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Applying UNESCO's ICT Framework to Enhance Technology Literacy Skills of Teachers

Muhammad Daud Ghumman*

Abstract

In the moment's technology-driven world, teachers need to be technologically knowledgeable. This includes having the knowledge and skills to effectively use different technology tools and applications. This study was conducted to assess the impact of a professional development program on technology literacy skills developed through teachers' training program developed on ICT competencies by using UNESCO's ICT framework. The study's population comprised all secondary school teachers at Govt. Central Model School, Lower Mall, Lahore. The total population consisted of 68 teachers. To ensure a balanced representation of both genders, a proportionate stratified random sampling technique was employed. This method involved dividing the population into two strategy male and female and selecting an equal proportion of participants from each group. The final sample comprised 34 teachers, representing 50% of the total population. To commence the study pre-test post-test design was used. The experiment was conducted while applying training on ICT competencies to enhance teachers' ICT capabilities. The study concentrated on ICT literacy areas i.e. computer operations, software operations, and digital communication. Results showed a positive change in the teachers' ICT faculty situations after the training program. A significant positive increase in post-test competencies related to the use of the Internet, World Wide Web (WWW), and email after the training program was also noted. This study recommends that regular professional development programs be organized for teachers to continuously enhance their ICT chops. Ongoing development can help teachers stay streamlined and complete in using technology.

Keywords: *ICT, Teachers, ICT Competencies, Technology Literacy, UNESCO's ICT Framework*

*Teacher at Govt. Central Model School Lower Mall Lahore, daudghu@gmail.com

Introduction

The aspect of competent teachers is pivotal for any education system to flourish and produce knowledge-grounded societies. In this technology-driven world, teachers need to be equipped with ICT skills to effectively use technology for tutoring and literacy. UNESCO (2023) has developed the ICT faculty framework for teachers, which outlines 18 capabilities and 64 objects necessary for teachers to thrive in the digital age. This frame aligns with sustainable development goal (SDG) 4 and supports the development of open educational coffers for schoolteacher training. Professional development plays a crucial part in enhancing schoolteacher capability, with ICT furnishing new openings for growth and literacy. Integrating technology in education can ameliorate learning issues by combining face-to- face tutoring with online tools. Technology also allows for substantiated literacy collaboration, and effective communication between teachers and scholars. The internet serves as a precious resource for education, offering multimedia content, streamlined accoutrements, and interactive platforms for pupil engagement. UNESCO's ICT faculty norms for teachers guide the development of schoolteacher education programs to ensure teachers are equipped to prepare scholars for the digital period. Technology-rich gadgets should be integrated throughout schoolteacher training programs to enhance their chops and capabilities. enterprise in countries like Pakistan for professional development for teachers. In Pakistan, in- house professional development centres are offering training programs to enhance schoolteacher capabilities, with a particular focus on ICT skills. In conclusion, technology plays a pivotal part in transubstantiating education and enhancing schoolteacher capability. By equipping teachers with ICT skills and professional development, education systems can acclimatize to the demands of the digital age and produce further effective literacy surroundings for scholars. Exercising technology in education has the implicit to revise tutoring practices, ameliorate pupil issues, and prepare both teachers and scholars for success in a technology- driven world. Following is the UNESCO's framework for ICT Literacy for teachers:

THE FRAMEWORK			
	TECHNOLOGY LITERACY	KNOWLEDGE DEEPENING	KNOWLEDGE CREATION
UNDERSTANDING ICT IN EDUCATION	1	1	1
CURRICULUM AND ASSESSMENT	2	2	2
PEDAGOGY	3	3	3
ICT	4	4	4
ORGANIZATION AND ADMINISTRATION	5	5	5
TEACHER PROFESSIONAL LEARNING	6	6	6

Source: https://unesdoc.unesco.org/ark:/48223/pf0000213475

Logical flow from global context to the specific focus on UNESCO's framework. Strengthening the linkage with empirical evidence supporting the need for educational interventions is also important as UNESCO (2018) defined the following:

