) to investigate students' perspectives on online instruction and its impact on their motivation over a seven-week course. Data was gathered by conducting semi-structured interviews and collecting creative writing samples from a group of 12 students in a classroom that remained unchanged. The interviews as well as creative writing tasks revealed that students generally hold unfavourable views towards online teaching, which they believed adversely affect their motivation due to a lack of social interaction, a discrepancy among expectations along with content, organizational issues and the arrangement of learning environments.

Integrating technology into instruction, together with effective teaching approaches, can enhance and enrich the teaching and learning processes. The evolving nature of education due to technological advancements increased the importance of instructors in effectively incorporating technology into the classroom. Consequently, it was imperative to comprehend the variables that influenced the incorporation of technology by teachers. This case study by Önalan and Kurt (2020) examined the factors that influenced the technology integration practices of 70 Turkish EFL teachers at the university level. It specifically investigated the teachers' knowledge of computer software programs, their personal computer usage habits, their attitudes and self-confidence in incorporating technology into teaching and their opinions on the school environment and support. An examination of the data obtained from a questionnaire revealed that teachers possessed a thorough understanding of commonly-utilized software programs. Additionally, they exhibited favourable attitudes towards incorporating technology into the way they taught and displayed a high level of self-assurance in combining technology into their instruction. Furthermore, teachers reported experiencing a positive school environment among their colleagues. However, they expressed concerns regarding limited support from the administration, particularly in terms of technological facilities and instructional encouragement. The results of this study suggested that in order to effectively incorporate technology into the classroom, teachers should be given sufficient access to technology resources, as well as administrative and technical assistance. Additionally, they should receive ongoing training tailored to their individual technology needs and how to integrate it into their teaching.

Digital technology is frequently used in schools, yet international studies show that it did not improve student achievement. Teachers must use digital technology effectively in their daily work. To master technology-based teaching and learning, teachers require training and guidance. Failure to do so may leave pupils without information age coping skills. This literature review by Spiteri and Chang Rundgren (2020) sought to understand what factors

influenced primary teachers' use of digital technology in their teaching practices to improve training and guide technology use in education. Applying the concept map to the selected studies' data revealed four influential factors: teachers' knowledge, attitudes and skills, which determined school culture.

Teachers must be skilled at using ICT to promote learning. Aslan and Zhu (2016) examined pre-service and starting teachers' perceptions of ICT-related variables--perceived ICT competence, perceived competence in ICT integration, attitudes toward ICT, anxiety around ICT usage, external barriers to ICT integration, ICT-related courses, pedagogical knowledge and prior experience using ICT in terms of their integration of ICT into teaching practice. In their fourth year of training, 200 pre-service teachers from Turkish language, social sciences, elementary mathematics and science and 105 starting teachers with less than three years of experience in those subjects provided quantitative data. Data was analyzed using t-test and multiple regression. Perceived ICT integration skills, computer phobia and pedagogical expertise substantially predicted instructors' ICT integration into teaching practices. Results demonstrated that they only used ICT for basic demonstrations and underused simulated tasks for experience, discovery and experimentation.

2.6   Studies related to the preferred mode of trainings for capacity building of Teachers

Teacher training programs play a crucial role in promoting academic excellence and student success in the field of education. Extensive studies were conducted throughout the years to discover the most effective methods of training for improving the abilities of educators. These studies have examined many strategies, ranging from conventional in-person workshops to cutting-edge online platforms, in order to determine which approaches have the most significant effect on teachers' development of skills and pedagogical expertise. Researchers attempt to enhance the overall quality of education for future generations by analyzing various methods of capacity building. This included optimizing the professional development of teachers.

In higher education, blended learning is widely acknowledged as an efficient method of delivering courses. The effectiveness of blended learning in professional course delivery was empirically tested; therefore, to determine its relevance in teacher development programs, empirical literature needs to be examined. Danushka (2024) conducted a study with three review questions: which blended learning models were best for delivering teacher development programs; which instructional strategies were appropriate for blended learning; and which activities and strategies were employable for blended teacher training programs. Google Scholar, ScienceDirect, Scinapse, ERIC and ProQuest were the five online databases that were searched for review articles. Paper selection criteria were used to narrow the selection of sixty-three publications from peer-reviewed journals. The results of the thematic evaluation indicated that general and blended teacher development programs frequently employed self-directed learning, self-regulated learning and self-paced learning methodologies. The preferred method for delivering blended teacher development programs was self-directed learning. In blended teacher development programs, asynchronous forum discussions, the provision of self-reflective resources and group activities were extremely desirable. In blended teacher

development programs, the flipped classroom paradigm was favoured because it helped teachers to advance their professional abilities in the company of peers and mentors.

For instructors to improve professionally and provide their pupils with a high-quality education, professional development, or PD, is a crucial component. However, practical strategies for professional growth must be identified. In order to accomplish this goal, Sun and Zhang (2023) examined the efficacy of three different delivery methods for an EFL course at a Chinese university: face-to-face, blended and online. The final goal was to support the PD of the participants. Class 1 received online instruction, Class 2 received blended instruction and Class 3 received in-person instruction in three intact English classes. An exam at the conclusion of the semester was used to gauge their level of learning. The face-to-face (onsite) teaching class outperformed the other two classes by a significant margin, according to the results of a one-way ANOVA. While the group interviews with the students leave room for interpretation, the ANOVA results showed that the group receiving face-to-face instruction outperformed the other two groups. It was evident that there were more drawbacks than advantages to online and hybrid modalities. In terms of the performance and cognition of the study's participants, the study's findings showed that, despite being a new and widely used educational paradigm in the industry, online instruction was not yet ready to completely replace in-person instruction.

Binmohsen and Abrahams (2022) conducted a comparative evaluation of the effects of in-person and online CPD programs on the pedagogical practices of science instructors. Twenty male science teachers were chosen to take part in this study from various Saudi Arabian schools. Ten teachers each comprised the two face-to-face and online groups into which the sample was split. The study employed a mixed methods approach that included: (1) semi-structured interviews; (2) a questionnaire survey of all participating teachers; and (3) classroom observations utilizing the Flanders Interaction Analysis Category (FIAC) methodology of classroom observational analysis. The study indicated that, when it came to fostering conceptual comprehension, the online CPD was just as beneficial as the in-person CPD and in some cases even more so. Additionally, it was observed that teachers completing the online CPD reported higher overall satisfaction than those completing the in-person CPD. These results had significant ramifications for educational policymakers since they demonstrated that online programs were not only easier to administer but also as effective—and in some cases even more so—than traditional face-to-face training when it came to providing CPD training. As a result, it offered a chance to increase the availability of CPD in both nations where societal norms forbid face-to-face interactions between people of different sexes and across vast geographic regions where such interactions may typically be impossible to arrange.

Moorhouse and Wong (2022) employed a two-stage qualitative-dominant arranged mixed-method approach. It involved an online survey of 73 English language teachers in elementary and secondary schools in Hong Kong, followed by interviews with 10 participants. The study aimed to investigate how these teachers adapted their instructional methods to online teaching in response to the COVID-19 pandemic. The results revealed that teachers employed a diverse range of asynchronous and synchronous digital tools and instructional methods to support students' learning, evaluate learning outcomes and maintain remote communication

with students and parents. The findings indicated that a combination of asynchronous and synchronous modes was considered optimal for facilitating online student learning.

Zagouras et al. (2022) compared traditional face-to-face teacher training and a blended learning approach using a case study of a large-scale in-service teacher training initiative in Greece focused on digital technology integration in teaching. The transition from exclusive face-to-face training to a blended learning model was examined, highlighting the effectiveness of each approach based on teacher trainees' performance, particularly in certification exams assessing acquired knowledge and skills. The findings revealed that better outcomes were observed with the blended learning model, albeit on a small or marginal scale, compared to traditional training. Higher comfort levels during certification exams, better success rates and slightly higher grades were observed among trainees of various specialties in the blended learning program. These results indicated that the blended learning approach enhanced learning outcomes, surpassing those of the traditional model.

The proliferation of online professional development opportunities for teachers, as a result of the COVID-19 pandemic, raised inquiries about the most efficacious methods for facilitating online professional development and the design components of Online Professional Development (OPD) programs that enhanced teachers' content and pedagogical content knowledge (PCK). These questions were crucial for the effective design and implementation of OPD for teachers. There was no comprehensive analysis available that offered solutions to these inquiries. Therefore, this review by Bragg et al. (2021) provided a comprehensive analysis of 11 studies that carefully investigated both observational and experimental research that assessed or appraised formalized OPD programs for teachers. There were eight quantitative researches and three mixed methods studies that provided evidence of the effectiveness of teachers' OPD programs. These studies discussed the design aspects that resulted in improvements in teachers' Content Knowledge, Pedagogical Content Knowledge (PCK), beliefs about teaching, self-efficacy and instructional practices. The design characteristics found encompassed a strong emphasis on providing support for learners, enhancing the acquisition or development of pedagogical content knowledge (PCK), promoting engagement, allowing for flexibility, accommodating individual differences in learners and learning styles, incorporating practical learning activities, encouraging reflection and emphasizing the significance and practical use of knowledge and skills. The examination revealed a fundamental problem: there were only a few publications of instructors' OPD that had strong methodological rigour. The conclusions of this systematic review focused on the design aspects that contribute to successful learning experiences for instructors in OPD.

2.7 Research Gap

Although the aforementioned studies offer vital insights into the characteristics that affected educators' digital competency and the incorporation of technology in education, there is still a significant research gap regarding the effectiveness of specific interventions designed to address the factors namely ICT knowledge, attitude and confidence among Teachers for ICT usage.

Although many studies identified specific traits and situational elements that influence educators' digital abilities and acceptance of technology, there was a scarcity of research on the development and execution of focused interventions aimed at enhancing educators' digital proficiency.

Moreover, there was a scarcity of study on how many characteristics, such as age, gender, educational background and teaching experience, intersect to influence educators' level of digital proficiency and their embrace of technology. Further research could investigate the interplay and impact of these overlapping elements on educators' utilization of technology, leading to a more intricate comprehension of the intricate dynamics involved.

It is necessary to conduct empirical research to fill these gaps by studying the effectiveness of specific interventions and exploring the combined effect of various factors on educators' digital proficiency and technology integration practices.

CHAPTER 3: METHODOLOGY

3.1 Introduction

The Review of Related Literature has been presented in the previous chapter. In the present chapter, Methodology followed in conducting this study is given under caption headings, like, Sample, Tool, Experimental Design, Procedure of Data Collection and Data Analysis.

3.2 Sample:

The population of this comprised of in-service teachers and teacher educators across all the States, Union Territories and Autonomous Organizations of the country who were ICT experts. It included individuals from diverse educational institutions and backgrounds who were actively involved in classroom instruction as well as those responsible for preparing future educators. Spanning across various educational institutions and disciplines, these individuals possessed a wealth of pedagogical knowledge and practical experience. Their involvement in the study offered a nuanced understanding of the complexities surrounding ICT integration in teaching practices. The sample was selected using Stratified Random Sampling Technique comprised of 189 teachers and teacher educators belonging to all states of India. The details of sample is being given in Table 3.1.

Table 3.1: Details of the sample

	S. No.	State/ UT/ Autonomous Organization	Target Sample	Actual no. of participants
State/ UT	1	Andaman & Nicobar Islands	5	5
	2	Andhra Pradesh	5	5
	3	Arunachal Pradesh	5	2
	4	Assam	5	5
	5	Bihar	5	4
	6	Chandigarh	5	5
	7	Chhattisgarh	5	4
	8	Dadra and Nagar Haveli & Daman and Diu	5	5
	9	Delhi	5	10
	10	Goa	5	3
	11	Gujarat	5	5
	12	Haryana	5	5
	13	Himachal Pradesh	5	5

	14	Jammu & Kashmir	5	5
	15	Jharkhand	5	5
	16	Karnataka	5	5
	17	Kerala	5	0
	18	Ladakh	5	3
	19	Lakshadweep	5	0
	20	Madhya Pradesh	5	5
	21	Maharashtra	5	4
	22	Manipur	5	4
	23	Meghalaya	5	3
	24	Mizoram	5	5
	25	Nagaland	5	3
	26	Odisha	5	5
	27	Puducherry	5	5
	28	Punjab	5	5
	29	Rajasthan	5	5
	30	Sikkim	5	4
	31	Tamil Nadu	5	4
	32	Telangana	5	5
	33	Tripura	5	0
	34	Uttar Pradesh	5	5
	35	Uttarakhand	5	3
	36	West Bengal	5	0
Autonomous Organization	1	AEES	5	4
	2	CBSE	5	15
	3	CICSE	5	0
	4	EMRS-NESTS	5	0
	5	KVS	5	11

