Teacher Competencies for the Use of Information Communication Technology

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Abstract

The Present study aimed to identify the competencies needed by teachers for development and implementation of Information Communication Technology (ICT)-based education. Survey method of research was employed for the study. A rating scale was used to know the ICT related competencies that teachers need for instructional purpose. The rating scale consisted of 47 items based on four types of teacher competencies namely-Technological ICT Competencies, Pedagogical ICT Competencies, Didactical ICT Competencies and Social ICT Competencies. The sample consisted of 73 teacher educators among which 44 were males and 29 were females. Data was collected through the use of e-mail and by personally contacted the respondents and analysed using frequencies and percentage. Findings of the study reveal that all the teacher educators were agree that the following ICT competencies that teachers need to develop are: (i) Use ICT skills in developing and presenting information; (ii) Prepare ICT-based learning environment, designing effective learning experiences and creating rich learning environments with the support of ICT and Understanding of computer technology can enhance student learning; (iii) Using ICT as a didactical tool in the class as well as implement cooperative learning strategies using ICT. Using ICT as a didactical tool implies using it to establish dynamic and powerful instructional strategies and environment and (iv) Demonstrating knowledge and skills for using technology in ethical, legal and safe ways and to use humour and good manners during the teaching and learning process.

Introduction

Information and Communication Technologies (ICTs) are obviously of great significance for education. The integration of ICT in general and teacher education in particular is the need of the hour. The enormous benefits of ICT have been well documented by various authorities and researchers such as BECTA (2004), Akudolu (2002), Sharp and Potter (2002) and Olibie (2003). Teaching is becoming one of the most

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challenging professions in our society where knowledge is expanding rapidly and much of it is available to students as well as teachers at the same time. As new concepts of learning have evolved, teachers are expected to facilitate learning and make it meaningful to individual learners rather than just to provide knowledge and skills. Modern developments of innovative technologies have provided new possibilities to teaching professions but at the same time have placed more demands on teachers to learn how to use these new technologies in their teaching.

The pace of technological revolution and emergence of a knowledge society changed the traditional role of the teacher. Traditionally, the teacher is the only source of knowledge for the students. The impact of the internet in education in the recent years fosters the vision of an open, global and flexible learning. In the framework of this educational landscape the role of the teacher is that of acting as guide and instrument to assure a comprehensive learning process via the modern age technologies and managing the student's learning process by the new instructional models set in newly created virtual environments. The teacher will have to develop competencies related to the learning contexts that changes in teaching and learning paradigms require. Authors such as Potter and Darbyshire (2005) and UNESCO (2004) are of the view that ICT competencies are concerned with the ability to:

Know when to apply or develop a particular skill in using an ICT resource

Be aware of the reasons for using ICT and its effect on both users and context, and Have a critical and confident attitude to learning with the technology

A New Competency Framework for Teachers

According to Mishra and Koehler (2006) technological, pedagogical and content knowledge are essential for teachers for successful integration of ICT in education. The researcher thoroughly studied the literature and frame out an ICT competency model for teachers. For successful instructional use of ICT, four types of competencies are required. These four competencies are- Technological Competencies (TC), Pedagogical Competencies (PC), Didactical Competencies (DC) and Social Competencies (SC). Figure-1 shows the ICT competency model for teachers.

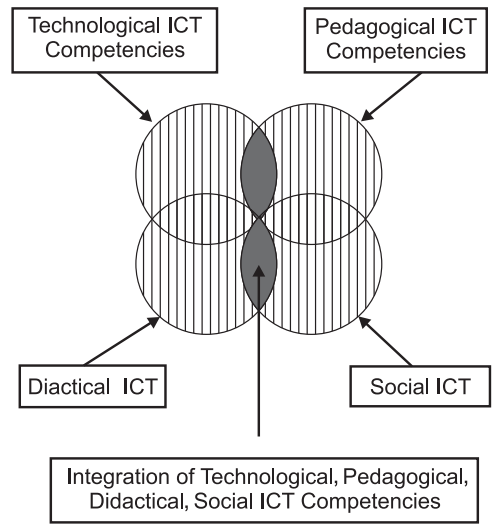


Fig 1 A New Competency Framework for Teachers

(1) Technological ICT Competencies: These competencies are related with teachers' knowledge and technical training that how to use and maintain ICT equipments and software. These competencies involve the skills to operate modern technologies such as- computer, Internet etc.