"The 2030 Agenda for Sustainable Development recognizes that the prevalence of Information and Communication Technologies (ICTs) have a significant potential to accelerate progress, to bridge the digital divide and support the development of inclusive Knowledge Societies based on human rights, the achievement of gender equality and empowerment. In the attainment of these goals, technology has the potential to provide innovative solutions to enable learners to take part in quality lifelong learning opportunities, to access information and knowledge and fully participate in society. The effective integration of ICT in the schools and classrooms can transform pedagogy and empower students. In response, UNESCO has developed the ICT Competency Framework for Teachers (ICT CFT) as a tool to guide pre- and in-service teacher training on the use of ICTs across the education system. The ICT Competency Framework for Teachers (ICT CFT) Version 3 is a response to recent technological and pedagogical developments in the field of ICT and Education, and incorporates in its structure inclusive principles of non-discrimination, open and equitable information accessibility and gender equality in the delivery of education supported by technology.

Now a days digital literacy skills are very important. According to Khateeb (2024) digital competencies are needed for teachers in the recent age which helps them to teach effectively in classes. Researchers around the globe (Aslan, & Zhu 2017; and Braslauskienė et al 2017) have developed keen interest in exploration of ICT competencies among teachers as teachers are nation builders. So, ICT competence is indispensable for teachers. We train teachers on ICT competencies through regular in-service teacher capacity building workshops and training sessions. The concept of ICT denotes Information Communication Technology which is the core of today's debate as the world has shrunk into a global village and much is needed from teachers to educate and train them in digital competence. As indicated by AlKhateeb (2024, p38) "digital competence does not only show the ability to make use of the wealth of new potentials associated with digital technologies and overcome the challenges they may involve, but it also indicates the meaningful participation in the emerging knowledge society of the twenty-first century. Undoubtedly, the diverse technologies (e.g., computer, interactive boards, apps … etc.) that are influencing the life of consumers and users around the globe can be beneficial for the learning

and teaching process as it may increase access to more education resources and reveal wider opportunities for collaboration and problem-solving". ICT competencies of teachers have been explored by diversity of research (Koehler & Mishra, 2009; Almerich et al., 2016; AlKhateeb, 2024; UNESCO, 2018; and Niyazova et al. 2023). In one study by Almerich et al. (2016) suggested a framework for teachers' ICT competencies (pedagogical competencies and technological competencies) by investigating 1095 teachers of primary, secondary and higher education levels. They found coherence and association between two sets of teachers' pedagogical competencies and technological competencies. Moreover, they found pedagogies of teachers are influenced by the nature of technological competencies. Their study recommended that ICT competencies should be a key element for teacher training in ICT.

Niyazova et al. (2023) conducted a study on ICT competencies to explore the association between ICTC and various digital skills. The study found that certain dimensions of digital skills, specifically "use of digital tools", "communication of digital content", and "creation of digital content", significantly influence ICTC. They recommended that tailored strategies should be used to enhance ICTC and digital literacy skills. In one study by VilppolaJoni et al. (2022) conducted a study on "relationship between teacher ICT competency and teacher acceptance and use of SMS in Negeri Sembilan secondary schools in Malaysia". They used survey technique and administered three questionnaires that comprised "a) teacher demographic variables; b) teacher ICT competency and c) teacher acceptance and use of SMS". They found that a high level of ICT competency, and acceptance and use of SMS among teachers who were teaching in secondary schools. ICT competency and teacher acceptance and use of SMS were also statistically correlated moderately. Overall, study concluded positive role of ICT competency dimensions in teachers' professional role as teachers.

Statement of the Problem

Information and communication technology (ICT) has revolutionized every walk of life. It is not only being used to impart education to the students of all levels but in the professional development of teachers widely in the modern world. In Pakistan the use of internet-based instruction in the continuous professional development (CPD) of teachers is not being practiced. That's why many trained teachers lack competencies in the use of ICTs while delivering lectures in their classes. Keeping in view the above background, this study is focused to measure the computer literacy in terms of ICT competencies of teachers trained

through CPD program at by using UNESCO's framework of digital literacy competencies.