	6	NVS	5	4
	7	Sainik Schools	5	5
		CIET - NCERT		4
		Total	**215**	**189**
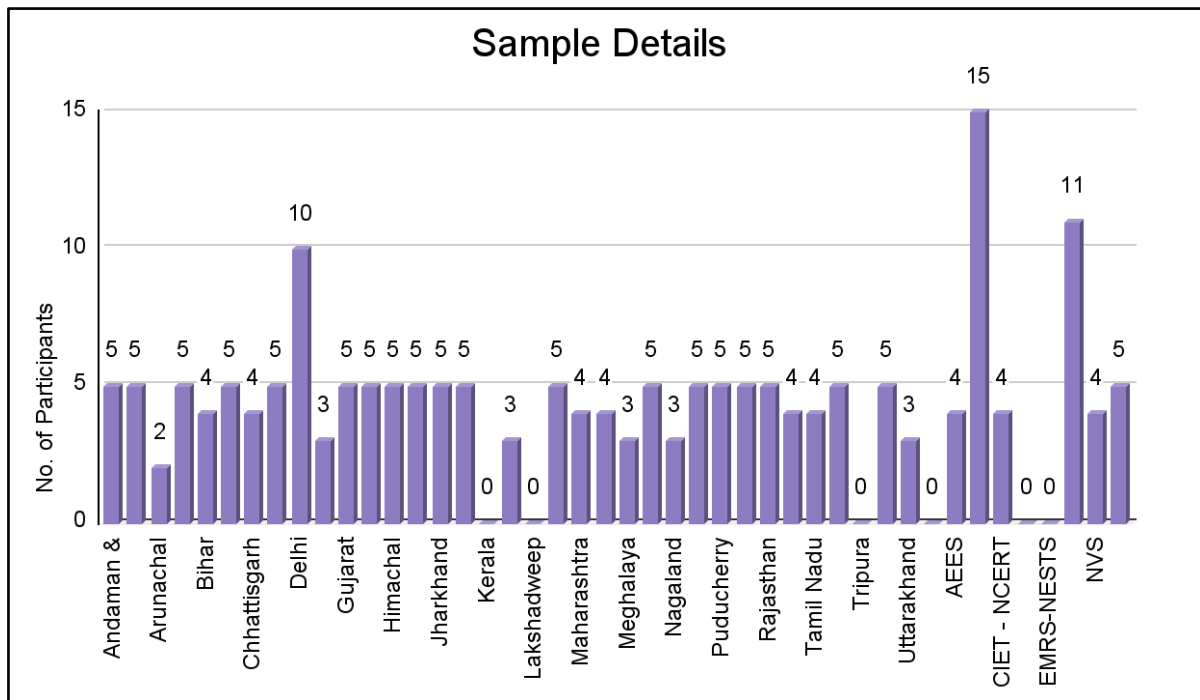
By capturing a cross-section of participants with varying levels of ICT proficiency and pedagogical backgrounds, the sample aimed to provide a comprehensive understanding of the intervention's effect. The sample included both male and Female teachers having teaching experience ranging from 1 year to more than 20 years.

3.3 Research Tools:

The variables studied in this research were ICT Knowledge, Attitude towards ICT and Confidence in using ICT.

Research Tool 1: ICT Knowledge Scale
ICT Knowledge Scale developed by Dr. Angel Rathnabai S. was used for collecting data. ICT Knowledge Scale had eight dimensions. These were Hardware and Software; Operating System; Working with Word Processor; Working with Images; Working with Audio and Video; Working with Spreadsheet; Internet, Web Browser and Browsing; and Working with an Email. In all there were 156 statements having a five-point scale. The five points were Strongly Agree, Agree, Undecided, Disagree and Strongly Agree. Dimension-wise number of items are given in Table 3.2. Content validity of the tool was established with the experts from the field.

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Table 3.2: Dimension-wise number of items in ICT Knowledge Scale

Variable	Dimensions	Items
ICT Knowledge	1. Hardware and Software	26 Five-point Likert Scale Items
	2. Operating System	15 Five-point Likert Scale Items
	3. Working with Word Processor	25 Five-point Likert Scale Items
	4. Working with Images	20 Five-point Likert Scale Items
	5. Working with Audio and Video	10 Five-point Likert Scale Items
	6. Working with Spreadsheet	15 Five-point Likert Scale Items
	7. Internet, Web Browser and Browsing	30 Five-point Likert Scale Items
	8. Working with an Email	15 Five-point Likert Scale Items

Research Tool 2: Attitude towards ICT Scale

Attitude towards ICT Scale developed by Dr. Angel Rathnabai S. was used for collecting data. There were four dimensions of Attitude towards ICT. These were: Technical aspect of handling ICT; Pedagogical usability of ICT; Social and ethical aspects related to ICT; and Professional use of ICT. In all there were 33 statements having a five-point scale. The five points were Strongly Agree, Agree, Undecided, Disagree and Strongly Agree. Content validity of the tool was established by the experts from the field.

Table 3.3: Dimension-wise number of items Attitude towards ICT Scale

Variable	Dimensions	Items
Attitude towards ICT	1. Technical aspect of handling ICT	5 Five-point Likert Scale Items
	2. Pedagogical usability of ICT	12 Five-point Likert Scale Items
	3. Social and ethical aspects related to ICT	8 Five-point Likert Scale Items
	4. Professional use of ICT	8 Five-point Likert Scale Items

Research Tool 3: Confidence in using ICT Scale

Confidence in using ICT Scale was developed by Dr. Angel Rathnabai S. There were three dimensions of Confidence in using ICT Scale. The three dimensions were Handling ICT Tools; Managing the use of ICT to learn and teach; and Solving the issues arising during the use of ICT. In all there were 10 statements having a five-point scale. The five points were Strongly Agree, Agree, Undecided, Disagree and Strongly Agree. Content validity of the tool was established by the experts from the field.

Table 3.4: Dimension-wise number of items in Confidence in using ICT Scale

Variable	Dimensions	Items
Confidence in using ICT	1. Handling ICT Tools	4 Five-point Likert Scale Items
	2. Managing the use of ICT to learn and teach	3 Five-point Likert Scale Items
	3. Solving the issues arising during the use of ICT	3 Five-point Likert Scale Items

3.4 Experimental Design:

In this study Pretest – Posttest Single Group Design was followed. The subjects were selected as available in the field. So the intact group was taken. The members of the group were pre-tested in respect of ICT Knowledge, Attitude towards ICT, and Confidence in using ICT variables by administering ICT Knowledge Scale, Attitude towards ICT Scale, and Confidence in using ICT Scale. Then the group was taught Foundations of Educational Technology Course for one week at the rate of eight hours per day. At the end of the treatment of Teaching of Foundations of Educational Technology Course, ICT Knowledge, Attitude towards ICT, and Confidence in using ICT variables were assessed by administering ICT Knowledge Scale, Attitude towards ICT Scale, and Confidence in using ICT Scale. The intervening variables were Gender, Age, Educational Qualifications, Teaching Experience, Teaching Grade Level, Previous exposure to ICT (in years), ICT related training (if any) done, etc. The modules on 'Foundations on Educational Technology Course' which served as the intervention for this study, had 12 modules which are given in Table 3.5.

Table 3.5: Modules of 'Foundations on Educational Technology Course'

S. No.	Module Title
1	Policy Perspectives on Educational Technology as envisioned in NEP (2020), NCF_FS (2022), NCF_SE (2023)
2	Leveraging Digital Technology in Education
3	Creating with ICT - Handling Media
4	Creating with ICT - Text
5	ICT in classroom hardware and software
6	Accessing information through web
7	Communication through email
8	Exploring web resources
9	Working with data: Exploring spreadsheet
10	Working with data: Representation and interpretation

| 11 | Working with text : exploring word processor |
| 12 | Continuing learning with ICT |

The modules were written by ICT experts. Modules went through multiple rounds of review including peer review, review by the Internal Team of CIET-NCERT and then final review by Educational Technology experts before being used for intervention.

During Intervention, along with sessions on the text modules, ample hands-on practice opportunities related to the sessions were given to the participants in the form of assignments.

3.5   Procedural of Data Collection:

Participants were pre-tested in respect of ICT Knowledge, Attitude towards ICT, and Confidence in using ICT variables by administering ICT Knowledge Scale, Attitude towards ICT Scale, and Confidence in using ICT Scale. Subsequently, participants engaged in the intervention phase, which involves participation in the 'Foundations of Educational Technology Course' having 12 technical modules. During this period, participants are exposed to instructional modules and activities aimed at facilitating their ICT competencies and fostering favourable attitudes towards technology integration in education. At the end of the intervention of Teaching of Foundations of Educational Technology Course, ICT Knowledge, Attitude towards ICT, and Confidence in using ICT variables were assessed by administering ICT Knowledge Scale, Attitude towards ICT Scale, and Confidence in using ICT Scale. Finally, participants were given opportunities to share their feedback on their experiences with the course, offering valuable insights into its effectiveness and areas for improvement. This procedural framework ensured a systematic and rigorous evaluation of the intervention's effect on the targeted outcomes, facilitating evidence-based conclusions and recommendations for teacher professional development.

Stage 1: Pretest

Stage 2: 5- day Workshop on Foundations of Educational Technology Course [Intervention]

Stage 3: Posttest

Stage 4: Participant Feedback
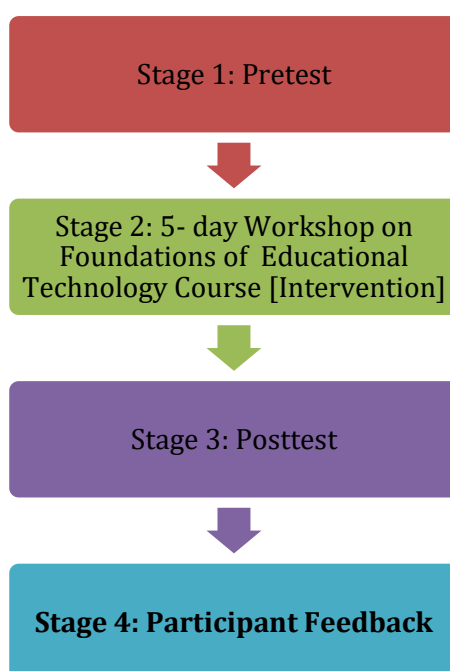
Figure 3.1: Procedural Framework for the study

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Sample was divided into 4 groups as given below and group-wise Intervention was carried out through a 5 - day Workshop on Foundations of Educational Technology Course.

Group 1: 19 February 2024 - 23 February 2024 (40 Participants)
Group 2: 26 February 2024 - 01 March 2024 (55 Participants)
Group 3: 04 March 2024 - 08 March 2024 (49 Participants)
Group 4: 11 March 2024 - 15 March 2024 (45 Participants)

Table 3.6: Sample Groups

Group	Participating State/ UT/ AO	No of Participants
Group 1	**States/UTs:** Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland and Sikkim **Autonomous Organisations:** KVS, NVS, CBSE	40
Group 2	**States/UTs:** Andhra Pradesh, Karnataka, Tamil Nadu, Telangana, Puducherry and Andaman & Nicobar Islands **Autonomous Organisations:** AEES, KVS, CBSE, CIET-NCERT	55
Group 3	**States/UTs:** Bihar, Jharkhand, Odisha, West Bengal, Chhattisgarh, Goa, Gujarat, Madhya Pradesh, Maharashtra, Dadra and Nagar Haveli & Daman and Diu **Autonomous Organisations:** Sainik Schools, KVS	49
Group 4	**States/UTs:** Haryana, Himachal Pradesh, Punjab, Rajasthan, Uttarakhand, Uttar Pradesh, Delhi, Chandigarh, Jammu & Kashmir and Ladakh	45
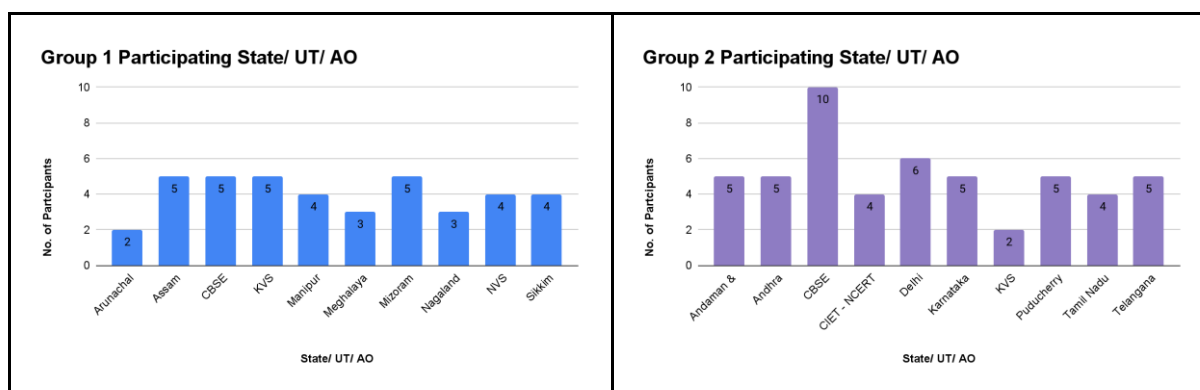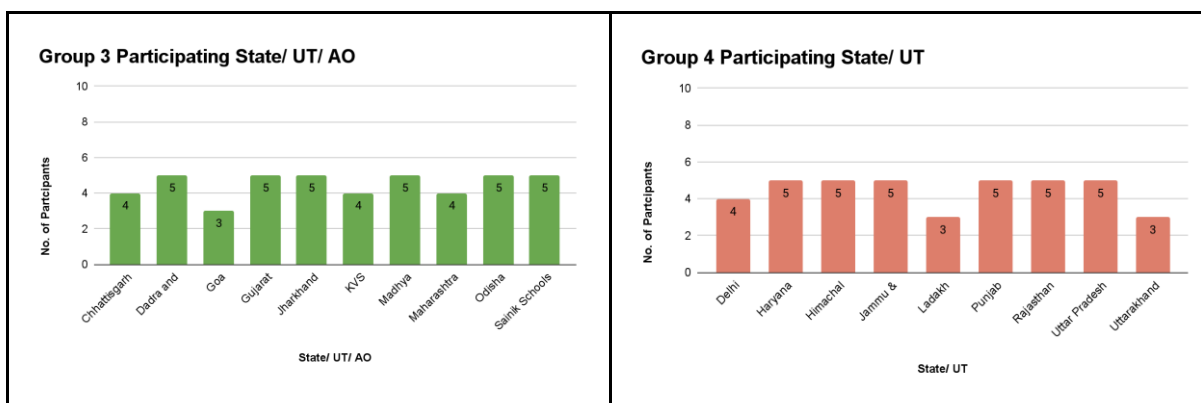
Figure 3.2: Group wise sample

