# The Role of Information Communication Technology (ICT) Learning Avenues, Facilities and Barriers in Evaluation of ICT Skills

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## Abstract

*The current study evaluated the usage of Information and Communication Technology (ICT) skills and competencies among college teachers. Additionally, it measured the association of ICT avenues, facilities and barriers of ICT skills and competencies. Furthermore, it explored the effects of socio-demographic characteristics on ICT skills and competencies of college academics. For this purpose, data were collected (N=304) from college faculty recently (during July-September, 2015) teaching at public sector colleges of the province Punjab, Pakistan. A self-structured questionnaire was constructed to elicit the usage of ICT skills of college teachers. This self-structured questionnaire was distributed among all faculty members of different colleges through ministerial staff working in those colleges. Factor analysis and reliability analysis were run to ensure reliability, validity and robustness of the scales for the current study after the data collection. Results revealed that self-study, consultation with colleagues, friends and relatives, and trial and error basis were the vital learning avenues of ICT. Shortfall of electricity, lack of time due to other academic activities and lack of incentives by management were the pivotal predictors of leaning obstacles of ICT. Designation, gender, and age, facilities of ICT, learning avenues of ICT and learning obstacles of ICT were significant with ICT skills and competencies among college teachers*.

**Keywords:** ICT skills, ICT learning avenues, teachers, ICT learning obstacles, ICT facilities, Pakistan

## Introduction

The trend has been shifted from inculcating factual and procedural knowledge in industrial society to concepts and meta-cognitive knowledge in the information society (Anderson, 2008). This transition made it indispensable for academician and teachers in college and even in universities to be equipped with Information and communication technology (ICT) skills and competencies. Despite the emphasis of the training course, which focused on the benefits of integrating ICT with existing subjects, cultural and systemic factors within the post-primary system continue to curb integration (McGarr & O'Brien, 2007). ICT skills refer to the ability of a person to handle a wide range of different computer applications for multiple tasks (Volman & van Eck, 2001). ICT skill refers to "enable an individual to use computers, software applications, databases and other technologies to achieve

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a wide variety of academic, work-related, and personal goals" (Association of College and Research Libraries, 2007).

ICT skills included use of office applications (Word, Excel, and others); databases, library catalogues, CD-ROM, online and internet searching; maintaining of in-house databases; managing automated systems; designing and constructing homepages; use of computers for searching and retrieval of information and the use of web 2.0 technologies (Buarki, Hepworth & Murray, 2011).