Objectives of the study

Following are the objectives of the study to:

1. Assess teacher's technology literacy on ICT competencies to describe and demonstrate the use of common computer hardware.
2. Examine teacher's technology literacy on ICT competencies to describe and demonstrate the use of basic file management and software installation / Un-installation.
3. Evaluate teachers' technology literacy on ICT competencies to describe and demonstrate the basic tasks and use of word processors.
4. Evaluate teachers' technology literacy on ICT competencies to describe and demonstrate the basic tasks and use of spreadsheets.
5. Judge teachers' ICT competencies to describe and demonstrate the purpose and basic features of presentation software.
6. Assess teachers' ICT competencies to describe and demonstrate the use of internet, World Wide Web (WWW) and email.
7. Compare the level of improvement in competency level achieved in CPD training program.

Research Questions/Hypotheses

RQ1. What change occurs in competency level of teachers to describe and demonstrate the use of keyboard and mouse as input unit of computer hardware after a CPD training program?

RQ2. What change occurs in competency level of teachers to describe and demonstrate the use of speakers as output unit of computer hardware after a CPD training program?

RQ3. What change occurs in competency level of teachers to describe and demonstrate the process of basic file management (cut, copy, rename, delete functions) after a CPD training program?

RQ4. What change occurs in competency level of teachers to describe and demonstrate the process of software installation / Un-installation after a CPD training program?

RQ5. What change occurs in competency level of teachers to describe and demonstrate the use of create, open, save, print, basic editing, formatting and insert functions in a word processor after a CPD training program?

RQ6. What change occurs in competency level of teachers to describe and demonstrate the use of table creation, page orientation, margins

and column creation functions in a word processor after a CPD training program?

RQ7. What change occurs in competency level of teachers to describe and demonstrate the use of create, open, save, print, basic editing, formatting and insert functions in a spreadsheet software after a CPD training program?

RQ8. What change occurs in competency level of teachers to describe and demonstrate the use of graphs/charts creation, cell formatting and entering formula functions in a spreadsheet software after a CPD training program?

RQ9. What change occurs in competency level of teachers to describe and demonstrate the use of create, open, save, print, basic editing, formatting and insert functions in a multimedia presentation software after a CPD training program?

RQ10. What change occurs in competency level of teachers to describe and demonstrate the use of slide layout, themes and templates, animations, transitions in a multimedia presentation software after a CPD training program?

RQ11. What change occurs in competency level of teachers to describe and demonstrate the use of internet, World Wide Web, Search Engines and E-mail client after a CPD training program?

RQ12. Is a CPD training program effective?

Research Methodology

Participants

The study's population comprised all secondary school teachers at Govt. Central Model School, Lower Mall, Lahore. The total population consisted of 68 teachers. To ensure a balanced representation of both genders, a proportionate stratified random sampling technique was employed. This method involved dividing the population into two strategy male and female and selecting an equal proportion of participants from each group. The final sample comprised 34 teachers, representing 50% of the total population. The sample distribution is shown in table below:

Gender	Population	Sample
Male	62	31
Female	6	3
Total	68	34

The sampling technique ensured that the study captured the ICT competencies of teachers from both genders in equal measure. The selection was carried out using a random numbers table, further enhancing

the objectivity of the process. The experimental design was a One Group Pretest-Posttest Design, where all participants were exposed to the same professional development intervention aimed at improving their ICT competencies. Inclusion criteria for participation in the study required that teachers be part of the secondary wing and have a basic understanding of ICT tools, as the training program was designed to enhance rather than introduce basic ICT skills.

Research Tool

The instrument used to measure ICT capabilities in this study was developed in the form of pretest- posttest grounded on the UNESCO ICT Competency Framework for teachers (2008, 2011). This encyclopedically honored framework outlines crucial ICT capabilities that teachers should retain to effectively integrate technology into their tutoring. The instrument comprised 40 items, divided into the following crucial faculty areas.