Table 3.7: Day wise schedule of

'Workshop on Foundations of Educational Technology Course'

Day 1	Welcome of the Participants
	Pretest (ICT Knowledge Scale, Attitude towards ICT Scale, Confidence in using ICT Scale)
	Module 1 - Policy Perspectives on Educational Technology as envisioned in NEP (2020), NCF_FS (2022), NCF_SE (2023)
	Module 2 - Leveraging Digital Technology in Education
	Module 3 - Creating with ICT - Handling Media
Day 2	**Module 4** - Creating with ICT - Text
	Module 6 - Accessing information through web
	Module 7 - Communication through Email
	Hands on Practical Sessions with assignments based on the covered sessions
Day 3	**Module 8** - Exploring web resources
	Module 9 - Working with data: Exploring spreadsheet
	Module 10 - Working with data: Representation and interpretation
	Hands on Practical Sessions with assignments based on the covered sessions
Day 4	**Module 11** - Working with text : exploring word processor
	Module 5 - ICT in classroom hardware and software

	Hands on Practical Sessions with assignments based on the covered sessions
	Visit to Studio, VSK & Experiential Learning Centre
Day 5	**Module 12** - Continuing learning with ICT
	Posttest (ICT Knowledge Scale, Attitude towards ICT Scale, Confidence in using ICT Scale)
	Participant Feedback
	Wrap Up of Workshop

---**Day 1**—---

Upon arrival, participants were greeted and welcomed to the workshop. The organisers introduced themselves and provided an overview of the workshop objectives and schedule. Following the introductory session, participants were pre-tested to assess their ICT Knowledge, Attitude towards ICT, and Confidence in using ICT. The pre-test served as a baseline for assessing the progress throughout the workshop.

Module 1: Policy Perspectives on Educational Technology as envisioned in NEP (2020), NCF_FS (2022), NCF_SE (2023)

This module focussed on policy landscape surrounding educational technology, examining key documents such as the National Education Policy (NEP) of 2020, the National Curriculum Framework for Foundational Stage (NCF_FS) of 2022 and the National Curriculum Framework for School Education (NCF_SE) of 2023.

Module 2: Leveraging Digital Technology in Education

Building upon the policy perspectives discussed earlier, this module focused on practical strategies for leveraging digital technology to enhance teaching and learning outcomes. Various digital initiatives, platforms and resources available for educators and best practices for incorporating technology into classroom instruction were covered in this module.

Module 3: Creating with ICT - Handling Media

This module focused on the creation and manipulation of non-textual content using ICT tools. How to handle different types of media, such as images, audio and video, using software applications and online platforms was demonstrated through this module. Through demonstrations and hands-on activities, capturing/ recording, saving, retrieving, creating libraries, basic editing and sharing/transferring/uploading images, audios and videos for educational purposes were shown to the participants.

The second day of the workshop was dedicated to hands-on practical sessions and further exploration of key topics. Time bound hands-on assignments were also given to the participants after the technical sessions for reflecting upon their learning.

Module 4: Creating with ICT - Text

Essential features of creating, editing, formatting and saving text-based documents using a text editor and word processing software was demonstrated. Through guided exercises, practice opportunities were also given to the participants.

Module 6: Accessing Information through the Web

Strategies for effectively navigating the web to access information and resources were discussed in this module. Accessing information using a search engine, using appropriate keywords, boolean operators and symbols to access information, saving a web page, bookmarking a web page, identifying and saving URLs were demonstrated to the participants. Introduction to Browsers and the process of browsing was also explained.

Module 7: Communication through Email

Use of email as a communication tool in educational settings was explained through this module. How to create an Email account, compose an Email with or without attachments, insert images, add a signature, access Emails, organise Emails in a folder, manage Emails, reply and auto reply, forward and share an Email was demonstrated to the participants.

The third day of the workshop continued with modules and hands-on practical sessions, focusing on advanced topics of the Foundations of Educational technology Course.

Module 8: Exploring Web Resources

The vast array of web resources available for teaching and learning purposes were shown to the participants. How to access and save desired images, audios, videos and documents from the web in multiple ways, recognition of various media formats, bookmarking and licensing of web resources, doing safe search on the web, exploring free repositories was demonstrated to the participants. Using a firewall and popup blocker for safe use was also shown to the participants.

Module 9: Working with Data - Exploring Spreadsheets

This module focused on working with data using open source spreadsheet software i.e LibreOffice Calc. The need and importance of a spreadsheet was shared with the participants. How to collect, input, organise data and analyse data using user-defined functions and by manually defining basic operations like sum, difference, product, quotient, percentage and average was demonstrated to the participants. Insertion, deletion, renaming, copying and moving worksheets were also covered in this module.

Module 10: Working with Data - Representation and Interpretation

Building on the spreadsheet skills of participants, how to represent and interpret data graphically using charts, graphs and other visualization tools was demonstrated to the participants. In addition to this, grouping of data in a spreadsheet, identification of the appropriate chart for representing the data, plotting the various charts to represent the given data, reading and interpreting charts, customising a chart, saving chart as image, saving the spreadsheet as PDF and making inferences from charts were also shown.

---Day 4—--

The fourth day of the workshop combined additional modules with practical experiences and a visit to relevant facilities.

Module 11: Working with Text - Exploring Word Processors

Working with text-based documents using an open source word processing software i.e. LibreOffice Writer was the focus of this module. Creating and editing documents, inserting images, inserting formulas, special characters and symbols in a document, resizing the image in the word processor, formatting images like anchoring, arranging, aligning, wrapping, flipping and rotating were demonstrated to the participants. Embedding audio and video in a document, creating and modifying a table, setting up a page, saving, storing, printing and retrieving a document were also taught.

Module 5: ICT in Classroom Hardware and Software

This module provided an overview of the hardware and software tools commonly used in educational settings. Interactive whiteboards, projectors and educational software applications were demonstrated to the participants. Considerations for selecting and integrating ICT hardware and software to support teaching and learning goals effectively were also discussed.

Visit to Studio, VSK & Experiential Learning Centre

As part of the practical experience component, a visit to the Audio and Video Studios, Vidya Seva Kendra (VSK) and Experiential Learning Centre equipped with state-of-the-art Virtual Reality (VR) facilities were made a part of the intervention.

---Day 5—--

The final day of the workshop concluded with additional modules, posttests, participant feedback and a wrap-up session.

Module 12: Continuing Learning with ICT

Familiarisation with mail-based e-Groups, various ways of transaction through the web and understanding of course portals were the primary objectives of this module. Participation in e-Groups by posting a comment, creating posts, etc. was demonstrated to the participants. In addition to this, online transactions and its features were shared with the participants. Course portals and its functionalities were also demonstrated to the participants.

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Posttest and Participant Feedback

Participants were given a posttest by administering ICT Knowledge Scale, Attitude towards ICT Scale, and Confidence in using ICT Scale to assess changes in their ICT Knowledge, Attitude towards ICT, and Confidence in using ICT following the workshop. Their reactions were also sought on the overall workshop experience, including strengths, areas for improvement and suggestions for future workshops.

Wrap-Up of Workshop

The workshop concluded with a wrap-up session where organizers summarized key learnings and expressed appreciation of participants for their active participation and contributions. Certificates of completion were distributed to participants, acknowledging their successful completion of the workshop and their commitment to advancing ICT integration in education. Participants were encouraged to stay connected with the workshop community and continue sharing ideas and resources for ongoing professional growth and collaboration in ICT-enhanced teaching and learning.

3.6   Statistical Techniques for Data Analysis:

Data were analysed with the help of Paired Samples t-test and 2 X 3 Factorial Design ANCOVA.

CHAPTER 4: RESULTS AND INTERPRETATION

4.1 Introduction

The Methodology followed in conducting this study has been given in detail in the previous chapter along with statistical techniques used in analysing the data. In the present chapter results and its' interpretation are being given objective-wise under different caption headings.

4.2 Testing-wise Comparison of mean scores of ICT Knowledge and its' dimensions separately of Teachers

The first objective was to compare mean scores of ICT Knowledge and its dimensions separately of Teachers before and after teaching of Foundations of Educational Technology Course. There were eight dimensions of ICT Knowledge. These were Hardware and Software, Operating System, Working with word processor, Working with images, Working with audio and video, Working with Spreadsheet, Internet, web browser and browsing, Working with an email. The data were analysed with the help of Paired Samples t-Test. The results are given variable-wise in Table 4.1.

Table 4.1: Testing-wise M, SD, N, r and correlated t-values of ICT Knowledge and its' dimensions separately of Teachers

Variable	Testing	M	SD	N	r	Correlated t-value	Remark
ICT knowledge	Pre Post	673.48 708.45	116.11 85.24	189	0.32	4.01	p<0.01
Hardware & Software dimension	Pre Post	111.7 120.0	19.96 12.80	189	0.67	8.19	p<0.01
Operating System dimension	Pre Post	56.34 64.78	17.08 12.07	189	0.65	8.89	p<0.01
Word processor dimension	Pre Post	115.03 122.2	15.64 6.16	189	0.70	8.60	p<0.01
Working with images dimension	Pre Post	90.19 97.48	12.56 5.62	189	0.54	9.43	p<0.01
Working with audio and video dimension	Pre Post	45.11 48.65	6.91 3.08	189	0.40	7.68	p<0.01
Working with spreadsheet dimension	Pre Post	64.84 73.01	13.98 4.84	189	0.59	9.50	p<0.01

Internet, web browser & browsing dimension	Pre Post	122.79 141.62	30.32 14.31	189	0.60	10.52	p<0.01
Working with an email dimension	Pre Post	67.48 72.81	9.85 5.53	189	0.59	9.19	p<0.01

4.2.1 Testing-wise Comparison of mean scores of ICT Knowledge

From Table 4.1, it is evident that the correlated t-value of ICT knowledge is 4.01 which is significant at 0.01 level with df= 188. It shows that there is a significant difference in mean scores of ICT knowledge of teachers before and after teaching of Foundations of Educational Technology Course. Thus, the null hypothesis that there is no significant difference in mean scores of ICT knowledge of teachers before and after teaching of Foundations of Educational Technology Course is rejected. Further the mean score of ICT knowledge of teachers before teaching of Foundations of Educational Technology Course is 673.48 which is significantly lower than after teaching of Foundations of Educational Technology Course where the mean score of ICT knowledge of teachers is 708.45. It may be said that teaching of Foundations of Educational Technology Course was found to be effective in promoting ICT knowledge of teachers.

4.2.2 Testing-wise Comparison of mean scores of ICT Knowledge dimensions

The correlated t-value of Hardware and Software dimension of ICT Knowledge is 8.19 which is significant at 0.01 level with df= 188 (Vide Table 4.1). It shows that there is a significant difference in mean scores of Hardware and Software dimension of ICT Knowledge of teachers before and after teaching of Foundations of Educational Technology Course. Thus, the null hypothesis that there is no significant difference in mean scores of Hardware and Software dimension of ICT Knowledge of teachers before and after teaching of Foundations of Educational Technology Course is rejected. Further, the mean score of Hardware and Software dimension of ICT Knowledge of teachers before teaching of Foundations of Educational Technology Course is 111.70 which is significantly lower than after teaching of Foundations of Educational Technology Course where the mean score of Hardware and Software dimension of ICT Knowledge of teachers is 120.50. It may be said that teaching of Foundations of Educational Technology Course was found to be effective in promoting favourable knowledge towards Hardware and Software dimension of ICT Knowledge of teachers.

The correlated t-value of Operating System dimension of ICT Knowledge is 8.89 which is significant at 0.01 level with df= 188 (Vide Table 4.1). It shows that there is a significant difference in mean scores of Operating System dimension of ICT Knowledge of teachers before and after teaching of Foundations of Educational Technology Course. Thus, the null hypothesis that there is no significant difference in mean scores of Operating System dimension of ICT Knowledge of teachers before and after teaching of Foundations of Educational Technology Course is rejected. Further, mean score of Operating System dimension of ICT Knowledge of teachers before teaching of Foundations of Educational Technology Course is 56.34 which is

significantly lower than after teaching of Foundations of Educational Technology Course where the mean score of Operating System dimension of ICT Knowledge of teachers is 64.78. It may be said that teaching of Foundations of Educational Technology Course was found to be effective in promoting knowledge of Operating System dimension of ICT Knowledge of teachers.

From Table 4.1, it is evident that the correlated t-value of Working with word processor dimension of ICT Knowledge is 8.60 which is significant at 0.01 level with df= 188. It shows that there is a significant difference in mean scores of Working with word processor dimension of ICT Knowledge of teachers before and after teaching of Foundations of Educational Technology Course. Thus, the null hypothesis that there is no significant difference in mean scores of Working with word processor dimension of ICT Knowledge of teachers before and after teaching of Foundations of Educational Technology Course is rejected. Further, the mean score of Working with word processor dimension of ICT Knowledge of teachers before teaching of Foundations of Educational Technology Course is 115.03 which is significantly lower than after teaching of Foundations of Educational Technology Course where the mean score of Working with word processor dimension of ICT Knowledge of teachers is 122.62. It may be said that teaching of Foundations of Educational Technology Course was found to be effective in promoting knowledge of Word processor dimension of ICT Knowledge of teachers.