(2) Pedagogical ICT Competencies: Pedagogical competencies are related with teachers' instructional practices and knowledge of the curriculum and requires that they develop applications within their disciplines that make effective use of ICT to support and extend teaching and learning. This is a generic form of knowledge that is involved in all issues of student learning, classroom management, lesson-plan development and implementation and student evaluation. It includes knowledge about techniques or methods to be used in the classroom; the nature of the target audience; and strategies for evaluating student understanding.

(3) Didactical ICT Competencies: These competencies are related with subject knowledge of the teacher that is to be learned or taught. Teachers must know and understand the subjects that they teach, including knowledge of central facts, concepts, theories and procedures within a given field, knowledge of explanatory frameworks that organise and connect ideas and knowledge of the rules of evidence and proof. Teachers must also understand the nature of knowledge and inquiry in different fields.

(4) Social ICT Competencies: Social competencies are related to the understanding of teachers with social and ethical issues surrounding ICT and apply that understanding in their practice

Need for the Study

To create ICT-enabled teaching and learning environments, it is also necessary to provide ICT training for teachers. Teachers need to know about ICT and about what ICT can provide. They also need to be able to critically evaluate and discriminate what (technological) resource to use and whether one should be used at all. They need to be able to understand conceptually and in pedagogically-appropriate ways, how, where and why to use computer related technologies. Thus, it is clear that teachers need competencies for successful instructional use of ICT. Apart from the strategy of introduction of ICT, some confusion is found about ICT competencies to be acquired by teachers. It is very said to say that that in India teacher education programs does not include the ICT competencies to prepare the future teachers. Through the program, the pupil-teachers only know how to use computers but not in the classroom with their pupils. To keep in mind the above problems, the researcher decided to know the opinion of the teacher educators on this aspect. The two main questions that are related with the present study were- (1) Bearing in mind the school environments in India and the vastness of ICT capabilities, what competencies are teachers expected to possess for them to implement an ICT based curriculum? and (2) What ICT-pedagogical competencies should teacher preparation institutions aim to

develop in teachers to ensure that these teachers can help the country cross to the positive side of the digital divide and keep pace on the information superhighway?

The study is limited to the development of ICT competencies of teachers. This is based on the fact that ICT competencies involve knowledge of skills, knowledge of how and when to apply the skills as well as knowledge of reasons for using the particular ICT or the contributions of that ICT to the solution of problems.

Objectives

The main objectives of the study were:

1. To know the Technological ICT Competencies that teacher need for instructional purpose.
2. To know the Pedagogical ICT Competencies that teacher need for instructional purpose.
3. To know the Didactical ICT Competencies that teacher need for instructional purpose.
4. To know the Social ICT Competencies that teacher need for instructional purpose.

Methodology

(a) Research Method

Survey method of research was employed for the present study.

(b) Sample of the Study

The sample consists of 73 teacher educators from various faculties of education at the colleges and universities. The participants in the study were 44 males (60.27%) and 29 females (39.73%).

(c) Variables in the Study

The four types of ICT competencies such as technological competencies, pedagogical competencies, didactical competencies and social competencies were selected as variables in the study.

(d) Tool Used

A four-point rating scale was developed by the researcher to know the ICT related competencies that teachers need for instructional purpose. The rating scale comprised four sections related with instructional use of ICT namely-technological competencies, pedagogical competencies, didactical competencies and social competencies. There were 47 items structured on a four-point rating scale ranging from strongly agree to strongly disagree. The description of the rating scale with their four types of competencies is given in table-1.

Table 1

Description of the Rating Scale

Section	*Teacher Competency Group for Instructional Use of ICT*	*Total Items*
A	Technological ICT Competencies	15
B	Pedagogical ICT Competencies	12
C	Didactical ICT Competencies	10
D	Social ICT Competencies	10
Total		**47**

(e) Data Collection Method

Data collection was done by personally contacting the respondent as well as copies of the rating scale were emailed to the respondent. Some of the respondent were contacted again physically or through phone and argued to complete the rating scale. A total number of 73 copies of the instrument

were completed and returned (20 by personally and 53 by e-mail).