- Use of Common Computer Hardware (e.g., keyboard, mouse, speakers)
- File management (e.g., cut, dupe, brand, cancel functions)
- Software Installation Uninstallation
- Word Processing (e.g., document creation, editing, saving, publishing)
- Spreadsheets (e.g., creating and editing worksheets, map/ graph creation)
- Multimedia Presentation (e.g., creating donations, fitting multimedia, applying robustness)
- Internet and World Wide Web (WWW) Use (e.g., hunt machine use, dispatch operation)

The tool used a 4- point Likert- type scale to assess party responses, where 1 = Not at each, 2 = kindly, 3 = Did well, and 4 = Excellently. This scale was designed to capture the varying degrees of faculty across actors, with each faculty point corresponding to practical tasks teachers would need to perform.

Psychometric Properties

Content Validity ensures the tool's validity, feedback was sought from five educational experts in the field of ICT and educational dimension. The experts reviewed the instrument for clarity, applicability, and alignment with the UNESCO ICT framework. Grounded on their suggestions, the instrument was meliorated from an original 60 particulars to the final 40- point interpretation. Also, the scale was modified from a 3- point scale to a 4- point scale to capture the nuance in faculty situations.

Reliability The consistency of scores of the tool was checked through test-retest reliability. For this purpose, a group of 20 teachers (included in the study's actual sample) were randomly selected and scale was administered on them. The same scale was administered on them after a two-weeks' time interval. Then the test- retest reliability was checked. The correlation coefficient .86*, indicated that this scale was 86 percent reliable to be used in the actual study.

Data Collection The data collection process followed a structured approach that adhered to both research rigor and ethical guidelines.

1. **Pretest Administration:**
   The pretest was administered to all participants before the commencement of the professional development program. This initial test was designed to establish a baseline measure of the teachers' ICT competencies. The pretest scores were recorded for each participant and later used to assess the effectiveness of the training intervention.

2. **Professional Development Program:**
   After the pretest, the teachers participated in a comprehensive professional development program focused on enhancing their ICT skills. The training covered the following areas:
   - Basic computer hardware operations (use of input/output devices)
   - File management and software installation
   - Word processing (creating and editing documents)
   - Spreadsheets (working with data in spreadsheet software)
   - Multimedia presentation (developing presentations)
   - Internet and email use (browsing, search engines, and email management)

   The program was delivered over several sessions and included hands-on training, allowing participants to practice and apply the skills they were learning.

3. **Posttest Administration:**
   Upon completion of the training, the same 40-item test was administered as a posttest to measure any changes in ICT competency levels. The posttest scores were compared to the pretest scores to determine the effectiveness of the professional development program in enhancing the teachers' ICT competencies.

Data Analysis After the collection of participant data, the scores were compiled and analyzed through statistical techniques. A paired t-test was

conducted to evaluate the differences between the pretest and posttest scores, with the objective of identifying any statistically significant enhancement in the teachers' ICT competencies resulting from the professional development program. Descriptive statistics, including mean and standard deviation, were computed to provide a summary of the pretest and posttest scores. The paired t-test was employed to determine the significance of the changes in ICT competency levels before and after the intervention. A significance threshold of $p < 0.05$ was established for the test, indicating that any differences observed between the pretest and posttest scores would be deemed statistically significant if the likelihood of their occurrence by chance was less than 5%.

RESULTS

For the statistical analysis, following values were computed and shown in the tables below:

The competency wise differences as di.

The sum of competency wise differences as ∑di.

The sum of squared competency wise differences as ∑di2.

The mean of the competency wise differences.

$\bar{d} = (\sum d\_i)/n$

The standard deviation (Sd) of the competency wise differences.

$S\_d=\sqrt{((\sum 〚d\_i〛 ^2-n\bar{d}^2)/(n-1))}$

Statistical value of t as stat

$t\_stat=\bar{d}/(S\_d\sqrt{n})$

critical value of t as tcrit.