From Table 4.1, it is evident that the correlated t-value of Working with images dimension of ICT Knowledge is 9.43 which is significant at 0.01 level with df= 188. It shows that there is a significant difference in mean scores of Working with images dimension of ICT Knowledge of teachers before and after teaching of Foundations of Educational Technology Course. Thus, the null hypothesis that there is no significant difference in mean scores of Working with images dimension of ICT Knowledge of teachers before and after teaching of Foundations of Educational Technology Course is rejected. Further, the mean score of Working with images dimension of ICT Knowledge of teachers before teaching of Foundations of Educational Technology Course is 90.19 which is significantly lower than after teaching of Foundations of Educational Technology Course where the mean score of Working with images dimension of ICT Knowledge of teachers is 97.48. It may be said that teaching of Foundations of Educational Technology Course was found to be effective in promoting knowledge of Working with images dimension of ICT Knowledge of teachers.

The correlated t-value of Working with spreadsheet dimension of ICT Knowledge is 7.68 which is significant at 0.01 level with df= 188 (Vide Table 4.1). It shows that there is a significant difference in mean scores of Working with spreadsheet dimension of ICT Knowledge of teachers before and after teaching of Foundations of Educational Technology Course. Thus, the null hypothesis that there is no significant difference in mean scores of Working with spreadsheet dimension of ICT Knowledge of teachers before and after teaching of Foundations of Educational Technology Course is rejected. Further, the mean score of Working with spreadsheet dimension of ICT Knowledge of teachers before teaching of Foundations of Educational Technology Course is 45.11 which is significantly lower than after teaching of Foundations of Educational Technology Course where the mean score of Working with spreadsheet dimension of ICT Knowledge of teachers is 48.5. It may be said that teaching

of Foundations of Educational Technology Course was found to be effective in promoting knowledge of Working with spreadsheet dimension of ICT Knowledge of teachers.

The correlated t-value of Working with audio and video dimension of ICT Knowledge is 9.50 which is significant at 0.01 level with df= 188 (Vide Table 4.1). It shows that there is a significant difference in mean scores of Working with audio and video dimension of ICT Knowledge of teachers before and after teaching of Foundations of Educational Technology Course. Thus, the null hypothesis that there is no significant difference in mean scores of Working with audio and video dimension of ICT Knowledge of teachers before and after teaching of Foundations of Educational Technology Course is rejected. Further, the mean score of Working with audio and video dimension of ICT Knowledge of teachers before teaching of Foundations of Educational Technology Course is 64.8 which is significantly lower than after teaching of Foundations of Educational Technology Course where the mean score of Working with audio and video dimension of ICT Knowledge of teachers is 73.01. It may be said that teaching of Foundations of Educational Technology Course was found to be effective in promoting favourable knowledge of Working with images dimension of ICT Knowledge of teachers.

From Table 4.1, it is evident that the correlated t-value of Internet, web browser and browsing dimension of ICT Knowledge is 10.52 which is significant at 0.01 level with df= 188. It shows that there is a significant difference in mean scores of Internet, web browser and browsing dimension of ICT Knowledge of teachers before and after teaching of Foundations of Educational Technology Course. Thus, the null hypothesis that there is no significant difference in mean scores of Internet, web browser and browsing dimension of ICT Knowledge of teachers before and after teaching of Foundations of Educational Technology Course is rejected. Further mean score of Internet, web browser and browsing dimension of ICT Knowledge of teachers before teaching of Foundations of Educational Technology Course is 122.79 which is significantly lower than after teaching of Foundations of Educational Technology Course where the mean score of Internet, web browser and browsing dimension of ICT Knowledge of teachers is 141.62. It may be said that teaching of Foundations of Educational Technology Course was found to be effective in promoting favourable knowledge of Internet, web browser and browsing dimension of ICT Knowledge of teachers.

From Table 4.1, it is evident that the correlated t-value of Working with an email dimension of ICT Knowledge is 9.19 which is significant at 0.01 level with df= 188. It shows that there is a significant difference in mean scores of Working with an email dimension of ICT Knowledge of teachers before and after teaching of Foundations of Educational Technology Course. Thus, the null hypothesis that there is no significant difference in mean scores of Working with an email dimension of ICT Knowledge of teachers before and after teaching of Foundations of Educational Technology Course is rejected. Further mean score of Working with an email dimension of ICT Knowledge of teachers before teaching of Foundations of Educational Technology Course is 67.48 which is significantly lower than after teaching of Foundations of Educational Technology Course where the mean score of Reaction towards working with an email dimension of ICT Knowledge of teachers is 72.81. It may be

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said that teaching of Foundations of Educational Technology Course was found to be effective in promoting knowledge of Working with an email dimension of ICT Knowledge of teachers.

4.3 Testing-wise Comparison of mean scores of Attitude towards ICT and its' dimensions separately of Teachers

The second objective was to compare mean scores of Attitude towards ICT and its dimensions separately of Teachers before and after teaching of Foundations of Educational Technology Course. The data were analysed with the help of Paired Samples t-Test for Attitude towards ICT and its dimensions separately. There were four dimensions of Attitude towards ICT. These were Technical aspects of ICT; Pedagogical usability of ICT; Social and ethical aspects of ICT; and Reaction towards Professional Use of ICT. The data were analysed with the help of Paired samples t-Test and the results are given in Table 4.2.

Table 4.2: Testing-wise M, SD, N, r and correlated t-values of Attitude towards ICT and its' dimensions of Teachers separately

Variable	Testing	M	SD	N	r	Correlated t-value	Remark
Attitude towards ICT	Pre Post	137.02 137.35	13.63 15.39	189	0.31	0.31	ns
Technical aspects ICT dimension	Pre Post	19.03 19.35	3.98 4.07	189	0.37	1.02	ns
Pedagogical usability of ICT dimension	Pre Post	52.53 52.51	5.07 6.35	189	0.44	0.05	ns
Social and Ethical aspects of ICT dimension	Pre Post	26.13 30.32	7.31 3.98	189	0.21	7.62	$p<0.01$
Professional use of ICT dimension	Pre Post	35.21 35.17	3.90 4.71	189	0.47	0.11	ns

*ns= Not significant

4.3.1 Testing-wise Comparison of mean scores of Attitude towards ICT

From Table 4.2, it is evident that the correlated t-value of Attitude towards ICT is 0.31 which is not significant. It shows that there is no significant difference in mean scores of Attitude towards ICT of teachers before and after teaching of Foundations of Educational Technology Course. Thus, the null hypothesis that there is no significant difference in mean scores of Attitude towards ICT of teachers before and after teaching of Foundations of Educational Technology Course is not rejected. It may be said that teaching of Foundations of Educational Technology Course was not found to be effective in promoting favourable Attitude towards ICT of teachers.

4.3.2 Testing-wise Comparison of mean scores of dimensions of Attitude towards ICT

The correlated t-value of Technical aspect of ICT is 1.02 which is not significant (Vide Table 4.2). It shows that there is no significant difference in mean scores of Technical aspect of ICT of teachers before and after teaching of Foundations of Educational Technology Course. Thus, the null hypothesis that there is no significant difference in mean scores of Technical aspect of ICT of teachers before and after teaching of Foundations of Educational Technology Course is not rejected. It may be said that teaching of Foundations of Educational Technology Course was not found to be effective in promoting favourable Attitude towards Technical aspect of ICT of teachers.

The correlated t-value of Pedagogical usability of ICT is 0.05 which is not significant (Vide Table 4.2). It shows that there is no significant difference in mean scores of Pedagogical usability of ICT of teachers before and after teaching of Foundations of Educational Technology Course. Thus, the null hypothesis that there is no significant difference in mean scores of Pedagogical usability of ICT of teachers before and after teaching of Foundations of Educational Technology Course is not rejected. It may be said that teaching of Foundations of Educational Technology Course was not found to be effective in promoting Attitude towards Pedagogical usability of ICT of teachers.

The correlated t-value of Social and ethical aspect of ICT is 7.62 which is significant at 0.01 level with df=188 (Vide Table 4.2). It shows that there is a significant difference in mean scores of Social and ethical aspect of ICT of teachers before and after teaching of Foundations of Educational Technology Course. Thus, the null hypothesis that there is no significant difference in mean scores of Social and ethical aspect of ICT of teachers before and after teaching of Foundations of Educational Technology Course is rejected. Further the mean score of Social and ethical aspect of ICT of teachers before teaching of Foundations of Educational Technology Course is 26.13 which is significantly lower than after teaching of Foundations of Educational Technology Course when the mean score of Social and ethical aspect of ICT is 30.32. It may be said that teaching of Foundations of Educational Technology Course was found to be effective in promoting favourable Attitude towards Social and ethical aspect of ICT of teachers.

From Table 4.2, it is evident that the correlated t-value of Professional Use of ICT is 0.11 which is not significant (Vide Table 4.2). It shows that there is no significant difference in mean scores of Reaction towards Professional Use of ICT of teachers before and after teaching of Foundations of Educational Technology Course. Thus, the null hypothesis that there is no significant difference in mean scores of Reaction towards Professional Use of ICT of teachers before and after teaching of Foundations of Educational Technology Course is not rejected. It may be said that teaching of Foundations of Educational Technology Course was not found to be effective in promoting favourable Attitude towards Professional Use of ICT of teachers.

4.4 Testing-wise Comparison of mean scores of Confidence in using ICT and its' dimensions separately of Teachers

The third objective was to compare mean scores of Confidence in using ICT and its dimensions separately of Teachers before and after teaching of Foundations of Educational Technology Course. There are three dimensions of Confidence in using ICT. These were Handling ICT tools; managing the use of ICT; and solving the issues that arise during the use of ICT. The data were analysed with the help of Paired Samples t-Test of Reaction towards confidence in using ICT and its dimensions separately. The results are given in Table 4.3.

Table 4.3: Testing-wise M, SD, N, r and correlated t-values of Confidence in using ICT and its' dimensions separately of Teachers

Variable	Testing	M	SD	N	r	Correlated t-value	Remark
Confidence in using ICT	Pre Post	40.37 43.25	8.17 6.96	189	0.54	5.42	p<0.01
Handling ICT tools dimension	Pre Post	1.48 17.50	3.19 2.79	189	0.52	4.73	p<0.01
Managing the use of ICT dimension	Pre Post	12.26 13.16	2.40 2.09	189	0.37	4.90	p<0.01
Solving the issues that arise during the use of ICT dimension	Pre Post	11.73 12.64	2.62 2.35	189	0.52	5.10	p<0.01

4.4.1 Testing-wise Comparison of mean scores of Confidence in using ICT

The correlated t-value of Confidence in using ICT is 5.42 which is significant at 0.01 level with df=188 (Vide Table 4.3). It shows that there is a significant difference in mean scores of Confidence in using ICT of teachers before and after teaching of Foundations of Educational Technology Course. Thus, the null hypothesis that there is no significant difference in mean scores of Confidence in using ICT of teachers before and after teaching of Foundations of Educational Technology Course is rejected. Further the mean score of Confidence in using ICT of teachers before teaching of Foundations of Educational Technology Course is 40.37 which is significantly lower than after teaching of Foundations of Educational Technology Course when the mean score of Confidence in using ICT is 43.25. It may be said that teaching of Foundations of Educational Technology Course was found to be effective in promoting Confidence in using ICT of teachers.

4.4.2 Testing-wise Comparison of mean scores of dimensions of Confidence in using ICT

From Table 4.3, it is evident that the correlated t-value of Handling ICT tools is 4.73 which is significant at 0.01 level with df=188 (Vide Table 4.3). It shows that there is a significant

difference in mean scores of Handling ICT tools of teachers before and after teaching of Foundations of Educational Technology Course. Thus, the null hypothesis that there is no significant difference in mean scores of Handling ICT tools of teachers before and after teaching of Foundations of Educational Technology Course is rejected. Further the mean score of Handling ICT tools of teachers before teaching of Foundations of Educational Technology Course is 16.48 which is significantly lower than after teaching of Foundations of Educational Technology Course when the mean score of Handling ICT tools is 17.50. It may be said that teaching of Foundations of Educational Technology Course was found to be effective in promoting confidence in handling ICT tools of teachers.

From Table 4.3, it is evident that the correlated t-value of Managing the use of ICT is 4.90 which is significant at 0.01 level with df=188 (Vide Table 4.3). It shows that there is a significant difference in mean scores of Managing the use of ICT of teachers before and after teaching of Foundations of Educational Technology Course. Thus, the null hypothesis that there is no significant difference in mean scores of Managing the use of ICT of teachers before and after teaching of Foundations of Educational Technology Course is rejected. Further the mean score of Managing the use of ICT of teachers before teaching of Foundations of Educational Technology Course is 12.26 which is significantly lower than after teaching of Foundations of Educational Technology Course when the mean score of Managing the use of ICT is 13.16. It may be said that teaching of Foundations of Educational Technology Course was found to be effective in promoting confidence in managing the use of ICT of teachers.