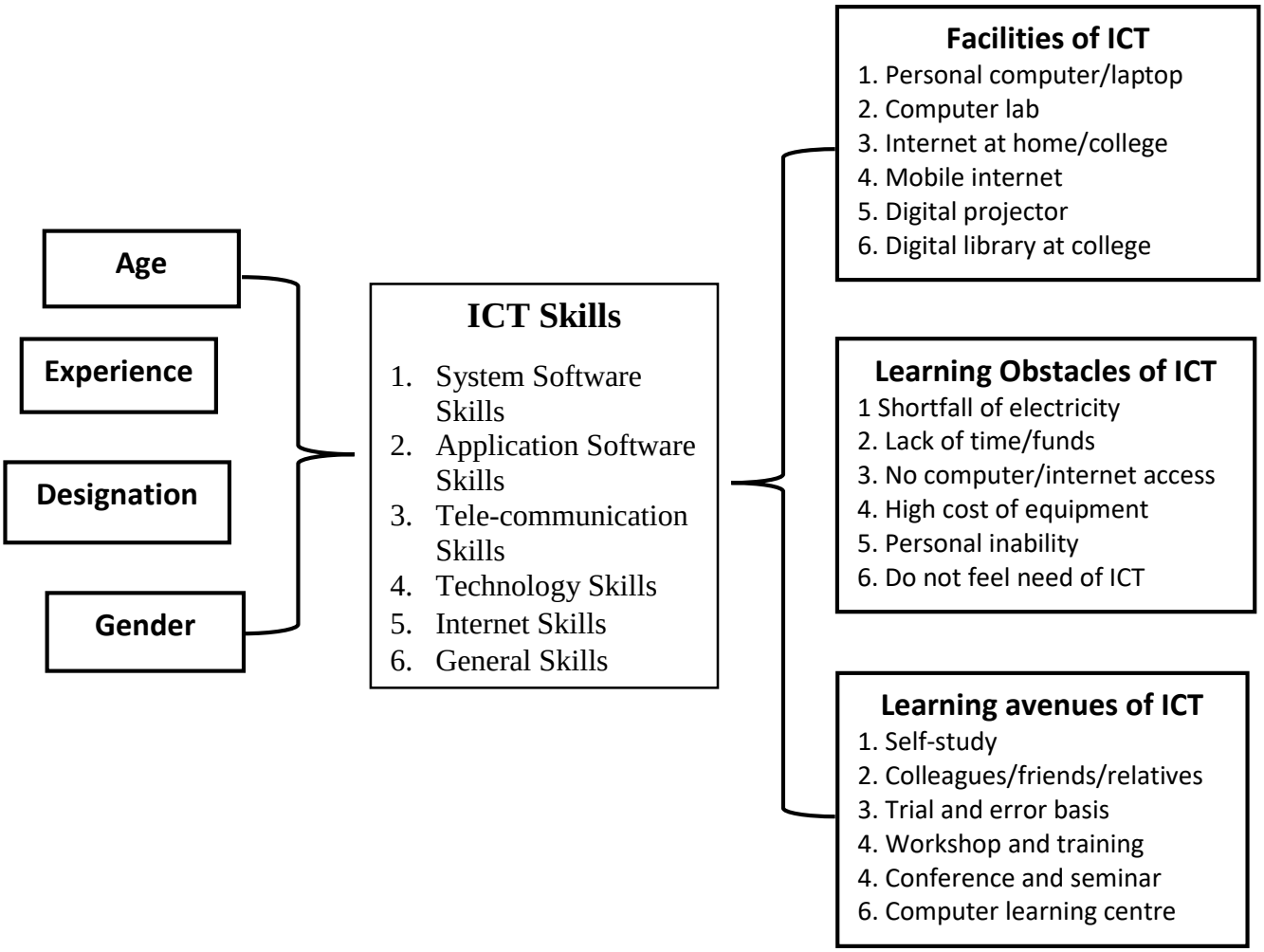


**Figure I: Conceptual Framework of the study**

ICT skills are divided into different categories such as basic operations and maintenance of equipment, operating technology assisted instruction programs, computer programming and internet skills. ICT skills are grouped into four main categories including file management, internet related, analysis/programming and creative/presentation skills (Jakobsdótti, Jónsdóttir & Hjartarson, 2004). Similarly, Miliszewska (2008) classified general ICT skills in the use of software and hardware tools (Windows, word processing, spread sheet applications, presentation software, database applications, web applications, mobile applications, mobile devices, hardware and software installation, principles of networks) and the responsible use of

internet services (email, web browsing, digital authoring, electronic databases, principles of digital communication). In this article researchers operationalized ICT skills into different six categories such as system software skills, application software skills, telecommunication skills, technology skills, internet skills and general skills. Nature of education technology and learning and teaching methods has been changed with the adoption of information and communication technology.

Scholarly literature is rife with the importance of ICT skills and competencies, particularly in the field of education. ICT is anticipated to play a pivotal role in course delivery and assessment, access to resources, communication around the globe and activities undertaken in academic institutions (Pearson, 2003). Furthermore, ICTs have pregnant potential in widening access to, and improvement in the quality of teacher education (Dhanarajan, 2001), enabling independent and collaborative learning and the development of new learning modes (Davies, Hayward & Lukman, 2006) and usage in group problem-solving activities and articulated projects (Forcheri & Molfino, 2000). ICT has given birth to cyber culture that used communication networks for sharing and accessing information and knowledge for education (Ademodi & Adepoju, 2009). Furthermore, the theoretical advancement in ICT encouraged diversified and active learning ways, prompt feedback and contact between students and faculty (Siemens & Tittenberger, 2009).

Manifestation of ICT in the educational sector has certain social implications for community of teachers. In education sector, adoption of ICT has brought forth educational change, improvement in learning outcomes and equipment of survival skills for the information society (Buabeng-Andoh, 2012). Adoption of ICT revolutionized an outmoded educational system, prepared students for the information age and accelerated national development efforts (Albirini, 2006). ICT requires a modification in the role of the teacher with new skills and responsibilities in addition to classroom teaching (Wheeler, 2001) and enthusiasm in learning ICT potentials is evident in the orientation of the teachers (Williams et al, 2000). Chronaki (2000) indicated four perspectives on interaction of ICT in a pedagogical environment such as (1) the pedagogical orientation of the educational system; (2) the pedagogical structure embedded within the computer system; (3) the pedagogical organization of lessons and (4) the pedagogical support provided by teachers.

There are different motives that influence teacher to use ICT skills and competencies. Particular inclinations related to subject specialties and applications in those subjects (Cuckle & Clark, 2002), access, individual competence and general motivation (Becta, 2008) and teacher's sense of self-efficacy or 'confidence to perform specific tasks' with respect to teaching in general (Smith, 2005) were leading factors of usage of ICT teachers.