(f) Validity and Reliability of the Test

(g) Analysis of data

Obtained data were analysed with the help of simple percentage.

Analysis and Interpretation

To know the ICT competencies that teachers need to develop, the responses of the teacher educators that were given on the rating scale were analysed. It was tried to observed that what percentage of teacher educators strongly agree, agree, disagree and strongly disagree with each competency of technological, pedagogical, didactical and social competency group. The result that was found is given below in tables 2, 3, 4 and 5.

(A) Technological ICT Competencies of Teachers for Instructional Use of ICT

The results related with Technological ICT competencies that teacher needs to develop in view of teacher educators are given below in table-2.

Table 2

Teacher Educators Views on the Technological ICT Competencies that Teachers Need for Instructional Purpose

Item No.	*Items*	*Strongly Agree*		*Agree*		*Disagree*		*Strongly Disagree*	
		f	%	*f*	%	*f*	%	*f*	%
TC1	Use of different operating system	5	7	13	18	36	26	19	49
TC2	Use of e-mail	16	22	35	48	16	22	6	8
TC3	Working with Multimedia	13	18	24	33	23	31	13	18
TC4	Using available computer hardware	20	27	36	49	10	14	7	10
TC5	Participating in online discussion	13	18	24	33	25	34	11	15
TC6	Hardware repairs	2	3	5	7	47	64	19	26
TC7	Writing general computer programs	1	1	3	4	48	66	21	29
TC8	Use of variety of software like- word processing, database, spreadsheet and statistical software.	32	44	24	33	13	18	4	5
TC9	Using ICT skills in developing and presenting information	41	56	32	44	-	-	-	-
TC10	Familiarisation with computer terminology	32	44	23	32	11	15	7	9
TC11	Setting up websites	6	8	15	21	38	52	14	19
TC12	Ability in and understanding of fundamental computer operations and concepts	32	44	18	25	19	26	4	5
TC13	Use of different instructional packages.	6	8	27	37	28	39	12	16
TC14	Clear understanding about computer hardware and software	12	16	49	67	9	12	3	5
TC15	Accessing the Internet	17	23	39	53	11	15	6	9

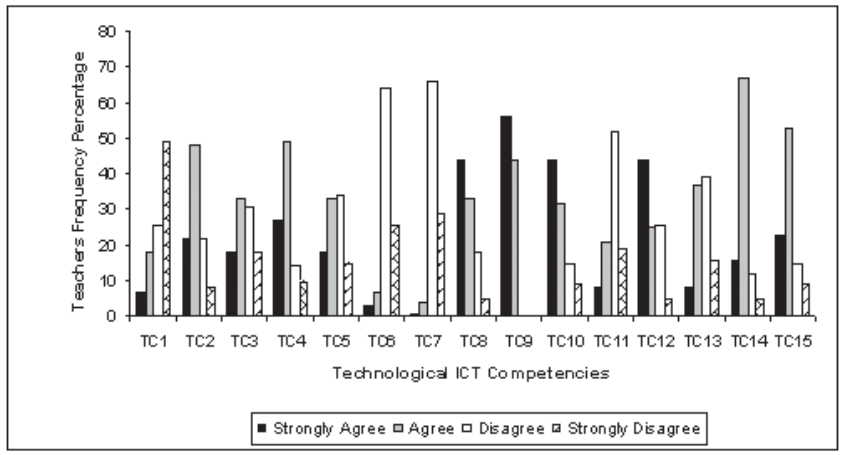
The data presented in table-2 shows that among the technical ICT competencies, a maximum of 41 (56%) teacher educators strongly agree with the Item TC 9 (Using ICT skills in developing and presenting information). Item TC 9 (Using ICT skills in developing and presenting information) had the highest score of 100

per cent (for Strongly Agree and Agree). This implies that the respondents think that using ICT skills in developing and presenting information is very essential technical competency that teachers need to require. The respondents think that the technical competencies TC 2 (Use of e-mail), Item TC 3 (Working with multimedia), Item TC 4 (Using available computer hardware), Item TC 5 (participation in on line discussion), Item TC 8 (Use of variety of software like- word processing, database, spreadsheet and statistical software), TC 10 (Familiarisation with computer terminology), TC 12 (Ability in and understanding of fundamental computer operations and concepts), TC13 (Use of different instructional packages), TC 14 (Clear understanding about computer hardware and software) and TC 15 (Accessing the internet) are very important technical competencies that modern teachers need to mastery on them. These items scored more than 50 per cent.