The correlated t-value of Solving the issues that arise during the use of ICT is 5.10 which is significant at 0.01 level with df=188 (Vide Table 4.3). It shows that there is a significant difference in mean scores of Solving the issues that arise during the use of ICT of teachers before and after teaching of Foundations of Educational Technology Course. Thus, the null hypothesis that there is no significant difference in mean scores of Solving the issues that arise during the use of ICT before and after teaching of Foundations of Educational Technology Course is rejected. Further the mean score of Solving the issues that arise during the use of ICT of teachers before teaching of Foundations of Educational Technology Course is 11.73 which is significantly lower than after teaching of Foundations of Educational Technology Course when the mean score of Solving the issues that arise during the use of ICT is 12.64. It may be said that teaching of Foundations of Educational Technology Course was found to be effective in promoting confidence in solving the issues that arise during the use of ICT of teachers.

4.5   Influence of Gender, Teaching Experience and their interaction on ICT knowledge of teachers taught Foundations of Educational Technology Course by considering their Pretest scores of ICT knowledge as covariate

The fourth objective was to study the influence of Gender, Teaching Experience and their interaction on ICT knowledge of teachers taught Foundations of Educational Technology Course by considering their Pretest scores of ICT knowledge as covariate. Male and Female were the two levels of Gender while 1 to 10 Years, 11 to 20 Years and more the 20 years were the three levels of Teaching Experience of teachers taught Foundations of Educational Technology Course. Pretest scores of ICT knowledge was the covariate. Thus the data were

analysed with the help of 2X3 Factorial Design ANCOVA and the results are given in Table 4.4.

Table 4.4: Summary of 2 X 3 factorial Design ANCOVA of ICT knowledge of teachers taught Foundations of Educational Technology Course by considering their Pretest scores of ICT knowledge as covariate

Source of Variance	df	$SS_{Y.X}$	$MSS_{Y.X}$	$F_{Y.X}$ - Value	Remark
Gender (A)	1	507.63	507.63	0.29	ns
Teaching Experience (B)	2	11255.32	5627.66	3.17	p<0.05
A X B	2	472.54	472.54	0.13	ns
Error	182	322956	1774.48		
Total	188				

*ns= Not significant

4.5.1 Influence of Gender on ICT knowledge of teachers taught Foundations of Educational Technology Course by considering their Pre- Reaction towards ICT knowledge as covariate

From Table 4.4, it is evident that the adjusted F-value for Gender is 0.29 which is not significant. It reflects that there is no significant difference in adjusted mean scores of ICT knowledge of Male and Female teachers taught Foundations of Educational Technology Course by considering their pretest scores of ICT knowledge as covariate. So there is no significant influence of Gender on ICT knowledge of teachers taught Foundations of Educational Technology Course by considering their pretest scores of ICT knowledge as covariate. Thus the null hypothesis that there is no significant influence of Gender on ICT knowledge of teachers taught Foundations of Educational Technology Course by considering their pretest scores of ICT knowledge as covariate is not rejected. It may be said that both Male and Female Teachers were found to have the same degree of favourable Reaction towards ICT knowledge of teachers taught Foundations of Educational Technology Course by considering their Pre- Reaction towards ICT knowledge as covariate.

4.5.2 Influence of Teaching Experience on ICT knowledge of teachers taught Foundations of Educational Technology Course by considering their Pretest scores of ICT knowledge as covariate

The adjusted F-value for Teaching Experience is 3.17 which is significant at 0.05 level with df=2/182 (Vide Table 4.4) It reflects that there is a significant difference in adjusted mean scores of ICT knowledge of teachers having teaching experience 1 to 10 years; 11 to 20 years and more than 20 years taught Foundations of Educational Technology Course by considering their pretest scores of ICT knowledge as covariate. So there is a significant influence of Teaching Experience on ICT knowledge of teachers taught Foundations of Educational

Technology Course by considering their pretest scores of ICT knowledge as covariate. Thus the null hypothesis that there is no significant influence of Teaching Experience on ICT knowledge of teachers taught Foundations of Educational Technology Course by considering their pretest scores of ICT knowledge as covariate is rejected. In order to know teachers with what years of Teaching Experience, had significantly more knowledge of ICT taught Foundations of Educational Technology Course by considering their pretest scores of ICT knowledge as covariate, the data were further analysed with the help of t-Test and the results are given in Table 4.5.

Table 4.5: Teaching Experience-wise $M_{Y.X}$, $SE_{Y.X}$, N and t-values of ICT knowledge of teachers taught Foundations of Educational Technology Course

Teaching Experience	$M_{Y.X}$	$SE_{Y.X}$	N	11 to 20 Years	More than 20 Years
1 to 10 Years	737.14	5.54	58	0.39	2.23*
11 to 20 Years	744.32	4.76	84		1.90
More than 20 years	729.02	6.50	47		

* Significant at 0.05 level

From Table 4.5, it can be seen that the t-Value of 0.39 for teachers having teaching experience from 1 to 10 years and 11 to 20 years is not significant. It shows that there is no significant difference in adjusted mean scores of ICT knowledge of teachers with teaching experience from 1 to 10 years and 11 to 20 years taught Foundations of Educational Technology Course by considering their pretest scores of ICT knowledge as covariate. It may be said that teachers having teaching experience from 1 to 10 years and 11 to 20 years were found to have the same degree of ICT knowledge taught Foundations of Educational Technology Course by considering their pretest scores of ICT knowledge as covariate.

The t-value of 2.23 for teachers having teaching experience from 1 to 10 years and more than 20 years is significant at 0.05 level with df=103 (Vide Table 4.5). It shows that there is a significant difference in adjusted mean scores of ICT knowledge of teachers with teaching experience from 1 to 10 years and more than 20 years taught Foundations of Educational Technology Course by considering their pretest scores of ICT knowledge as covariate. Further the adjusted mean score of ICT knowledge of teachers having teaching experience from 1 to 10 years is 747.14 which is significantly higher than those with teaching experience more than 20 years whose adjusted mean score of ICT knowledge is 729.02. It may be said that teachers having teaching experience between 1 to 10 Years were found to have significantly more favourable ICT knowledge as compared to teachers with more than 20 years taught Foundations of Educational Technology Course by considering their pretest scores of ICT knowledge as covariate.

From Table 4.5, it can be seen that the t-Value of 0.1.90 for teachers having teaching experience from 11 to 20 years and more than 20 years is not significant. It shows that there is

no significant difference in adjusted mean scores of ICT knowledge of teachers with teaching experience from 11 to 20 years and more 20 years taught Foundations of Educational Technology Course by considering their pretest scores of ICT knowledge as covariate. It may be said that teachers having teaching experience from 11 to 20 years and and more than 20 years were found to have the same degree of favourable ICT knowledge taught Foundations of Educational Technology Course by considering their pretest scores of ICT knowledge as covariate.

4.5.3 Influence of interaction between Gender and Teaching Experience on ICT knowledge of teachers taught Foundations of Educational Technology Course by considering their pretest scores of ICT knowledge as covariate

From Table 4.4, it can be seen that the adjusted P-Value for interaction between Gender and Teaching Experience is 0.13 which is not significant. It shows that there is no significant difference in mean scores of ICT knowledge of Male and Female teachers having Teaching Experience from 1 to 10 years; 11 to 20 years and more than 20 years taught Foundations of Educational Technology Course by considering their pretest scores of ICT knowledge as covariate. So there is no significant influence of interaction between Gender and Teaching Experience on ICT knowledge of teachers taught Foundations of Educational Technology Course by considering their pretest scores of ICT knowledge as covariate. Thus the null hypothesis that there is no significant influence of interaction between Gender and Teaching Experience on ICT knowledge of teachers taught Foundations of Educational Technology Course by considering their pretest scores of ICT knowledge as covariate is not rejected. It may be said that ICT knowledge of teachers taught Foundations of Educational Technology Course by considering their pretest scores of ICT knowledge as covariate was found to be independent of interaction between Gender and Teaching Experience.

4.6 Influence of Gender, Teaching Experience and their interaction on Attitude towards ICT of teachers taught Foundations of Educational Technology Course by considering their Pretest scores of Attitude towards ICT as covariate

The fifth objective was to study the influence of Gender, Teaching Experience and their interaction on Attitude towards ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of Attitude towards ICT as covariate. Male and Female were the two levels of Gender while 1 to 10 Years, 11 to 20 Years and more the 20 years were the three levels of Teaching Experience of teachers taught Foundations of Educational Technology Course. Pretest scores of Attitude towards ICT was the covariate. Thus the data were analysed with the help of 2X3 Factorial Design ANCOVA and the results are given in Table 4.6.

Table 4.6: Summary of 2 X 3 factorial Design ANCOVA of Attitude towards ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of Attitude towards ICT as covariate

Source of Variance	df	$SS_{Y.X}$	$MSS_{Y.X}$	$F_{Y.X}$ - Value	Remark
Gender (A)	1	93.50	93.50	0.49	ns
Teaching Experience (B)	2	71.44	35.72	0.19	ns
A X B	2	450.09	225.04	1.19	ns
Error	182	34424.75	189.15		
Total	188				

*ns= Not significant

4.6.1 Influence of Gender on Attitude towards ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of Attitude towards ICT as covariate

The adjusted F-value for Gender is 0.49 which is not significant (Vide Table 4.6) It reflects that there is no significant difference in adjusted mean scores of Attitude towards ICT of Male and Female Teachers taught Foundations of Educational Technology Course by considering their pretest scores of Attitude towards ICT as covariate. So there is no significant influence of Gender on Attitude towards ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of Attitude towards ICT as covariate. Thus the null hypothesis that there is no significant influence of Gender on Attitude towards ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of Attitude towards ICT as covariate is not rejected. It may be said that both Male and Female teachers were found to have the same degree of Attitude towards ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of Attitude towards ICT as covariate.

4.6.2 Influence of Teaching Experience on Attitude towards ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of Attitude towards ICT as covariate

The adjusted F-value for Teaching Experience is 0.19 which is not significant (Vide Table 4.6) It reflects that there is no significant difference in adjusted mean scores of Attitude towards ICT of Teachers having 1 to 10 Years, 11 to 20 Years and more than 20 years of Teaching Experience taught Foundations of Educational Technology Course by considering their pretest scores of Attitude towards ICT as covariate. So there is no significant influence of Teaching Experience on Attitude towards ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of Attitude towards ICT as covariate. Thus the null hypothesis that there is no significant influence of Teaching Experience on Attitude towards ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of Attitude towards ICT as covariate is not rejected. It may be said that teachers

having 1 to 10 Years, 11 to 20 Years and more than 20 years of Teaching Experience were found to have the same degree of Attitude towards ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of Attitude towards ICT as covariate.

4.6.3 Influence of interaction between Gender and Teaching Experience on Attitude towards ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of Attitude towards ICT knowledge as covariate

From Table 4.6, it can be seen that the adjusted P-Value for interaction between Gender and Teaching Experience is 1.19 which is not significant. It shows that there is no significant difference in mean scores of Attitude towards ICT of Male and Female teachers having Teaching Experience from 1 to 10 years; 11 to 20 years and more than 20 years taught Foundations of Educational Technology Course by considering their pretest scores of Attitude towards ICT as covariate. So there is no significant influence of interaction between Gender and Teaching Experience on Attitude towards ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of Attitude towards ICT as covariate. Thus the null hypothesis that there is no significant influence of interaction between Gender and Teaching Experience on Attitude towards ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of Attitude towards ICT as covariate is not rejected. It may be said that Attitude towards ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of Attitude towards ICT as covariate was found to be independent of interaction between Gender and Teaching Experience.

4.7 Influence of Gender, Teaching Experience and their interaction on Confidence in using ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of Confidence in using ICT as covariate

The sixth objective was to study the influence of Gender, Teaching Experience and their interaction on Confidence in using ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of Confidence in using ICT as covariate. Male and Female were the two levels of Gender while 1 to 10 Years, 11 to 20 Years and more the 20 years were the three levels of Teaching Experience of teachers taught Foundations of Educational Technology Course. Pretest scores of Confidence in using ICT was the covariate. Thus the data were analysed with the help of 2X3 Factorial Design ANCOVA and the results are given in Table 4.7.

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Table 4.7: Summary of 2 X 3 factorial Design ANCOVA of Confidence in using ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of Confidence in using ICT as covariate

Source of Variance	df	$SS_{Y.X}$	$MSS_{Y.X}$	$F_{Y.X}$ - Value	Remark
Gender (A)	1	0.71	0.71	0.02	ns
Teaching Experience (B)	2	97.84	48.92	1.41	ns
A X B	2	32.08	16.04	0.46	ns
Error	182	6297.45	34.60		
Total	188				

*ns= Not significant

4.7.1 Influence of Gender on Confidence in using ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of Confidence in using ICT as covariate

The adjusted F-value for Gender is 0.0.02 which is not significant (Vide Table 4.7) It reflects that there is no significant difference in adjusted mean scores of Confidence in using ICT of Male and Female Teachers taught Foundations of Educational Technology Course by considering their pretest scores of Confidence in using ICT as covariate. So there is no significant influence of Gender on Confidence in using ICT of Male and Female Teachers taught Foundations of Educational Technology Course by considering their pretest scores of Confidence in using ICT as covariate. Thus the null hypothesis that there is no significant influence of Gender on Confidence in using ICT of Male and Female Teachers taught Foundations of Educational Technology Course by considering their pretest scores of Confidence in using ICT as covariate is not rejected. It may be said that both Male and Female teachers were found to have the same degree of Reaction towards Confidence in using ICT of Teachers taught Foundations of Educational Technology Course by considering their Pre-Reaction towards Confidence in using ICT as covariate.