Similarly, previous studies have also suggested that the role of ICT in pedagogical approaches had increased manifold since revolution of information. Hennessy, Deaney and Ruthven (2005) explored that ICT could provide a catalyst for creating collaborative relationship among students and teachers and could advocated the partnership that would facilitate coordination and foster an environment of exploration within the learning commons. Torruam (2012) emphasized that advances in ICT have really revolutionized the patterns of teaching and learning in many ways like increasing access to post-secondary instruction, improving the availability of educational resources and facilitating meaningful interaction among learners. He further stated that ICT was an important tool which can be used in pedagogy to produce excellence among students.

Siemens and Tittenberger (2009) were concerned about the slow improvement in teaching and learning and they opined that educators generally resist advanced pedagogical discussions that were not readily transferable to the classroom. Additionally, it was difficult to harness learning potential due to the lack of ICT skills and competence of teachers (Lau & Sim, 2008). ICT skills and competence of teachers are indispensable in the emerging knowledge society, involving the ability to solve increasingly complex problems in a variety of knowledge-rich domains and participating in knowledge work and engaging in various networked activities (Hakkarainen et al, 2000). Application of ICT in education has become an important area of research because ICT skill and competence are regarded as sources of professional growth, academic expansion and a response to society's latest prerequisites (Vosniadou, 2006).

This study evaluated the usage of ICT skills and competencies among college teachers. It also measured the effects of ICT learning avenues, the role of ICT facilities and ICT learning barriers on ICT skills and competencies. Furthermore, it explored the effects of socio-economic characteristics (gender, designation and age of the respondents) on ICT skills and competencies of college academics. It also explored the effect of socio-economic characteristics of on an individual's ICT skill such as system software skills, application software skills, telecommunication skills, technology skills, internet skills and general skills. The current study also tested following hypothesis, give as under

H1: More the facilities of ICT, higher the ICT skills

H2: More the learning avenues of ICT, higher the ICT skills

H3: More the Learning obstacles of ICT, lower the ICT skills

H4: Age, experience and gender have relationship with on ICT skills.

**Literature Review**

In this portion of the literature review, the researchers have discussed different learning avenues and facilities of ICT skills and competencies among college teachers. Furthermore, they have described different learning obstacles of ICT skills and the role of socio-economic status in adoption of ICT skills and competencies among college academics.

**Learning avenues of ICT skills**

In this portion researchers divided learning avenues of ICT into two segments. Human learning avenues of ICT included attitude towards ICT, trial and error basis and colleagues and friends. While, informational learning avenues of ICT included training and workshops, seminars and conferences etc. Institutional support and capability of using online learning avenues to enhance skills (Hoffman, 2001, & Neyland, 2011), positive attitude towards ICT and preference for individual study (Watson, 1998, Moseley & Higgins, 1999) and interlocking factors of institutional environment, access to the resources and the orientation of teachers (Mumtaz, 2000) play very important role for learning and usage of ICT skills and competencies. Personal ability and knowledge of the teachers plays a pivotal role in successful ICT usage and integration (Markauskaite, 2007). Wikan and Molster (2011) indicated learner-oriented education philosophy, a positive attitude towards ICT in education and subject in particular as endogenous teacher level factors of ICT integration. Inconsistency existed between belief and actual use of ICT skills and

competencies in classrooms (Eugene, 2006). On the contrary, positive relationship existed between attitudes and actual use of information technology by the teachers (Simonson, 2004).

## Facilities of ICT skills

Availability of equipment in the class and views of their teacher-mentors in using ICT influenced the usage of ICT skills and competencies among teachers (Cuckle and Clark, 2002). Teachers needed time and support and confidence to use of computers in the classroom (Kennewell & Beauchamp, 2003). Sang, Valcke, van Braak and Tondeur (2006) emphasized that in spite of availability of infrastructure few teachers integrate ICT into learning environment. Morris (2010) described the diverse skills requirement continuing professional development of teachers through reconfiguration of the learning community. Loveless (2003) argued about the difference between claim of the teachers about their ICT skills and actual use in classrooms. Jacobsen (1998) narrated that ICT was being used effectively and efficiently in higher education for communication, teaching and learning and for information access and delivery in libraries.

## Learning obstacles of ICT skills

Scholarly literature has elicited many learning obstacles of ICT skills and competencies among college teachers. Lack of confidence, competence and resources (Bingimlas, 2007) were the major barriers of integration of ICT among teachers. Cuckle and Clark (2003) indicated that teacher value ICT highly but generally less than teaching skills, including planning, preparation and class management. Lack technical skills, personal ability, and professional experience were the leading factors that hindered faculty to use technology for effective teaching (Bates and Poole, 2003). Teachers' perceived lack of computers, equipment and in-service training (Sipilä, 2014), and cost of adequate hardware and software and low levels of confidence in knowledge of ICT (Russell, Finger & Russell, 2000; Wikan & Molster, 2011) were the main recalcitrant in the use of ICT skill and competencies. Similarly, lack of time, lack of belief in the impact of ICT and low sense of self-efficacy were identified as major barriers in usage of ICT skills and competencies among teachers (Hammond, Reynolds & Ingram, 2011).