Statistical value of t as tstat and critical value of t as tcrit. (using t distribution table which is used to determine the significance of statistics Annexure C) were compared to find the change in each competency level.

Following tables show t-test statistics for measuring change in ICT competency level.

Table 1

Change in ICT Competency Level Regarding Use of Common Computer Hardware.

ICT Competency	Mean	SD	at α	T_{stat}	T_{crit} (From Table)
use of Keyboard	0.97	0.63	0.05	-8.81	-2.035
use of mouse	0.97	0.63	0.05	-8.81	-2.035
use of Speaker	1.03	0.52	0.05	-11.44	-2.035

Note.SD= Standard Deviation, $t_{crit.}$ = critical value of t, tstat =Statistical value of t, **α**=level of significance Table 1 explains the competency wise difference in competency level regarding use of common computer hardware. The mean score of competency wise difference is 0.97 regarding use of keyboard, 0.97 regarding use of mouse, 1.03 regarding use of speaker respectively. Table shows significant increase in the level of posttest competencies as for each pair of pretests- posttest scores we find ($t_{stat}>t_{crit}$).

Table 2

ICT Competency Level Regarding Area of File Management, Installation and Un-installation of Software

ICT Competency	Mean	SD	at α	T_{stat}	T_{crit} (From Table)
use of basic file functions	1.18	0.62	0.05	-10.73	-2.035
uninstall applications in Windows	0.59	0.61	0.05	-5.9	-2.035
install applications in Windows	0.56	0.69	0.05	-4.67	-2.035

Table 2 tells the competency wise difference in competency level regarding area of file management, installation of software and uninstallation of software. The mean score of competency wise difference is 1.18 regarding use of basic file functions, 0.59 regarding software uninstallation, 0.56 regarding software installation. Above table shows significant increase in the level of posttest competencies as for each pair of pretests- posttest scores we find ($t_{stat}>t_{crit}$).

Table 3
Change in ICT Competency Level Regarding Area of Word Processing

ICT Competency	Mean	SD	at α	T_{stat}	T_{crit} (From Table)
Create a new document in MS Word	1.26	0.90	0.05	-8.40	-2.035
Open a document in MS Word	0.97	0.72	0.05	-8.08	-2.035
Save a document in MS Word	1.32	0.88	0.05	-8.80	-2.035
use of Print functions in MS Word	0.65	0.81	0.05	-4.64	-2.035
use of Text Editing functions in MS Word	1.26	0.84	0.05	-9.0	-2.035
use of Text Formatting functions in MS Word	1.33	0.83	0.05	-9.50	-2.035
use of Insert functions in MS Word	1.32	0.77	0.05	-10.15	-2.035
Tables Creation in MS Word	1.47	0.82	0.05	-10.50	-2.035
use of Page orientation, Margins and Columns functions in MS Word	0.74	0.66	0.05	-6.72	-2.035

Note.SD= Standard Deviation, $t_{crit.}$ = critical value of t, tstat =Statistical value of t, **α**=level of significance

Table 3 explains the competency wise difference in competency level regarding area of word processing. The mean score of competency wise difference is 1.18 regarding use of basic file functions, 0.59 regarding software uninstallation, 0.56 regarding software installation. Above table shows significant increase in the level of posttest competencies as for each pair of pretests- posttest scores we find ($t_{stat}>t_{crit}$).

Table 4

Change in ICT Competency Level Regarding Area of Spreadsheets

ICT Competency	Mean	SD	at α	T_{stat}	T_{crit} (From Table)
Create a new Workbook in MS Excel	1.44	0.89	0.05	-9.60	-2.035
Open a Workbook in MS Excel	1.18	0.79	0.05	-8.42	-2.035
Save a Workbook in MS Excel 2007	1.41	0.86	0.05	-9.40	-2.035
demonstrate the use of Print functions in MS Excel	0.65	0.69	0.05	-5.42	-2.035
To demonstrate the use of Basic Editing functions in MS Excel	1.26	0.72	0.05	-10.50	-2.035
demonstrate the use of Text Formatting functions in MS Excel	1.38	0.82	0.05	-9.86	-2.035
demonstrate the use of Insert functions in MS Excel	1.21	0.76	0.05	-9.30	-2.035
demonstrate Charts/Graphs Creation in MS Excel	1.18	0.79	0.05	-8.43	-2.035
demonstrate the use of cell formatting in MS Excel	0.76	0.66	0.05	-6.90	-2.035
demonstrate the use of formula/functions in MS Excel	1.59	0.74	0.05	-12.23	-2.035