4.7.2 Influence of Teaching Experience on Confidence in using ICT of Teachers having 1 to 10 Years, 11 to 20 Years and more than 20 years of Teaching Experience taught Foundations of Educational Technology Course by considering their pretest scores of Confidence in using ICT as covariate

The adjusted F-value for Teaching Experience is 1.41 which is not significant (Vide Table 4.7). It reflects that there is no significant difference in adjusted mean scores of Confidence in using ICT of Teachers having 1 to 10 Years, 11 to 20 Years and more than 20 years of Teaching Experience taught Foundations of Educational Technology Course by considering their pretest scores of Confidence in using ICT as covariate. So there is no significant influence of Teaching Experience on Confidence in using ICT of teachers taught Foundations of Educational

Technology Course by considering their pretest scores of Confidence in using ICT as covariate. Thus the null hypothesis that there is no significant influence of Teaching Experience on Confidence in using ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of Confidence in using ICT as covariate is not rejected. It may be said that teachers having 1 to 10 Years, 11 to 20 Years and more than 20 years of Teaching Experience were found to have the same degree of Confidence in using ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of Confidence in using ICT as covariate.

4.7.3 Influence of interaction between Gender and Teaching Experience on Confidence in using ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of Confidence in using ICT knowledge as covariate

From Table 4.7, it can be seen that the adjusted P-Value for interaction between Gender and Teaching Experience is 0.46 which is not significant. It shows that there is no significant difference in mean scores of Confidence in using ICT of Male and Female teachers having Teaching Experience from 1 to 10 years; 11 to 20 years and more than 20 years taught Foundations of Educational Technology Course by considering their pretest scores of Confidence in using ICT as covariate. So there is no significant influence of interaction between Gender and Teaching Experience on Confidence in using ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of Confidence in using ICT as covariate. Thus the null hypothesis that there is no significant influence of interaction between Gender and Teaching Experience on Confidence in using ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of Confidence in using ICT as covariate is not rejected. It may be said that Confidence in using ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of Confidence in using ICT as covariate was found to be independent of interaction between Gender and Teaching Experience.

4.8 Findings

The following are the findings of this study.
1. Teaching of Foundations of Educational Technology Course was found to be effective in promoting favourable ICT knowledge of teachers.
2. Teaching of Foundations of Educational Technology Course was found to be effective in promoting knowledge of Hardware and Software dimension of ICT Knowledge of teachers.
3. Teaching of Foundations of Educational Technology Course was found to be effective in promoting knowledge of Operating System dimension of ICT Knowledge of teachers.
4. Teaching of Foundations of Educational Technology Course was found to be effective in promoting knowledge of working with word processor dimension of ICT Knowledge of teachers.

5. Teaching of Foundations of Educational Technology Course was found to be effective in promoting knowledge of working with images dimension of ICT Knowledge of teachers.

6. Teaching of Foundations of Educational Technology Course was found to be effective in promoting knowledge of working with spreadsheet dimension of ICT Knowledge of teachers.

7. Teaching of Foundations of Educational Technology Course was found to be effective in promoting knowledge of working with images dimension of ICT Knowledge of teachers.

8. Teaching of Foundations of Educational Technology Course was found to be effective in promoting knowledge of internet, web browser and browsing dimension of ICT Knowledge of teachers.

9. Teaching of Foundations of Educational Technology Course was found to be effective in promoting knowledge of working with an email dimension of ICT Knowledge of teachers.

10. Teaching of Foundations of Educational Technology Course was not found to be effective in promoting favourable Attitude towards ICT of teachers.

11. Teaching of Foundations of Educational Technology Course was not found to be effective in promoting a favourable attitude towards the Technical aspect of ICT of teachers.

12. Teaching of Foundations of Educational Technology Course was not found to be effective in promoting a favourable attitude towards Pedagogical usability of ICT of teachers.

13. Teaching of Foundations of Educational Technology Course was found to be effective in promoting a favourable attitude towards the Social and ethical aspect of ICT of teachers.

14. Teaching of Foundations of Educational Technology Course was not found to be effective in promoting a favourable attitude towards Professional Use of ICT of teachers.

15. Teaching of Foundations of Educational Technology Course was found to be effective in promoting Confidence in using ICT of teachers.

16. Teaching of Foundations of Educational Technology Course was found to be effective in promoting confidence in handling ICT tools of teachers.

17. Teaching of Foundations of Educational Technology Course was found to be effective in promoting confidence in managing the use of ICT of teachers.

18. Teaching of Foundations of Educational Technology Course was found to be effective in promoting confidence in solving the issues that arise during the use of ICT of teachers.

19. Both Male and Female Teachers were found to have the same degree of favourable ICT knowledge of teachers taught Foundations of Educational Technology Course by considering their pretest scores of ICT knowledge as covariate.

20. Teachers having teaching experience between 1 to 10 Years were found to have significantly more favourable ICT knowledge as compared to teachers with more than 20 years taught Foundations of Educational Technology Course by considering their pretest scores of ICT knowledge as covariate. Also teachers having teaching experience from 1 to 10 years and 11 to 20 years and from 11 to 20 years and more than 20 years were found to have the same degree of favourable ICT knowledge when taught with Foundations of Educational Technology Course by considering their pretest scores of ICT knowledge as covariate.

21. Attitude towards ICT knowledge of teachers taught Foundations of Educational Technology Course by considering their pretest scores of Attitude towards ICT as covariate was found to be independent of interaction between Gender and Teaching Experience.

22. Both Male and Female teachers were found to have the same type of ReactionAttitude towards ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of Attitude towards ICT as covariate.

23. Teachers having 1 to 10 Years, 11 to 20 Years and more than 20 years of Teaching Experience were found to have the same type of Attitude towards ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of Attitude towards ICT as covariate.

24. Attitude towards ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of Attitude towards ICT as covariate was found to be independent of interaction between Gender and Teaching Experience.

25. Both Male and Female teachers were found to have the same degree of Confidence in using ICT of Teachers taught Foundations of Educational Technology Course by considering their pretest scores of Confidence in using ICT as covariate.

26. Teachers having 1 to 10 Years, 11 to 20 Years and more than 20 years of Teaching Experience were found to have the same degree of Confidence in using ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of Confidence in using ICT as covariate.

27. Confidence in using ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of Confidence in using ICT as covariate was found to be independent of interaction between Gender and Teaching Experience.

CHAPTER 5: DISCUSSION

5.1 Introduction

The results and their interpretation have been given objective-wise in the previous chapter. The present chapter is devoted to the discussion of findings. This has been done objective-wise.

5.2 Testing-wise comparison of ICT knowledge and its' dimensions separately of teachers before and after Teaching Foundations of Educational Technology Course

The first objective was to compare mean scores of ICT knowledge and its dimensions separately of teachers before and after Teaching Foundations of Educational Technology Course. There were eight dimensions of ICT Knowledge. These were: Hardware and Software; Operating System; Working with word processor; Working with images; Working with Audio and Video; Working with Spreadsheet; Internet, Web Browser and Browsing; and Working with email. The findings were that Teaching of Foundations of Educational Technology Course was found to be effective in promoting favourable ICT knowledge and its dimensions of teachers. This finding is supported by Rana and Rana (2020) and ElSayed (2023). There might be different reasons for the finding. One of the reasons might be that ICT is an upcoming area and has wider implications including education. Due to the introduction of ICT, the teachers might have observed that the classrooms are being changed into Smart Classrooms where digital boards are being used. Teachers might have found ICT to be useful. Teachers might be using email, sharing the images, audios and videos and found them to be very useful. It might have improved their working efficiency. Teachers do use computers even in their day to day work. Personal experience goes a long way in forming a favourable ICT Knowledge and its dimensions. Among the most important factors that accounted for efficiency in training in educational technology was the good-equipped training laboratory for ICT resources and materials which were used by teachers (Ghavifekr & Rosdy, 2015). A teacher's attitude towards integration of ICT into their teaching is favourable if they can access technological gadgets and resources. Additionally, teacher's professional development courses have emerged as the key vehicle through which they acquire skills to use technology in their classrooms effectively.

5.3 Testing-wise comparison of Attitude towards ICT and its' dimensions separately of teachers before and after Teaching Foundations of Educational Technology Course

The second objective was to compare mean scores of Attitude towards ICT and its dimensions separately of teachers before and after Teaching Foundations of Educational Technology Course. There were four dimensions of Attitude towards ICT. These were: Technical aspects of ICT; Pedagogical Usability of ICT; Social and Ethical Aspects; and Professional Use of ICT. The findings were that Teaching of Foundations of Educational Technology Course was not found to be effective in promoting favourable Attitude towards ICT, Technical aspect of ICT, and Professional Use of aspects of ICT of teachers but Teaching of Foundations of Educational Technology Course was found to be effective in promoting favourable Attitude towards Social and Ethical aspect of ICT of teachers. This finding is supported by Zhang &

Martinović (2009) who found that even though technical aspects and pedagogical aspects were addressed in courses, equal focus ought to have been given to social and ethicalities concerning using technology in a classroom. Jimoyiannis & Komis (2007) reported that the development and substance of course content in teacher education programs must be carefully considered when developing teachers' ICT competencies. Also it was found from the researches that teacher education programs should take a holistic approach to integrating ICT by attending not only to the technical skills but also addressing attitudinal and perceptual factors that influence teacher's readiness towards adopting new technologies (Mirzajani et al., 2016 and Mumtaz, 2000). This would mean offering more opportunities for pre-service teachers to critically think about how technology affects society and its implications on educational practices (Chen, 2011). Teacher education Programs should address these areas so as to better prepare teachers for dealing with complexities of ICT integration thereby fostering positive perception about technology in the classrooms (Martinović & Zhang, 2012). The other reason might be the short duration of the training programme on Foundations of Educational Technology Course. In the short duration, it is not possible to form favourable Attitude towards ICT, Technical aspect of ICT, and Professional Use of aspects of ICT by teachers. The background of trainees might have been a barrier in promoting favourable Attitude towards ICT, Technical aspect of ICT, and Professional Use aspects of ICT by teachers. Participants with a science background might have an edge over those with a social science background. To take participants to their understanding level is a time consuming process. Individual differences and lack of concentration during the training programme might also be the reason for the present finding.

5.4 Testing-wise comparison of confidence in using ICT and its' dimensions separately of teachers before and after Teaching Foundations of Educational Technology Course

The third objective was to compare mean scores of Confidence in using ICT and its dimensions separately of teachers before and after Teaching Foundations of Educational Technology Course. There were three dimensions of Confidence in using ICT. The dimensions were: Handling ICT tools; Managing the use of ICT; and Solving the issues that arise during the use of ICT. Teaching of Foundations of Educational Technology Course was found to be effective in promoting confidence in handling of ICT tools; managing the use of ICT and solving the issues that arise during the use of ICT of teachers. The findings of this study revealed a significant improvement in teachers' confidence in using ICT immediately after attending the Foundations of Educational Technology Course. This finding is supported by Mirzajani et al. (2016) who reported that the course can facilitate effective integration of technology in the classroom by enhancing teachers' competencies in handling ICT tools, managing the use of ICT, and solving issues that arise during use. The study emphasised that it was important to fully train and support teachers in the use of ICT in teaching. Reports from other prior studies indicated that it was not sufficient to give teachers exposure to the technology; they required structured opportunities to develop practical skills and deeper understandings of how to effectively integrate ICT into their teaching – learning process. In the programme, each participant got the opportunity to work with different tools independently in the ICT Lab of CIET. In case participants had any problem in using the ICT tool, immediate help was

available. Using tools individually, getting immediate solution of the problem faced by the participant, and interest in using ICT tools might have gone a long way in facilitating the favourable Confidence in using ICT and its dimensions.

5.5 Influence of Gender, Teaching Experience and their interaction on ICT knowledge of teachers taught Foundations of Educational Technology Course by considering their pretest scores of ICT knowledge as covariate

The fourth objective was to study the influence of Gender, Teaching Experience and their interaction on ICT knowledge of teachers taught Foundations of Educational Technology Course by considering their pretest scores of ICT knowledge as covariate. The finding in respect of influence of Gender on ICT knowledge of teachers taught Foundations of Educational Technology Course by considering their pretest scores of ICT knowledge as covariate was that both Male and Female Teachers were found to have same degree of favourable ICT knowledge of teachers taught Foundations of Educational Technology Course by considering their pretest scores of ICT knowledge as covariate. The finding was supported by Seng et al. (2014) found that male and female students tend to be indifferent in regard to necessity and importance in learning technology. Jimoyiannis & Komis (2007) also found that the personal factors encapsulated the dispositions and beliefs of an individual and they served more as a reason behind what took place in the reaction of teachers to ICT than demographic characteristics such as gender. But the finding was not supported by Alazzam et al. (2012) who strongly indicated that gender significantly should affect teachers' readiness towards ICT and their attitude towards it. The reason might be that both male and female trainees were given the same treatment. The duration of the treatment was the same. Each participant got an equal chance to use the software in which they were trained. These might have been some of the reasons for the present finding in respect of gender.