The respondent did not consider TC 1 (Use of different operating system), TC 6 (Hardware repairs), TC 7 (Writing general computer programs) and TC 11 (Setting up websites) as teacher required technical competencies. Figure-1 shows the percentage of frequencies marked by teacher educators as strongly agree, agree, disagree and strongly agree on teacher required technical competencies for instructional use of ICT.

Figure 1

Distribution of Frequency Percentage of Teacher Educators on Required Technological ICT Competencies for Teachers (N = 73)



(B) Pedagogical ICT Competencies of Teachers for Instructional Use of ICT

The results related with pedagogical ICT competencies that teacher needs to develop in view of teacher educators are given below in table-3.

Table 3

Teacher Educators Views on the Pedagogical ICT Competencies that Teachers Need for Instructional Purpose

Item No.	*Items*	*Strongly Agree*		*Agree*		*Disagree*		*Strongly Disagree*	
		f	%	*f*	%	*f*	%	*f*	%
PC1	Select and evaluate subject-specific educational software	14	19	31	43	16	22	12	16
PC2	Develop and maintain educational website	9	12	17	23	29	40	18	25
PC3	Prepare ICT-based learning environment	44	60	29	40	-	-	-	-
PC4	Develop educational programs with the help of programming languages	4	5	13	18	32	44	24	33
PC5	Monitor and evaluate ICT-based teaching-learning process	43	59	28	38	2	3	-	-
PC6	Applying ICT supported strategies to manage students' learning	17	23	51	70	3	4	2	3
PC7	Designing effective learning experiences and creating rich learning environments with the support of ICT	36	49	37	51	-	-	-	-
PC8	Surfing the internet and locating useful information from the internet for the development of lesson plans	24	33	45	62	4	5	-	-
PC9	Integrate ICT in other subjects across the curriculum	43	59	21	29	7	9	2	3
PC10	Prepare schemes of work and lesson notes using ICT	27	37	32	44	8	11	6	8
PC11	Ability to explore and apply to suitability of ICT for cooperative learning and for peer interaction	38	52	25	34	6	8	4	6
PC12	Understanding of how computer technology can enhance student learning	34	47	39	53	-	-	-	-

The data presented in table-3 shows that among all 12 pedagogical competencies, a maximum of 44 (60%) teacher educators are strongly agree with the Item PC 3 (Prepare ICT based learning environment). Item PC 3 had the highest score of 100 per cent [for Strongly Agree (60%) and Agree (40%)]. This implies that the respondents think that using ICT skills in developing and presenting information is very essential pedagogical competency that teachers need to require. Similarly PC 7 (Designing effective learning experiences and creating rich learning environments with the support of ICT) and PC 12 (Understanding of how computer technology can enhance student learning) had the highest score of 100 per cent (for Strongly Agree and Agree). The respondents think that the pedagogical competencies PC 1 (Select and evaluate subject-specific educational software), Item PC 5 (Monitor and evaluate ICT-based teaching-learning process), Item PC 6 (Applying ICT supported strategies to manage students' learning), Item PC 8 (Surfing the internet and locating useful information from the internet for the development of lesson plans), Item PC 9 (Integrate ICT in other subjects across the curriculum), PC 10 (Prepare schemes of work and lesson notes using ICT) and PC 11 (Ability to explore and apply to suitability of ICT for cooperative learning and for peer interaction) are very important pedagogical competencies that modern teachers need to mastery on them and that are essential for

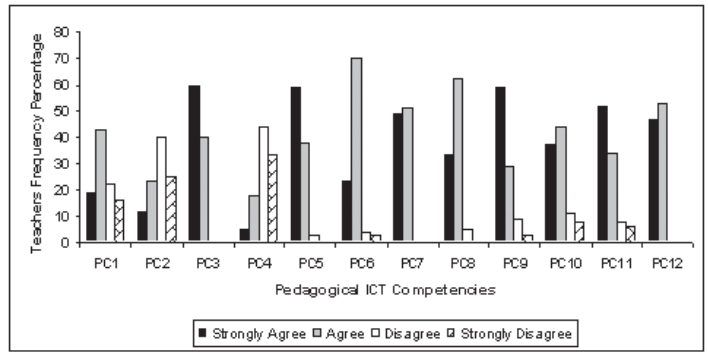
successful instructional use of ICT in education. These items scored more than 50 per cent.