## Socio-economic status and ICT skills

Male teachers' knowledge and usage levels of ICT were higher than that of female teachers (Tezci, 2011). Similarly, Jakobsdóttir, Jónsdóttir, and Hjartarson (2004) revealed that a gender gap exists in favor of the male which increased with the age. Wikan and Molster (2011) indicated age, gender and experience as exogenous teacher-level factors that influence the implementation of ICT in education. Inverse correlation existed between the use of ICT, age, and teaching experience of teachers (Buabeng-Andoh, 2012). Level of ICT skills and competence decreased as the level of experience of teachers in years increase (Vitanova, Atanasova-Pachemska, Iliev & Pachemska, 2015).

## Methodology

There are 600 colleges (intermediate, degree and post degree colleges) in Punjab. 5000 teachers are serving in these colleges as lectures, assistant professors and professors. The survey was used as a technique of data collection while a self-structured questionnaire was used as a tool for data collection. The self-structured questionnaire was designed to elicit the learning pattern of ICT

skills. This self-structured questionnaire was distributed among all faculty members of different colleges through ministerial staff working in those colleges. 400 questionnaires were distributed among college academics from 20 selected colleges around the province of Punjab 304 questionnaire correctly filled and fit for analysis, representing almost 75 percent response rate.

The self-structured questionnaire was divided into two parts. First part gathered demographic information like age, education and gender of college academics. It also collected information about experience, discipline and the designation of the respondents. The second part of the questionnaire asked questions about information and communication technology skills and competencies such as system software skills, application software skills, telecommunication skills, technology skills, internet skills and general skills.

Table 1 represented the values of reliability and validity for the scales of ICT skills (system software skills, application software skills, telecommunication skills, technology skills, internet skills and general skills). The standardized Cronbach alpha reliability coefficient of 0.804 was obtained for scale of system software skills. Scale of system software skills enlisted 3 items including usage of Microsoft windows, Linus/UNIX/Ubuntu and OS X/Mac. Loadings of the categories of the factor analysis were above .65 that demonstrated the reliability and validity of the scale of System software skills. The standardized Cronbach alpha reliability coefficient of 0.940 was obtained for scale of application software skills. Scale of application software skills enlisted 10 items including usages of Microsoft Excel, PowerPoint and Access, adobe reader, download manager and media player. Loadings of the constructs of the factor analysis were above .65 that validated the reliability and validity of the scale of application software skills.

**Table 1: Descriptive statistics of factor and reliability analysis of ICT skills of teachers (N=304)**

| ICT Skills | | Factor analysis |
|---|---|---|
| **System Software Skills (value of Cronbach alpha=0.804)** | | |
| 1. | Microsoft windows | .704 |
| 2. | Linus/UNIX/Ubuntu | .938 |
| 3. | OS X/Mac | .929 |
| **Application Software Skills (value of Cronbach alpha=0.94)** | | |
| 4. | Micro Soft Word | .860 |
| 5. | Micro Soft Excel | .851 |
| 6. | Micro Soft PowerPoint | .854 |
| 7. | Micro Soft Access | .791 |
| 8. | Adobe reader | .850 |
| 9. | Download manager | .855 |

| | | |
|---|---|---|
| 10. | Media player | .836 |
| 11. | Offline Browsers | .766 |
| 12. | Statistical Package for Social Sciences (SPSS) | .714 |
| 13. | EndNote | .667 |
| **Telecommunication Skills (value of Cronbach alpha=0.917)** | | |
| 14. | Emailing | .868 |
| 15. | Audio/video conferencing (Skype etc.) | .888 |
| 16. | Social Networking sites (Facebook, twitter) | .897 |
| 17. | Chatting (MSN, Yahoo, Facebook) | .915 |
| 18. | Blogging | .762 |
| **Technology Skills (value of Cronbach alpha=0.952)** | | |
| 19. | Digital projector | .686 |
| 20. | Scanner | .860 |
| 21. | Printer | .906 |
| 22. | Bluetooth | .897 |
| 23. | Wi-Fi | .878 |
| 24. | Memory storage devices (Flash drive, CD/DVD) | .903 |
| 25. | Digital camera | .897 |
| 26. | Electronic cards (ATM cards etc.) | .877 |
| **Internet Skills (value of Cronbach alpha=0.932)** | | |
| 27. | Understanding connectivity (broadband, dial-up) | .898 |
| 28. | Internet searching techniques | .893 |
| 29. | Coordination of online group activity | .925 |
| 30. | Sharing information/file over internet | .932 |
| **General Skills (value of Cronbach alpha=0.960)** | | |
| 31. | File management and organization | .909 |
| 32. | Personal assistance package (calendar, address book etc.) | .866 |
| 33. | Change file formats | .910 |
| 34. | Protect computer from virus | .929 |

| | | |
|---|---|---|
| 35. | Troubleshooting procedures | .902 |
| 36. | Navigation between drives and applications | .903 |
| 37. | Installations and un-installation of software | .879 |