Note.SD= Standard Deviation, tcrit. = critical value of t, tstat =Statistical value of t, α=level of significance

Table 4 elaborates the competency wise difference in competency level regarding area of spreadsheet. Above table shows significant increase in the level of posttest competencies as for each pair of pretests- posttest scores we find (tstat>tcrit).

Table 5
Change in ICT Competency Level Regarding Area of Multimedia Presentation

ICT Competency	Mean	SD	at α	T_{stat}	T_{crit} (From Table)
Create a new Presentation in MS Power Point	1.50	0.71	0.05	-12.50	-2.035
Open a Presentation in MS Power Point	1.15	0.7	0.05	-9.58	-2.035
Save a Presentation in MS Power Point	1.35	0.70	0.05	-11.25	-2.035
To demonstrate the use of Print functions in MS Power Point	0.62	0.78	0.05	-4.77	-2.035
To demonstrate the use of Text Editing functions in MS Power Point	1.35	0.82	0.05	-9.64	-2.035
To demonstrate the use of Text Formatting functions in MS Power Point	1.32	0.81	0.05	-9.43	-2.035
To demonstrate the use of Insert functions in MS Power Point	1.50	0.66	0.05	-13.64	-2.035
To demonstrate the use of Slide Layout, Themes and Templates in MS Power Point	0.76	0.7	0.05	-6.33	-2.035
To demonstrate the use of Slide Animations and Slide Transition in MS Power Point	0.74	0.70	0.05	-6.17	-2.035
To demonstrate the steps of running a Slide Show in MS Power Point	1.59	0.74	0.05	-12.23	-2.035

Note.SD= Standard Deviation, tcrit. = critical value of t, tstat =Statistical value of t, α=level of significance

Table 5 explains the competency wise difference in competency level regarding area of multimedia presentation. Above table shows significant increase in the level of posttest competencies as for each pair of pretests-posttest scores we find (tstat>tcrit).

Table 6

Change in ICT Competency Level Regarding Area of Internet, World Wide Web and E-Mail

ICT Competency	Mean	SD	at α	T_{stat}	T_{crit} (From Table)
accessing websites using a browser	1.32	0.92	0.05	-8.25	-2.035
searching websites using different Search Engines	1.35	0.82	0.05	-9.64	-2.035
creating a Web Mail account	0.97	0.63	0.05	-8.81	-2.035
composing an E-mail message	0.97	0.67	0.05	-8.81	-2.035
sending and receiving e-mails	1.53	0.75	0.05	-11.77	-2.035

Table 6 tells the competency wise difference in competency level regarding area of regarding the use of Internet, World Wide Web (WWW) and E-mail. Above table shows significant increase in the level of posttest competencies as for each pair of pretests- posttest scores we find ($t_{stat}>t_{crit}$).

Findings and Discussions

A notable enhancement in ICT competencies concerning the use of common computer hardware following the training program was found. Regarding keyboard usage, 14.7% of participants transitioned from no competency to moderate competency, 26.5% advanced from little to moderate competency, 2.9% progressed from little to excellent competency, and 35.3% elevated their skills from moderate to excellent competency. Likewise, for mouse usage, 14.7% improved from no competency to moderate, 26.5% from little to moderate, 2.9% from little to excellent, and 35.3% from moderate to excellent competency. Concerning speaker usage, 44.1% exhibited an increase from no competency to little competency, 14.7% from no to moderate competency, 23.5% from little to moderate competency, and 2.9% from moderate to excellent competency.