The respondents did not consider PC 2 (Develop and maintain educational websites) and PC 4 (Develop educational programs with the help of programming languages) as teacher required pedagogical competencies. Figure-2 shows the percentage of frequencies marked by teacher educators as strongly agree, agree, disagree and strongly agree on teacher required pedagogical competencies for instructional use of ICT.

Figure-2 shows the percentage of frequencies marked by teacher educators as strongly agree, agree, disagree and strongly agree on teacher required pedagogical competencies for instructional use of ICT.

Figure 2

Distribution of Frequency Percentage of Teacher Educator on Required Pedagogical ICT Competencies for Teachers (N = 73)



(C) Didactical ICT Competencies of Teachers for Instructional Use of ICT

The results related with Didactical ICT competencies that teacher needs to develop in view of teacher educators are given below in table-4.

Table 4

Teacher Educators Views on the Didactical ICT Competencies that Teachers Need for Instructional Purpose

Item No.	*Items*	*Strongly Agree*		*Agree*		*Disagree*		*Strongly Disagree*	
		f	%	*f*	%	*f*	%	*f*	%
DC1	Make decisions about how to present the content.	15	21	36	49	14	19	8	11
DC2	Create materials and tools that adapt the use of ICT to students	5	7	8	11	39	53	21	29
DC3	Make decisions about how students are to interact and tools are appropriate for a given type of interaction (e.g. wikis for collaborative construction, blogging for conversation-type activities, etc.).	14	19	38	52	13	18	8	11

DC4	Plan student support during the teaching and learning process	21	29	36	49	10	14	6	8
DC 5	Use ICT as a didactical tool in the class.	45	62	28	38	-	-	-	-
DC6	Make decisions about methodologies appropriate to previous knowledge and experience of students	29	40	30	41	8	11	6	8
DC7	Design the feedback and evaluation moments adjusted to the learning and teaching process.	7	10	12	16	31	42	23	32
DC8	Create activities related to specific aims. These activities have								
	a close relationship with the knowledge to be acquired.	21	29	49	67	2	3	1	1
DC9	Know how to use ICT tools to create and facilitate a community of learning.	18	25	44	60	11	15	-	-
DC10	Implement cooperative learning strategies using ICT.	51	70	22	30	-	-	-	-

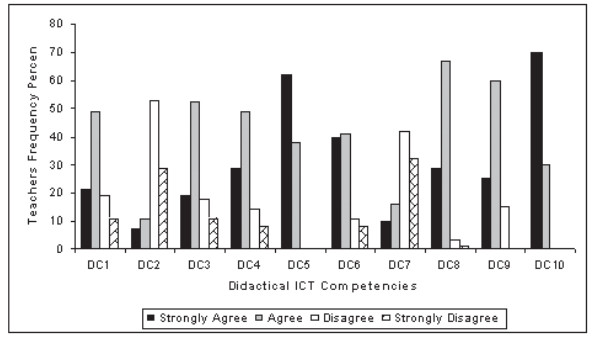
The data presented in table-4 shows that among the didactical ICT competencies, a maximum of 51 (70%) teacher educators strongly agree with the Item DC 10 (Implement cooperative learning strategies using ICT). Item DC 10 had the highest score of 100 per cent [for Strongly Agree (70%) and Agree (30%)]. This implies that the respondents think that Implement cooperative learning strategies using ICT is very essential didactical competency that teachers need to require. Similarly DC 5 (Use ICT as a didactical tool in the class) had the highest score of 100 per cent (for Strongly Agree and Agree). The respondents think that the didactical competencies DC 1 (Make decisions about how to present the content), Item DC 3 (Make decisions about how students are to interact and which tools are appropriate for a given type of interaction (e.g. wikis for collaborative construction, blogging for conversation-type activities, etc.), Item DC 4 (Plan student support during the teaching and learning process), Item DC 6 (Make decisions about methodologies appropriate to previous knowledge and experience of students), Item DC 8 (Create activities related to specific aims. These activities have a close relationship with the knowledge to be acquired) and DC 9 (Know how to use ICT tools to create and facilitate a community of learning) are very important didactical competencies that modern teachers need to mastery on them and that are essential for successful instructional use of ICT in education. These items scored more than 50 per cent.