The standardized Cronbach alpha reliability coefficient of 0.917 was obtained for the scale of telecommunication skills. Scale of telecommunication skills enlisted 5 items including categories of emailing and blogging, audio/video conferencing (Skype, etc.), social networking sites (Facebook, Twitter) and chatting (MSN, Yahoo, Facebook). Loadings of the constructs of the factor analysis were above .65 that validated the reliability and validity of the scale of telecommunication skills. The standardized Cronbach alpha reliability coefficient of 0.952 was obtained for scale of technology skills. Scale of technology skills enlisted 8 categories including usage of digital projector, scanner & printer, Bluetooth and Wi-Fi. Loadings of the constructs of the factor analysis were above .65 that validated the reliability and validity of the scale of technology skills. The standardized Cronbach alpha reliability coefficient of 0.932 was obtained for scale of internet skills. Scale of internet skills enlisted 4 items including understanding connectivity (broadband, dial-up), internet searching techniques, coordination of online group activity, and sharing information/file over internet. Loadings of the constructs of the factor analysis were above .65 that validated the reliability and validity of the scale of internet skills.

The standardized Cronbach alpha reliability coefficient of 0.960 was obtained for scale of general skills. Scale of general skills enlisted 7 items including usage of file management and organization, personal assistance package (calendar, address book etc.) and changing file formats. Furthermore, protection of computer from virus, troubleshooting procedures, navigation between drives and applications and installations/un-installation of software were included in the scale of general skills. Loadings of the constructs of the factor analysis were above .65 that validated the reliability and validity of the scale of general skills. Response categories of the scales ranged from excellent (5), good (4), average (3), poor (2) to don't know (1).

It also gathered information about the facilities of ICT, learning avenues of ICT and learning obstacles of ICT. Facilities of ICT included such as personal computer/laptop, computer lab with internet facility at college, internet at home, campus & mobile and digital projector. Learning avenues of ICT included categories such as self-study, colleagues & students, friends and relatives, trial & error basis, workshop & training and conference & seminar. Learning obstacles of ICT asked questions about the shortfall of electricity, lack of time due to other activities, lack of incentives by management, lack of computer/internet access lack of interest & funds and high cost of equipment, etc. Response categories for the scales of facilities of ICT, learning avenues of ICT and learning obstacles of ICT ranged from Yes (2) to No (1).

Data was entered in Statistical package for social sciences (SPSS) while multiple linear regression analysis was used to find out the association between dependant variable (learning obstacles of ICT, age, Facilities of ICT, background, and gender, learning avenues of ICT, designation and experience) and independent variables (system software skills, application software skills, telecommunication skills, technology skills, internet skills, general skills and ICT skills and competencies).

**Data Analysis**

Out of total respondents who participated in this study, 67.8 per cent were male, while 32.2 per cent were female. Similarly, 81.8 per cent were lecturers and 18.2 per cent were assistant professors. In discipline, 35 percent of the respondents were from arts and humanities, 34.3 percent belonged to social sciences and 30.8 percent were from natural sciences and professional sciences.

**Table 2: Descriptive details of avenues of learning ICT skills among college academics (N=304)**

| Learning avenues of ICT | Mean | Std. Deviation |
|---|---|---|
| Self-study | 1.61 | .489 |
| Colleagues | 1.48 | .501 |
| Friends and relatives | 1.44 | .497 |
| Trial and error basis | 1.29 | .456 |
| Workshop and training | 1.18 | .386 |
| Students | 1.17 | .380 |
| Conference and seminar | 1.16 | .368 |
| Computer centre in college | 1.15 | .355 |
| Computer centre at city | 1.14 | .347 |
| Junior staff in college | 1.08 | .267 |

Table 1 explored the descriptive statistics of avenues of learning ICT skills among college academics. The values of the means indicated that self-study (M=1.61), colleagues (M=1.48), friends & relatives (M=1.44) and trial & error basis (M=1.29) were the leading avenues of learning ICT skills among college academics. Low mean values of conference & seminar (M=1.16) and workshop & training (M=1.18) suggested that there was a lack of training facility among college academician.