The finding in respect of influence of Teaching Experience on ICT knowledge of teachers taught Foundations of Educational Technology Course by considering their pretest scores of ICT knowledge as covariate was that Teachers having teaching experience between 1 to 10 Years were found to have significantly more favourable ICT knowledge as compared to teachers with more than 20 years taught Foundations of Educational Technology Course by considering their pretest scores of ICT knowledge as covariate. Also teachers having teaching experience from 1 to 10 years and 11 to 20 years and from 11 to 20 years and more than 20 years were found to have the same degree of favourable ICT knowledge of teachers taught Foundations of Educational Technology Course by considering their pretest scores of ICT knowledge as covariate. This finding aligns with study by Ibieta et al. (2017) who found that less-experienced teachers are more inclined to accept and implement technological innovations in their classrooms. On the other hand Farrukh and Singh (2014) and Jimoyiannis and Komis (2007) found a similar and positive attitude towards ICT knowledge by teachers who had teaching experience between 1 to 10 years and 11 to 20 years, and those between 11 to 20 years to those more than 20 years. Teachers having teaching experience up to 20 years are using ICT heavily. Normally, young people start the day with ICT and end it with ICT. Different ICT devices and facilities are easily available and people are efficient in their use. Another reason is the teachers having teaching experience up to 20 years have to remain in the system for more

years. Also the majority of educational institution work has to be done online. Even the State as well as the Central Government are emphasising on using ICT. These might have been some of the reasons for favourable ICT knowledge of teachers taught Foundations of Educational Technology Course. It also might have been due to first-hand experience in using ICT in different walks of life and finding it more convenient.

The finding in respect of influence of interaction between Gender and Teaching Experience on ICT knowledge of teachers taught Foundations of Educational Technology Course by considering their pretest scores of ICT knowledge as covariate was that the ICT knowledge of teachers taught Foundations of Educational Technology Course by considering their pretest scores of ICT knowledge as covariate was found to be independent of interaction between Gender and Teaching Experience. It indicates that irrespective of Teaching Experience both Male and Female Teachers were found to have similar ICT knowledge taught Foundations of Educational Technology Course. Previous research has examined ways in which personal factors contribute to the formation of teachers' beliefs and perceptions about ICT in education. The present finding is not supported by Jimoyiannis & Komis (2007) who found that personal factors like gender and teaching experience were highly correlated with attitude and belief towards the integration of ICT in the classroom. One reason for the finding can be the short duration of the treatment of the training programme. It is difficult to form an attitude towards ICT knowledge within five days. Formation of ICT knowledge requires lots of experience in its use. Just reading and attending a training programme of five days does help in forming an attitude towards ICT Knowledge. Apart from training, variability in pre-existing ICT knowledge, access to professional development programs, individual attitudes, support systems, generational differences, context, and perceptions of benefits and challenges all play a role. Younger teachers with more exposure to technology are more comfortable with ICT, while older teachers may be more adept. Contextual factors like school environment, resource availability, and administrative support also influence teachers' reactions. Therefore, a multifaceted approach is needed to understand teachers' ICT knowledge and integration.

5.6 Influence of Gender, Teaching Experience and their interaction on Attitude towards ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of Attitude towards ICT as covariate

The fifth objective was to study the influence of Gender, Teaching Experience and their interaction on Attitude towards ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of Attitude towards ICT as covariate.

The finding in respect of influence of Gender on Attitude towards ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of Attitude ICT as covariate was that both Both Male and Female teachers were found to have same type of Attitude towards ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of Attitude towards ICT as covariate. The fact that male and female teachers evoked the same type of attitude to ICT regarding taking the Foundations of Educational Technology course was established even after attributing their pre-existing ICT reactions, hence implying the insignificance of gender in determining the attitude of teachers toward technology use. This outcome suggests that the influential factors of

teachers' response to ICT probably lie in other variables, for example, the course material quality, the efficiency level of the course instructor or the support rendered during the course. The reason the two sets of views obtained were similar between male teachers and female teachers may be that either both genders were exposed to similar levels of ICT before the study or that both were similarly trained, thus generating equivalent levels of confidence and attitudes. Further, because of the design of the course, it could more or less address the needs of and concerns about all participants, a situation that could arouse a uniformly positive reaction across gender. This finding challenges traditional assumptions that gender differences inherently affect attitude towards technology and underscores the importance of creating inclusive and well-structured professional development programs that can equally benefit all teachers, regardless of gender.

The finding in respect of influence of Teaching Experience on Attitude towards ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of Attitude towards ICT as covariate was that Teachers having 1 to 10 Years, 11 to 20 Years and more than 20 years of Teaching Experience were found to have same type of Attitude towards ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of Attitude towards ICT as covariate. The fact that teachers with 1-10, 11-20 years and more than 20 years of teaching experience showed similar kinds of attitude towards ICT in the course on Foundations of Educational Technology even when their pretest scores of attitude towards ICT was taken into consideration may indicate that teaching experience does not play important role in teachers' attitude towards ICT integration. There could be several probable reasons for this uniformity. First and foremost, the quality of the course content and delivery might have been that effective and engaging for any participant to grasp the competencies and confidence required towards embracing ICT. The professional development opportunities offered by the course might have been unique in bridging the diverse needs of teachers with different teaching experience, hence benefiting all equally. Finally, the growing presence and requirement of ICT in the classroom may have meant that all teachers, regardless of their experience, had developed a base level of familiarity and comfort with technology prior to course participation. It, therefore, places an emphasis on the need for inclusive training that would not only take note of prior knowledge but also the reaction of the teachers toward equitable growth and the building of confidence in ICT integration around the teaching profession.

The finding in respect of influence of interaction between Gender and Teaching Experience on Attitude towards ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of Attitude towards ICT as covariate was that Attitude towards ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of Attitude towards ICT as covariate was found to be independent of interaction between Gender and Teaching Experience. These findings call into question a prevailing assumption: that substantial teaching experience would, above all, be related to teachers' reaction towards integrating ICT. Owing to the uniformity in reactions from teachers with different teaching experience, factors such as the quality of professional development, tailoring of training for the diversity of needs, and growing presence of technology in the classroom could be at work in shaping teachers' attitude towards ICT

integration equally well of male and female teachers. Teachers' attitude towards ICT was found to be independent of interaction between gender and teaching experience. This could be due to the course's standardised design, which addressed the needs of a diverse group of teachers, ensuring equal benefits for all participants. The professional development provided by the course was likely inclusive and equitable, catering to the diverse needs of teachers. The growing prevalence and importance of ICT in education may have led to a convergence in reaction towards technology among teachers. This widespread familiarity with ICT may explain why the interaction between gender and teaching experience did not significantly affect attitude to the course. The professional development landscape may have evolved to provide continuous and adaptive learning opportunities for all teachers, bridging any gaps due to gender or teaching experience. This finding challenges traditional assumptions that gender and teaching experience interact to influence attitudes towards technology, emphasising the importance of inclusive and well-designed professional development programs.

5.7 Influence of Gender, Teaching Experience and their interaction on Confidence in using ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of confidence in using ICT as covariate

The seventh objective was to study the influence of Gender, Teaching Experience and their interaction on Confidence in using ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of confidence in using ICT as covariate.

The finding in respect of influence of Gender on confidence in using ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of confidence in using ICT as covariate was that both Male and Female teachers were found to have same degree of Confidence in using ICT of Teachers taught Foundations of Educational Technology Course by considering their pretest scores of Confidence in using ICT as covariate. These days both male and female teachers use mobiles, WhatsApp, YouTube, etc. They do not have any hesitation in using software. They can download the software, install it and start using it. Even the institutions to which teachers belong do use computers and most of the work is done online. Government keeps on asking many information about students, teachers, institution, etc. which they have to provide online. Not only this even the state government as well as central government conducts courses for teachers in the use of ICT. All this goes a long way in eliciting the same type of confidence in using ICT of male and female teachers. Further, Foundations of Educational Technology Course was found to be effective in bridging any potential gender gaps in confidence in using ICT of teachers. Equally plausible explanations for this finding could be that the course implemented a holistic and inclusive approach to the integration of ICT, considering the very special needs and characteristics of both male and female teachers. Also, it could have created an enabling learning environment that encourage active participation and put the teachers into hands-on activity with ICT, hence enhancing their confidence levels regardless of gender. This research has found that, provided an appropriate training and support setting, both men and women teachers can equally attain the very highest levels of confidence in using ICT. These findings underscore the importance of designing inclusive and gender-responsive integration initiatives for ICT within teacher education programs and professional development efforts.

The finding in respect of influence of Teaching Experience on confidence in using ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of confidence in using ICT as covariate was that Teachers having 1 to 10 Years, 11 to 20 Years and more than 20 years of Teaching Experience were found to have same degree of Confidence in using ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of Confidence in using ICT as covariate. This might be due to the fact that the duration of the training programme in Foundations of Educational Technology Course was too short so teachers with different teaching experience might have expressed the same confidence in using ICT in the teaching learning process. To develop confidence in using ICT, treatment duration should have been longer than five days. Moreover, the supportive learning environment created by the course, including peer collaboration, mentorship, and access to resources, may have played a crucial role in boosting teachers' confidence uniformly. Such an environment can help mitigate any initial differences in confidence levels due to varying teaching experience, fostering a sense of community and shared learning.

The finding in respect of influence of interaction between Gender and Teaching Experience on Confidence in using ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of confidence in using ICT as covariate was that Confidence in using ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of Confidence in using ICT as covariate was found to be independent of interaction between Gender and Teaching Experience. During training equal help was provided to both male and female teachers with different teaching experience. The finding suggests that the course efficiently masked any possible biases or preconceptions related to male and female having different length of teaching experience, hence setting an environment within which all teachers were provided equal opportunities regarding the enhancement of their skills and confidence in using ICT. By focusing on the development of skills while cultivating a learning community that sustained the participants, most likely the course allowed the participants to transcend any barriers or biases existing, leading to a favourable reaction towards confidence in using ICT irrespective of Gender and Teaching Experience.

CHAPTER 6: SUMMARY, FINDINGS AND IMPLICATIONS

6.1 Introduction

The details of this study have been presented in previous chapters. The present chapter is devoted to the presentation of this study in a nutshell. It has been given under captions, like, Rationale of the Problem, Statement of the Problem, Operational Definitions, Objectives, Hypotheses, findings, implications and recommendations

The main areas of focus include enhancing the capacity of SCERTs/DIETs/BRCs/CRCs, delivering ongoing professional development, ensuring safety, health, and environment awareness, providing opportunities for self-improvement, promoting technology platforms for online training, and acknowledging the significance of in-person learning. The School Leadership Development Programme (SLDP) aims to augment leadership proficiency at the school level to facilitate the establishment and growth of institutions. The scheme provides financial assistance for various interventions, allowing states to supplement or augment provisions from their own resources. Preference will be given to states and UTs that have restructured their SCERT and DIETs, as per MOE2018 Guidelines. The National Initiative for School Heads and Teachers Holistic Advancement (NISHTHA) is a unique effort supported by the Government of India and incorporating academic institutions such as NCERT and NIEPA, aimed at transforming in-service teacher training. NISHTHA focuses on developing competencies among all teachers and school principals at the elementary stage, aiming to motivate and equip teachers to effectively cultivate critical thinking skills in students. The program has been launched in August 2019, with a blended mode of training adopted once the pandemic is over. The NISHTHA Educational Technology initiative aligns with the Education Budget 2022-23, which emphasises advancing digital learning and empowering teachers with digital tools. This training program ensures that teachers can effectively integrate technology into their teaching practices and maximise its benefits for student learning. Teacher training in educational technology is also emphasised, with comprehensive programs designed to equip future educators with the necessary skills and knowledge to effectively utilise digital tools and platforms in the educational process. The policy also emphasises the potential of adaptive learning platforms and artificial intelligence (AI) in revolutionising the education sector.

6.2 Rationale of the Problem

Teachers' attitudes and proficiency levels are frequently mentioned as obstacles to the implementation and efficient utilisation of ICT in teaching. Although there is a strong focus on improving ICT capabilities, the results of these efforts are more noticeable in students' proficiency in ICT skills rather than their ability to effectively utilise these talents in other sections of the curriculum. Recently, there have been several efforts from both the scientific community and educational policy authorities to train teachers in incorporating ICT into their regular teaching methods.

The NISHTHA Educational Technology programme has implemented a three-level systematic course to provide teachers and school administrators with the necessary skills to become digital educators and close the existing gap. The proposed curriculum is both contemporary and essential in providing educators with the necessary skills to handle the intricacies of digital teaching methods. The Foundations of Educational Technology Course (Level - 1) aims to augment the ICT proficiencies of teachers, acknowledging the crucial significance of technology in contemporary education. Due to the swift progress of technology, educators need to adjust to emerging patterns and use information and communication technology (ICT) into their instructional methods to establish lively and captivating learning settings. This course focuses on the necessity for teachers to possess expertise in using ICT tools, in line with worldwide patterns that underscore the significance of ICT in education. The course aims to enhance teaching effectiveness and prepare students for the digital economy by providing instructors with the necessary skills and knowledge to effectively utilise ICT. Moreover, the course is in line with National Education Policy (NEP 2020) that prioritises the incorporation of ICT in education, showcasing the government's dedication to enhancing the standard of education. This course offers teachers valuable professional development opportunities and fosters lifelong learning, assuring their continued competitiveness in the education area and their contribution to improving the overall quality of education.

6.3 Statement of the Problem

The present study aimed at studying the effect of teaching of Foundations of Educational Technology course which is a Level 1 course in NISHTHA Educational Technology on the ICT competencies of the in-service teachers and teacher educators. Hence the study is entitled as:

EFFECTIVENESS OF FOUNDATIONS OF EDUCATIONAL TECHNOLOGY COURSE ON THE BASIS OF REACTION TOWARDS ICT KNOWLEDGE, ICT AND CONFIDENCE IN USING ICT OF IN-SERVICE TEACHERS AND TEACHER EDUCATORS OF INDIA

6.4 Operational Definitions

The study used the following operational definitions for its variables:

Foundations of Educational Technology Course:

This course was a Level-1 course of the NISHTHA Educational Technology training. The course had 12 modules consisting of ICT basics sessions.