The respondents did not consider DC 2 (Create materials and tools that adapt the use of ICT to students) and DC 7 (Design the feedback and evaluation moments adjusted to the learning and teaching process) as teacher required didactical competencies.

Figure-3 shows the percentage of frequencies marked by teacher educators as strongly agree, agree, disagree and strongly agree on teacher required didactical competencies required for instructional use of ICT.

Figure 3

Distribution of Frequency Percentage of Teacher Educator on Required Didactical ICT Competencies for Teachers (N = 73)



(D) Social ICT Competencies of Teachers for Instructional Use of ICT

The results related with Social ICT competencies that teacher needs to develop in view of teacher educators are given below in table-5.

Table 5

Teacher Educators Views on the Social ICT Competencies that Teachers Need for Instructional Purpose

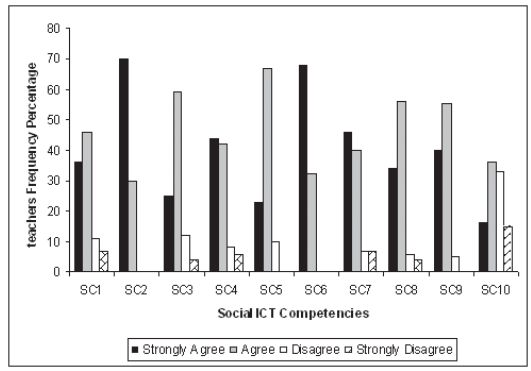
Item No.	*Items*	*Strongly Agree*		*Agree*		*Disagree*		*Strongly Disagree*	
		f	%	*f*	%	*f*	%	*f*	%
SC1	Understanding the concepts of ICT and its impact upon current society and the whole world.	26	36	34	46	8	11	5	7
SC2	Demonstrating knowledge and skills for using technology in ethical, legal and safe ways.	51	70	22	30	-	-	-	-
SC3	Maintain continuous, positive and constructive feedback to encourage student participation and high levels of motivation.	18	25	43	59	9	12	3	4
SC4	Set a trustful atmosphere for communication.	32	44	31	42	6	8	4	6
SC5	Be able to give to students equal opportunities to participate in collaboration.	17	23	49	67	7	10	-	-
SC6	Be able to use humour and good manners during the teaching and learning process.	50	68	23	32	-	-	-	-
SC7	Promote communication between students.	34	46	29	40	5	7	5	7
SC8	Demonstrating knowledge and skills for acquiring and processing learning resources with technology tools and using the resources foe educational purposes in fair ways.	25	34	41	56	4	6	3	4
SC9	Promote collaboration among students and assist them in the acquisition of collaboration skills.	29	40	40	55	4	5	-	-
SC10	Build a feeling of belonging to an online learning community.	12	16	26	36	24	33	11	15

The data presented in table-5 shows that among all 10 social competencies, a maximum of 51 (70 %) teacher educators strongly agree with the Item SC 2 (Demonstrating knowledge and skills for using technology in ethical, legal and safe