**Table 3: Descriptive details obstacles for learning ICT skills among college academics (N=304)**

| Learning obstacles of ICT | Mean | Std. Deviation |
|---|---|---|
| Shortfall of electricity | 1.62 | .500 |
| Lack of time due to other activities | 1.49 | .501 |
| Lack of incentives by management | 1.43 | .496 |

| | | |
|---|---|---|
| Lack of computer/Internet access | 1.36 | .482 |
| Lack of interest | 1.26 | .454 |
| Lack of funds | 1.24 | .426 |
| High cost of equipment | 1.22 | .418 |
| Personal inability (language barriers etc.) | 1.15 | .361 |
| Do not feel any need of ICT skills | 1.14 | .347 |
| Physical/health problems | 1.11 | .316 |

Table 2 presented the descriptive statistics of learning obstacle of ICT among college academics. The value of the means of shortfall of electricity (M=1.62), lack of time due to other activities (M=1.49) and lack of incentives by management (M=1.43) indicated that these were leading learning obstacle of ICT among college academics

**Table 4: Descriptive details of ICT skills and competencies among college academics (N=304)**

| ICT Skills | Mean | Std. Dev. |
|---|---|---|
| **SYSTEM SOFTWARE SKILLS (2.3563)** | | |
| Microsoft windows | 3.1316 | 1.32567 |
| Linus/UNIX/Ubuntu | 1.7368 | 1.13777 |
| OS X/Mac | 1.6184 | 1.00945 |
| **APPLICATION SOFTWARE SKILLS (3.0448)** | | |
| Micro Soft Word | 3.3026 | 1.33739 |
| MS excel | 3.0724 | 1.28208 |
| MS PowerPoint | 2.9211 | 1.34964 |
| MS Access | 2.2961 | 1.33143 |
| Adobe reader | 2.8289 | 1.38476 |
| Download manager | 3.2171 | 2.05526 |
| Media player | 3.1974 | 1.48297 |
| Offline Browsers | 2.5000 | 1.32225 |
| SPSS | 2.2961 | 1.41814 |
| EndNote | 2.0526 | 1.28047 |

| | | |
|---|---|---|
| **TELECOMMUNICATION SKILLS (3.6862)** | | |
| Emailing | 3.7763 | 1.30814 |
| Audio/video conferencing (Skype etc.) | 3.2237 | 1.43373 |
| Social Networking sites (Facebook, twitter) | 3.1974 | 1.52263 |
| Chatting (MSN, Yahoo, Facebook) | 3.2434 | 1.47382 |
| Blogging | 2.8026 | 1.40500 |
| **TECHNOLOGY SKILLS (3.101163)** | | |
| Digital projector | 2.3092 | 1.20832 |
| Scanner | 2.7961 | 1.32894 |
| Printer | 2.9474 | 1.39910 |
| Bluetooth | 3.2632 | 1.45455 |
| Wi-Fi | 3.2303 | 1.48489 |
| Memory storage devices (Flash drive, CD/DVD) | 3.4342 | 1.39854 |
| Digital camera | 3.3947 | 1.43816 |
| Electronic cards (ATM cards etc.) | 3.4342 | 1.49468 |
| **INTERNET SKILLS (3.0592)** | | |
| Understanding connectivity (broadband, dial-up) | 3.1316 | 1.37953 |
| Internet searching techniques | 3.3750 | 1.30619 |
| Coordination of online group activity | 2.7368 | 1.30072 |
| Sharing information/file over internet | 2.9934 | 1.40716 |
| **GENERAL SKILLS (2.577071)** | | |
| File management and organization | 2.7105 | 1.44493 |
| Personal assistance package (calendar, address book etc.) | 2.6711 | 1.36064 |
| Change file formats | 2.5987 | 1.33848 |
| Protect computer from virus | 2.6447 | 1.38300 |
| Troubleshooting procedures | 2.3355 | 1.34186 |
| Navigation between drives and applications | 2.2303 | 1.37369 |
| Installations and un-installation of software | 2.8487 | 1.56856 |

Table 3 presented the descriptive statistics of ICT skills and competencies among college academics. In system software, mean value suggested that Microsoft Windows skills were higher while the skills of Linus/UNIX/Ubuntu and OS X/Mac were lower among college teachers. In application software, mean value suggested that skills in Microsoft Word, MS excel, MS PowerPoint, media player and download manager were higher while Adobe reader, MS Access, Media player, Offline Browsers, SPSS and EndNote skills were lower among college teachers. In telecommunication, mean value suggested that the skills of Emailing, Audio/video conferencing (Skype, etc.), social networking sites (such as Facebook, Twitter) and chatting (MSN, Yahoo, Facebook) were higher while blogging skills were lower among college teachers.

In technology, mean value suggested that the skills of Bluetooth, Wi-Fi, memory storage devices (Flash drive, CD/DVD, etc.) and digital camera were higher while digital projector, scanner and printer skills were relatively lower among college teachers. In internet, mean value suggested that skills of understanding connectivity (broadband, dial-up) and internet searching techniques were relatively higher while the skills of coordination of online group activity and sharing information/file over the internet were lower among college teachers. The mean value suggested that general skills were relatively lower among the college teachers.