Significant positive enhancement in posttest competencies concerning file management and software installation/uninstallation following the training program was seen in the results of pre and posttest. In terms of basic file functions, 44.1% of participants progressed from no competency to a minimal level of competency, 14.7% advanced from no competency to a moderate level, 26.5% improved from a minimal to a moderate level, and 2.9% elevated their skills from a moderate to an excellent level.

Regarding the uninstallation of applications in Windows 7, 32.4% transitioned from no competency to a minimal level, 20.6% moved from a minimal to a moderate level, and 5.9% advanced from a moderate to an excellent level. For the installation of applications in Windows 7, 17.6% progressed from no competency to a minimal level, 2.9% advanced from no competency to a moderate level, 2.9% moved from no competency to an excellent level, 20.6% improved from a minimal to a moderate level, and 2.9% elevated their skills from a moderate to an excellent level.

Enhancement in posttest competencies related to word processing in MS Word 2007 following the completion of the training program was seen. Specifically, 26.5% of participants progressed from no competency to moderate competency in the creation of new documents, while 8.8% advanced from no competency to excellent competency, and 41.2% transitioned from moderate to excellent competency. In terms of opening documents, 23.5% exhibited improvement from no to moderate competency, and 50% advanced from moderate to excellent competency. Regarding the saving of documents, 32.4% improved from no to moderate competency, 8.8% from no to excellent competency, and 41.2% from moderate to excellent competency. In demonstrating print functions, 23.5% progressed from no to little competency, while 17.6% moved from no to moderate competency, and 5.9% advanced from moderate to excellent competency. Concerning text editing, 8.8% improved from no to little competency, and 26.5% from no to moderate competency, with further advancements across various competency levels. For text formatting, 8.8% showed improvement from no to little competency, and 32.4% from no to moderate competency, with others achieving excellent competency. In the use of insert functions, 20.6% improved from no to little competency, and 26.5% from no to moderate competency. Additionally, in table creation, 14.7% improved from no to little competency, while 29.4% advanced from no to moderate competency, with others reaching excellent competency. Finally, regarding page orientation and margins, 41.2% moved from no to little competency, and 11.8% advanced from no to moderate competency.

A notable enhancement in posttest competencies concerning spreadsheets in MS Excel after the completion of the training program was seen. In the area of creating a new workbook, 2.9% of participants progressed from no competency to a little competency, 26.5% advanced from no to moderate competency, 14.7% moved from no to excellent competency, and 44.1% improved from moderate to excellent competency. When it comes to opening a workbook, 23.5% increased their competency from none to moderate, 5.9% progressed from none to

excellent, and 52.9% advanced from moderate to excellent competency. In terms of saving a workbook, 29.4% improved from no to moderate competency, 11.8% from no to excellent, and 47.0% from moderate to excellent competency. For demonstrating print functions, 32.4% transitioned from no to little competency, 11.8% from no to moderate competency, and 5.9% from little to moderate competency. In basic editing functions, 20.6% improved from no to little competency, 26.5% from no to moderate, and 2.9% from no to excellent competency. Regarding text formatting, 14.7% advanced from no to little competency, 29.4% from no to moderate, and 17.6% from moderate to excellent competency. In the use of insert functions, 26.5% improved from no to little competency, while 23.5% progressed from no to moderate competency. For the creation of charts and graphs, 29.4% moved from no to little competency, and 20.6% from no to moderate competency. In cell formatting, 44.1% improved from no to little competency, and in the application of formulas and functions, 11.8% advanced from no to little competency, with further improvements observed across various competency levels.