ways). Item SC 2 had the highest score of 100% [for Strongly Agree (70%) and Agree (30%)]. This implies that the respondents think that Demonstrating knowledge and skills for using technology in ethical, legal and safe ways is very essential social competency that teachers need to require. Similarly SC 6 (Be able to use humour and good manners during the teaching and learning process) had the highest score of 100 per cent (for Strongly Agree and Agree). The respondents think that the social competencies SC 1 (Understanding the concepts of ICT and its impact upon current society and the whole world), Item SC 3 (Maintain continuous, positive and constructive feedback to encourage student participation and high levels of motivation), Item SC 4 (Set a trustful atmosphere for communication), Item SC 5 (Be able to give to students equal opportunities to participate in collaboration), Item SC 7 (Promote communication between students), SC 8 (Demonstrating knowledge and skills for acquiring and processing learning resources with technology tools and using the resources foe educational purposes in fair ways), SC 9 (Promote collaboration among students and assist them in the acquisition of collaboration skills) and SC 10 (Build a feeling of belonging to an online learning community) are very important social competencies that modern teachers need to mastery on them and that are essential for successful instructional use of ICT in education. These items scored more than 50 per cent. Figure-4 shows the percentage of frequencies marked by teacher educators as strongly agree, agree, disagree and strongly agree on teacher required social competencies required for instructional use of ICT.

Figure 4

Distribution of Frequency Percentage of Teacher Educator on Required Social ICT Competencies for Teachers (N = 73)



Discussion

It has been revealed in present study that among the technological ICT competencies that teachers need to develop, the highest scoring item is the development of the competency to use ICT skills in developing and presenting information. Freedman (1999) presents

technological key ICT skills in four main areas of knowledge namely: hardware, software, curriculum and general knowledge. These key ICT skills are not limited to knowledge of technical skills such as key boarding and technical use of some software packages. They include the ability to recognise when and how to apply ICT to the solution of problems.

Another finding of this study is that teachers need to develop three main pedagogical ICT competencies in priority basis and these competencies are: prepare ICT-based learning environment, designing effective learning experiences and creating rich learning environments with the support of ICT and Understanding of computer technology can enhance student learning. This type of ICT-based education offers opportunities for spiritual, moral, social and cultural development of pupils (DfEE and QCA, 1999).

It is interesting that all the respondents agree that teachers need to develop competencies in using ICT as a didactical tool in the class as well as implement cooperative learning strategies using ICT. Using ICT as a didactical tool implies using it to establish dynamic and powerful instructional strategies and environment. An interesting finding of this study is that teachers need to develop two main social ICT competencies in priority basis and these competencies are: (1) Demonstrating knowledge and skills for using technology in ethical, legal and safe ways and (2) Able to use humour and good manners during the teaching and learning process. Others social ICT competencies are comes after the above two competencies

Conclusion and Recommendations

We live in a technologically fast changing world. We are already witnessing some of the significant social and economic consequences of ICT and its impact on education. A new era of education has been started which necessarily demands a new role of teacher, pupils and education system. In the era of ICT, it will be very difficult for India to cross the digital divide, if concerted efforts are not made to promote ICT education. One of the strategies to be adopted in this regard is the production of teachers who have developed competencies for the successful instructional use of ICT in education. Those teachers are called 21st century teachers who will possess the technological, pedagogical, didactical and social competencies in them and they will shape the personality of their pupils on constructivist level. To ensure the development of teachers' ICT competencies, the following recommendations are made:

1. ICT should be a compulsory course in all teacher preparation institutions. Teacher preparation should not be based on training for "Computer Literacy" but should prepare teachers for using technologies to construct, represent and share knowledge in real life authentic contexts. Research shows that teachers tend to teach the way that they werte taught (Ball, 1990, Lortie, 1975).
2. On the basis of research, an innovative model of pre-service teacher education should be developed that fulfill our present requirement. It should be remember that the model has the potential to equip that knowledge and

skills and train our future teachers that confidently provide knowledge and instructions in the classroom with the help of modern technologies keeping in view the national and international standards.

3. Sufficient facilities and resources should be provided to in-service and pre-service teachers to practices the ICTs in teaching-learning process. They should be given environment in which they develop their ICT-based competencies.
4. An integrated approach should be implemented in teacher preparation institutions. The goal of this approach should be to create and develop teaching-learning environment in which practitioners should be able to understand the nature of above four types of competencies and use the suitable competencies which is required and expected to them.
5. Both theory and practice related to the technological, pedagogical, didactical and social competencies should be the compulsory course of the teacher preparation programs.
6. Computers and internet should be provided in the schools so as to provide access to ICT to both teachers and learners.
7. Professional development programs (PDP) should be organised for the teachers in which emphasis should be laid down on the development of ICT-pedagogical competencies.

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