The average mean value of the variable suggested that telecommunication skills (M=3.6862), technology skills (M=3.101163), internet skills (M=3.0592) and application software skills (M=3.0448) had high level while general skills (M=2.577071) and system software skills (M=2.3563) had low level among college teachers. The average mean value of ICT skills and competencies (M=2.97) indicated that it was average among college teachers.

**Table 5: Descriptive details of ICT facilities among college academics (N=304)**

| ICT facilities | Mean | Std. Deviation |
|---|---|---|
| Personal computer/laptop | 1.8112 | .39204 |
| Computer Lab with internet facility at College | 1.5385 | .49939 |
| Internet at home | 1.5245 | .50028 |
| Internet at campus | 1.3846 | .48736 |
| Internet use on Mobile | 1.3007 | .45937 |
| Digital projector | 1.0909 | .28798 |
| Digital library at College | 1.0140 | .16695 |

Table 4 presented the descriptive statistics of ICT facilities among college academics. The mean values of personal computer/laptop (M=1.8112), computer lab with internet facility at the college (M=1.5385) and the internet at home (M=1.5245) suggested that these were the leading ICT facilities among college academics. The values of the means digital projector (M=1.0909) and digital library at the college (M=1.0140) suggested that the majority of the respondents were devoid of these ICT facilities among college academics.

**Table 6: Descriptive details of regression analysis of dependent variable and dependent variable among college academics (N=304)**

| Dependent | System Software Skills | Application Software Skills | Tele-Communication Skills | Technology Skills | Internet Skills | General Skills | ICT Skills |
|---|---|---|---|---|---|---|---|
| Designation | .026 | -.080 | -.169** | -.107 | -.169** | -.094 | -.107* |
| Gender | -.151* | -.163** | -.054 | -.135* | -.162** | -.262** | -.179** |
| Age | -.105 | -.166* | -.067 | -.128* | -.202** | -.181* | -.162* |
| Background | -.112* | -.011 | -.014 | -.068 | -.018 | .018 | -.027 |
| Experience | -.152 | -.092 | -.244** | -.171* | -.004 | -.129 | -.143 |
| Facilities of ICT | -.004 | .239** | .143** | .186** | .112* | .124* | .175** |
| Learning avenues of ICT | .276** | .324** | .279** | .252** | .358** | .296** | .322** |
| Learning Obstacles of ICT | -.132* | -.147** | -.117* | -.258** | -.177** | -.246** | -.204** |

Factors which were found to be significant with system software skills were gender (standard beta=-.151*), background (standard beta=-.112*), learning avenues of ICT (standard beta=.276) and learning obstacles of ICT (standard beta=-.132). Factors which were found to be significant with application software skills were gender (standard beta=-.163), age (standard beta=-.166), facilities of ICT (standard beta=.239), learning avenues of ICT (standard beta=.324) and learning obstacles of ICT (standard beta=-.147).

Factors which were found to be significant with telecommunication skills were designation (standard beta=-.169), experience (standard beta=-.244), facilities of ICT (standard beta=.143), learning avenues of ICT (standard beta=.279) and learning obstacles of ICT (standard beta=-.117). Factors which were found to be significant with technology skills were gender (standard beta=-.135), age (standard beta=-.128), experience (standard beta=-.171), facilities of ICT (standard beta=.186), learning avenues of ICT (standard beta=.252) and learning obstacles of ICT (standard beta=-.258).

Factors which were found to be significant with internet skills were designation (standard beta=-.169), gender (standard beta=-.162), age (standard beta=-.202), facilities of ICT (standard beta=.112), learning avenues of ICT (standard beta=.358) and learning obstacles of ICT (standard beta=-.177). Factors which were found to be significant with general skills were gender (standard beta=-.262), age (standard beta=-.181), facilities of ICT (standard beta=.124), learning avenues of ICT (standard beta=.296) and learning obstacles of ICT (standard beta=-.246).

Factors which were found to be significant with ICT skills were designation (standard beta=-.107), gender (standard beta=-.179), age (standard beta=-.162), facilities of ICT (standard beta=.175), learning avenues of ICT (standard beta=.322) and learning obstacles of ICT (standard beta=-.204).

**Discussion**

The research reported here examined whether there are gender and age differences in the use of ICT skills and competencies among college teachers. Furthermore, it also investigated the influence of ICT facilities, avenues of learning ICT, barriers of learning ICT on ICT skills and competencies.