A significant increase in posttest competencies related to multimedia presentations in MS PowerPoint 2007 following the training program was seen. Specifically, for creating a new presentation, 35.3% of participants improved from no competency to moderate competency, while 8.8% progressed from no to excellent competency, and 52.9% advanced from moderate to excellent competency. In opening a presentation, 23.5% moved from no to moderate competency, 2.9% from no to excellent, and 58.8% from moderate to excellent competency. For saving a presentation, 2.9% improved from no to little competency, 29.4% from no to moderate competency, 5.9% from no to excellent, and 55.9% from moderate to excellent competency. In demonstrating print functions, 29.4% advanced from no to little competency, 8.8% from no to moderate competency, and 5.9% from moderate to excellent competency. Regarding text editing, 11.8% improved from no to little competency, 26.5% from no to moderate, and 5.9% from no to excellent competency. In text formatting, 11.8% progressed from no to little competency, 26.5% from no to moderate, and 14.7% from moderate to excellent competency. For using insert functions, 17.6% improved from no to little competency, and 29.4% from no to moderate competency. In using slide layouts, themes, and templates, 20.6% improved from no to little competency, and 14.7% from no to moderate competency. For slide animation and transitions, 17.6% advanced from no to little competency, and 14.7% from no to moderate competency. Lastly, for running a slideshow, 5.9% improved from no to

little competency, 44.1% from no to moderate competency, and 8.8% from little to excellent competency.

A significant positive increase in posttest competencies related to the use of the Internet, World Wide Web (WWW), and email after the training program was noted. For accessing websites using a web browser, 17.6% of participants improved from no competency to moderate competency, 14.7% from no to excellent competency, and 52.9% from moderate to excellent competency. In searching websites using different search engines, 5.9% advanced from no to little competency, 11.8% from no to moderate, 14.7% from no to excellent, and 55.9% from moderate to excellent competency. Regarding creating a web mail account, 20.6% improved from no to little competency, 14.7% from no to moderate competency, and 41.2% from moderate to excellent competency. For composing an email message, 26.5% moved from no to little competency, 11.8% from no to moderate, 2.9% from no to excellent, and 41.2% from moderate to excellent competency. Lastly, in sending and receiving emails, 32.4% advanced from no to moderate competency, 11.8% from no to excellent competency, and 52.9% from moderate to excellent competency. Overall, there is significant increase in the level of all posttest ICT competencies achieved in CPD training program as for each pair of pretests- posttest scores we find (tstat>tcrit).

Conclusion and Recommendations

Teachers' ICT competencies in the 21st century call for standard revision, updating in different areas including teachers' knowledge of ICT and technology dynamic skills of handling ICT equipment in classroom teaching. Study secluded that training develops required ICT requisites, skills and competencies for teachers to teach smoothly with technology-embedded skills and requirements of 21st century. These ITC competencies are also required in 21st century skills' framework also. The overwhelming majority of participants showed positive change in their ICT competency level after professional development training program which led to the conclusion that the key challenge facing education institutions locally as well as globally is curriculum transformation in ICT skills to equip teachers with the pertinent competencies required in the 21st century. Thus, use of technology proved to be very successful for the professional development training of teachers. The results of the comparison of pretest-posttest proved the "UNESCO ICT competency framework for teachers" very effective for the design and development of Professional Development training program in ICT competencies. So, ICT knowledge, skills and its effective integration is vital for educators and

learners to deal with huge amount of knowledge demanded to execute intricate responsibilities in education and training.

This study recommends that:

1. Teachers may be offered opportunities for Continuous Professional Development on a regular basis.

2. Use of technology may be encouraged to make Professional development training programs effective.

3. ICT competency building is a must for teachers for the implementation of the I.T based teaching and learning.

4. The knowledge of the teachers may be updated on a regular basis regarding integration of technology in curriculum.

5. The time-to-time ICT competency audit of teachers in the form of pre-test may be used to reflect the current technology related knowledge of the teachers.

6. The record of the trail of results obtained from ICT competencies audits may be used in the planning and the role of specific teachers in the implementation of the technology driven teaching and learning.

7. The comparison of pretest post-posttest scores regarding ICT competencies may be used by the teachers for their capacity building and to improve the areas of weakness.

8. For the design and development of ICT competency building programs, there is a need to adapt the internationally recognized ICT competency frameworks.

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