ICT knowledge:

In this study, knowledge of ICT was defined as the familiarity, awareness, or understanding of facts, information, descriptions of ICT concepts, tools and the use of ICT for teaching and learning. ICT Knowledge consists of eight dimensions i.e., hardware & software, operating

system, working with word processor, working with images, working with audio & video, working with spreadsheets, internet browser & browsing and working with email.

Attitude towards ICT

In this study, "attitude towards ICT" refers to the positive or negative attitude towards ICT's capabilities in the teaching and learning process, the skill of using ICT, and the social aspects related to the use of ICT in education. ICT attitude consists of four parameters i.e., handling ICT tools, managing the use of ICT to learn and teach, solving the issues arising during the use of ICT.

Confidence in using ICT

In this study, "confidence in using ICT" refers to the ability to handle ICT tools, manage their use in the teaching-learning process, and resolve issues related to integrating ICT and pedagogy. ICT confidence consists of three parameters: technical aspect of handling ICT, pedagogical usability of ict, social & ethical aspects related to ICT, professional use of ICT

6.5   Objectives

The following were the objectives:

- To compare mean scores of ICT knowledge and its' dimensions separately of teachers before and after Teaching Foundations of Educational Technology Course.
- To compare mean scores of Attitude towards ICT and its' dimensions separately of teachers before and after Teaching Foundations of Educational Technology Course.
- To compare mean scores of Confidence in using ICT and its' dimensions separately of teachers before and after Teaching Foundations of Educational Technology Course.
- To study the influence of Gender, Teaching Experience and their interaction on ICT knowledge of teachers taught Foundations of Educational Technology Course by considering their Pretest scores of ICT knowledge as covariate.

- To study the influence of Gender, Teaching Experience and their interaction on Attitude towards ICT of teachers taught Foundations of Educational Technology Course by considering their Pretest scores of Attitude towards ICT as covariate.
- To study the influence of Gender, Teaching Experience and their interaction on Confidence in using ICT of teachers taught Foundations of Educational Technology Course by considering their Pretest scores of confidence in using ICT as covariate.

6.6   Hypotheses

The following hypotheses were formulated for this research:

1. There is no significant difference in mean scores of ICT knowledge of teachers before and after Teaching Foundations of Educational Technology Course.
2. There is no significant difference in mean scores of Hardware and Software dimension of ICT knowledge of teachers before and after Teaching Foundations of Educational Technology Course.

3. There is no significant difference in mean scores of Operating System dimension of ICT knowledge of teachers before and after Teaching Foundations of Educational Technology Course.

4. There is no significant difference in mean scores of Working with word processor dimension of ICT knowledge of teachers before and after Teaching Foundations of Educational Technology Course.

5. There is no significant difference in mean scores of Working with Images dimension of ICT knowledge of teachers before and after Teaching Foundations of Educational Technology Course.

6. There is no significant difference in mean scores of working with Audio and Video dimension of ICT knowledge of teachers before and after Teaching Foundations of Educational Technology Course.

7. There is no significant difference in mean scores of Working with spreadSheet dimension of ICT knowledge of teachers before and after Teaching Foundations of Educational Technology Course.

8. There is no significant difference in mean scores of Internet, Web Browser and Browsing dimension of ICT knowledge of teachers before and after Teaching Foundations of Educational Technology Course.

9. There is no significant difference in mean scores of Working with an email dimension of ICT knowledge of teachers before and after Teaching Foundations of Educational Technology Course.

10. There is no significant difference in mean scores of Attitude towards ICT of teachers before and after Teaching Foundations of Educational Technology Course.

11. There is no significant difference in mean scores of Technical Aspects of ICT dimension of Attitude towards ICT of teachers before and after Teaching Foundations of Educational Technology Course.

12. There is no significant difference in mean scores of Pedagogical Usability of ICT dimension of Attitude towards ICT of teachers before and after Teaching Foundations of Educational Technology Course.

13. There is no significant difference in mean scores of Social and Ethical aspects of ICT dimension of Attitude towards ICT of teachers before and after Teaching Foundations of Educational Technology Course.

14. There is no significant difference in mean scores of Professional use of ICT dimension of Attitude towards ICT of teachers before and after Teaching Foundations of Educational Technology Course.

15. There is no significant difference in mean scores of Confidence in using ICT of teachers before and after Teaching Foundations of Educational Technology Course.

16. There is no significant difference in mean scores of Handling of ICT Tools dimension of Confidence in using ICT of teachers before and after Teaching Foundations of Educational Technology Course.

17. There is no significant difference in mean scores of Managing the use of ICT dimension of Confidence in using ICT of teachers before and after Teaching Foundations of Educational Technology Course.

18. There is no significant difference in mean scores of Solving the issues that arise during the use of ICT dimension of Confidence in using ICT of teachers before and after Teaching Foundations of Educational Technology Course.

19. There is no significant influence of Gender, Teaching Experience and their interaction on ICT knowledge of teachers taught Foundations of Educational Technology Course by considering their Pretest scores of ICT knowledge as covariate.

20. There is no significant influence of Gender, Teaching Experience and their interaction on Attitude towards ICT of teachers taught Foundations of Educational Technology Course by considering their Pretest scores of Attitude towards ICT as covariate.

21. There is no significant influence of Gender, Teaching Experience and their interaction on confidence in using ICT of teachers taught Foundations of Educational Technology Course by considering their Pretest scores of confidence in using ICT as covariate.

6.7 Delimitations of the study

- Sample was selected on the basis of criterion.
- Due to limited resources, five participants from each institution were targeted.
- Both male and female teachers as well as teacher educators were taken for the study.

6.8 Methodology

Sample: Population for this study consisted of in-service teachers and teacher educators across all the States, Union Territories and Autonomous Organizations of the country who were ICT experts. Sample of the study has been purposively selected through multistage sampling. The sample was selected using Stratified Random Sampling Technique comprised of 189 teachers and teacher educators belonging to all states of India.

Tools: The following tools were used:

1.	ICT Knowledge Scale
2.	Attitude Towards ICT Scale
3.	Confidence in using ICT Scale
4.	Structured Participant Feedback
5.	**Experimental Design**: Pretest – Posttest Single Group Design design was used. The treatment duration was five working days.

PROCEDURE

6.9   Statistical Techniques

Data were analysed with the help of Paired Samples t-test and 2 X 3 Factorial Design ANCOVA.

6.10   Findings

The following are the findings of this study:

1. Teaching of Foundations of Educational Technology Course was found to be effective in promoting favourable ICT knowledge of teachers.

2. Teaching of Foundations of Educational Technology Course was found to be effective in promoting knowledge of Hardware and Software dimension of ICT Knowledge of teachers.

3. Teaching of Foundations of Educational Technology Course was found to be effective in promoting knowledge of Operating System dimension of ICT Knowledge of teachers.

4. Teaching of Foundations of Educational Technology Course was found to be effective in promoting knowledge of working with word processor dimension of ICT Knowledge of teachers.

5. Teaching of Foundations of Educational Technology Course was found to be effective in promoting knowledge of working with images dimension of ICT Knowledge of teachers.

6. Teaching of Foundations of Educational Technology Course was found to be effective in promoting knowledge of working with spreadsheet dimension of ICT Knowledge of teachers.

7. Teaching of Foundations of Educational Technology Course was found to be effective in promoting knowledge of working with images dimension of ICT Knowledge of teachers.

8. Teaching of Foundations of Educational Technology Course was found to be effective in promoting knowledge of internet, web browser and browsing dimension of ICT Knowledge of teachers.

9. Teaching of Foundations of Educational Technology Course was found to be effective in promoting knowledge of working with an email dimension of ICT Knowledge of teachers.

10. Teaching of Foundations of Educational Technology Course was not found to be effective in promoting favourable Attitude towards ICT of teachers.

11. Teaching of Foundations of Educational Technology Course was not found to be effective in promoting a favourable attitude towards the Technical aspect of ICT of teachers.

12. Teaching of Foundations of Educational Technology Course was not found to be effective in promoting a favourable attitude towards Pedagogical usability of ICT of teachers.

13. Teaching of Foundations of Educational Technology Course was found to be effective in promoting a favourable attitude towards the Social and ethical aspect of ICT of teachers.

14. Teaching of Foundations of Educational Technology Course was not found to be effective in promoting a favourable attitude towards Professional Use of ICT of teachers.

15. Teaching of Foundations of Educational Technology Course was found to be effective in promoting Confidence in using ICT of teachers.

16. Teaching of Foundations of Educational Technology Course was found to be effective in promoting confidence in handling ICT tools of teachers.

17. Teaching of Foundations of Educational Technology Course was found to be effective in promoting confidence in managing the use of ICT of teachers.

18. Teaching of Foundations of Educational Technology Course was found to be effective in promoting confidence in solving the issues that arise during the use of ICT of teachers.

19. Both Male and Female Teachers were found to have the same degree of favourable ICT knowledge of teachers taught Foundations of Educational Technology Course by considering their pretest scores of ICT knowledge as covariate.

20. Teachers having teaching experience between 1 to 10 Years were found to have significantly more favourable ICT knowledge as compared to teachers with more than 20 years taught Foundations of Educational Technology Course by considering their pretest scores of ICT knowledge as covariate. Also teachers having teaching experience from 1 to 10 years and 11 to 20 years and from 11 to 20 years and more than 20 years were found to have the same degree of favourable ICT knowledge when taught with Foundations of Educational Technology Course by considering their pretest scores of ICT knowledge as covariate.

21. Attitude towards ICT knowledge of teachers taught Foundations of Educational Technology Course by considering their pretest scores of Attitude towards ICT as covariate was found to be independent of interaction between Gender and Teaching Experience.

22. Both Male and Female teachers were found to have the same type of Reaction Attitude towards ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of Attitude towards ICT as covariate.

23. Teachers having 1 to 10 Years, 11 to 20 Years and more than 20 years of Teaching Experience were found to have the same type of Attitude towards ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of Attitude towards ICT as covariate.

24. Attitude towards ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of Attitude towards ICT as covariate was found to be independent of interaction between Gender and Teaching Experience.

25. Both Male and Female teachers were found to have the same degree of Confidence in using ICT of Teachers taught Foundations of Educational Technology Course by considering their pretest scores of Confidence in using ICT as covariate.

26. Teachers having 1 to 10 Years, 11 to 20 Years and more than 20 years of Teaching Experience were found to have the same degree of Confidence in using ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of Confidence in using ICT as covariate.

27. Confidence in using ICT of teachers taught Foundations of Educational Technology Course by considering their pretest scores of Confidence in using ICT as covariate was found to be independent of interaction between Gender and Teaching Experience.

6.11 Implications

1. Teachers with 1 to 10 years of experience showed a significantly more favourable ICT knowledge compared to those with more than 20 years of experience. This suggests that younger or less experienced teachers might be more receptive to ICT training, possibly due to greater familiarity with technology or a stronger inclination towards adopting new teaching methods. Tailoring training programs to address the specific needs and challenges faced by more experienced teachers could help in mitigating this disparity.

2. Attitude towards ICT and confidence in using ICT were found to be consistent across different teaching experience levels. This stability suggests that the course can effectively cater to teachers regardless of their years of experience, making it a versatile training program.

3. The independence of ICT knowledge, ICT in general, and confidence in using ICT from the interaction between gender and teaching experience indicates that the course's impact is consistent and does not vary based on the combination of these factors. This reinforces the course's broad applicability and effectiveness across diverse teacher demographics.

4. Given the positive outcomes, it is crucial to integrate the course or similar ICT training programs into ongoing professional development for teachers. Regular updates and enhancements to the course content should be made based on feedback and emerging technological trends to ensure that teachers remain proficient in using ICT tools effectively.

5. Policymakers and curriculum designers should consider incorporating comprehensive ICT training modules within teacher education programs. Emphasising the practical applications of ICT in teaching, alongside theoretical knowledge, can foster a more technology-savvy teaching workforce.

6. To maximise the benefits of the course, educational institutions should provide continuous support and resources for teachers. This includes access to up-to-date

technology, technical support, and opportunities for collaborative learning and sharing of best practices among teachers.

6.12 Recommendations:

Based on the research on the effectiveness of Foundations of Educational Technology Course on ICT knowledge, attitude, and confidence of in-service teachers and teacher educators, here are some potential recommendations:

1. **Customised Training Modules:** Based on the findings of the research, the curriculum of the Foundations of Educational Technology Course should be enhanced to further emphasise areas where in-service teachers may need improvement in ICT knowledge, attitude, and confidence. Customised training modules or resources tailored to address specific gaps identified among in-service teachers and teacher educators should be developed.

2. **Peer Learning Communities:** Peer learning communities or networks should be fostered where in-service teachers and teacher educators can collaborate, share best practices, and support each other in integrating technology effectively into their teaching practices.

3. **Longitudinal Studies:** Longitudinal studies to track the long-term impact of the Foundations of Educational Technology Course on in-service teachers' ICT knowledge, attitude, and confidence, and to identify any sustained improvements or areas requiring further intervention over time should be conducted.

4. **Upgrade to Advanced Competencies:** In-service Teachers/ Teacher Educators who have completed 'Foundations of Educational Technology Course' should be upgraded to the next level for advanced competencies required for the effective integration of content, technology, and pedagogy. The next level should empower teachers with the necessary skills to create high-quality digital content, ensuring that they can adapt to the evolving landscape of educational technology.

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