There was a significant negative relationship (standard beta=-.179, p>.001) between gender and ICT skills as male respondents have higher level of ICT skills as compared to female respondents. Similar trends found in the previous scholarship where men were more likely to have higher ICT skills and competence than women (van Dijk & Hacker, 2003; Vitanova, et al., 2015). Ilomäki (2011) indicated that lack of motivation and interest was the reason that is why females had a low level of ICT skills and competencies as compared to males. Additionally, it was found that male teachers' perceived confidence in the usage of ICT was higher than female teachers (Buabeng-Andoh, 2015). Furthermore, it is because new technology has not removed gender-based differences in work, and the gender-based selection of ICT professionals favour men (Perrons, 2002). But, now between the genders, the gap in the ICT usage is narrowing (Shade, 1998).

The negative value of standard beta (standard beta=-.162, p>.05) suggested that age had the negative association with ICT skills. It suggested that younger college teachers have greater ICT

skills as compared to older college academics. Relationship of age and ICT skills was also supported by the previous researchers. Age is a significant factor in ICT skills and usage, more significant than education, income level, or geographical location (van Dijk & Hacker, 2003). Similarly, older teachers seem to be reluctant towards the incorporation of ICT in schools, while student teachers and some newly qualified teachers are the most confident users of ICT (Galanouli & McNair, 2001; Madden, Ford, Miller & Levyet, 2005 & Sime & Priestley 2005). There was a significant negative relationship (standard beta=-.107) between designation and ICT skills as lecturers have higher level of ICT skills as compared to the assistant professors/associate professors/professors. The results of level of ICT skills and competence decrease as the designation of teachers increase; this association may be due to the intervening effects of variables of age and experience of teaching.

Additionally, a positive relationship (standard beta=.175, p>0.001) was found between ICT facilities and ICT skills and competencies. It revealed that college academics with greater ICT facilities at college and home have greater ICT skills and competencies as compared to college academics with lesser ICT facilities. Critical reflection of ways of usage of ICT depends upon the provision of ICT facilities, easy and immediate access and use of ICT as integral part of teaching (Crisan, 2001). Similarly, there was a significant association between access (facilities) and level of use of ICT (Hammond, Reynolds & Ingram, 2011). Additionally, social influence and facilitate conditions influence teacher's decisions about utilizing ICT in education (Venkatesh, Morris, Davis & Davis, 2003). Furthermore, professional use, personal computers, ICT capacity and motivational factors were the predictors of ICT skills and competence among teachers (Vitanova, et al., 2015). Similarly, institutional factors (such as technical support, availability of ICT infrastructure, staff development requirements, etc.), teacher-based factors (such as technical competence, perceived obstacles, etc.) and change-based factors (such as teacher practice orientation, learning resources, etc.) influence teachers' ICT usage (Pelgrum & Voogt, 2009).

Furthermore, a positive relationship (standard beta=.322, p>0.001) was found between learning avenues of ICT and ICT skills and competencies. It indicated that the college academics with greater usage of learning sources of ICT have greater ICT skills and competencies as compared to college academics with the lesser usage of learning avenues of ICT. Resources and avenues are very helpful for teachers in learning ICT skills and competencies. Previous research also supported that when the time and resources were available the teacher educators learned to use technology and incorporated it into their teaching (Matthew, Stephens, Callaway, Letendre & Kimbell-Lopez, 2002). Many of the avenues of ICT competence (such as virtual training and workshops, self-learning by computer, research groups, internet workgroup, network search) play a pivotal role in ICT application by teachers in the learning process and its impression on learning improvement (Block, Ostam, Otter, & Overmaat2002; Akpan & Andre, 2000). Crawford (1998) studied ICT skills of teachers and found that many were self-taught and less qualified in some aspects. Simpson, Payne, Munro and Hughes (1999) indicated that ICT changes rapidly and teachers may find it difficult to keep pace.

A negative relationship (standard beta=-.204, p>0.001) was found between learning obstacles of ICT and ICT skills and competencies. It demonstrated that college academics with greater learning obstacles of ICT have less ICT skills and competencies while college academics with lesser learning obstacles of ICT have greater ICT skills and competencies. Shortfall of electricity and

lack of time due to other activities were the leading learning obstacles of ICT skills among college academics. Lack of time as an important obstacle for teachers was also supported by the findings of Lai and Pratt (2004). Low mean values of conference & seminar and workshop & training identified lack of training facilities among college academician. Dawson and Rakes (2003) identified that more training of teachers would lead to more ICT skills and competencies and finally ICT integration in education. Similar trends were revealed by the previous studies as Kozma, McGhee, Quellmalz and Zalles (2004) indicated lack of time for teachers in order to integrate ICT in their lessons, lack of appropriate computer hardware, software and teacher training as the barriers in the implementation of ICT. There are many factors that contribute to low level of ICT skills and competencies among teacher. Tang and Ang (2002) suggested structural constraint as major factors rather teacher's own recalcitrance.

## Conclusions

ICT has increased the efficiency of the organizations and departments. The proliferation of e-resources has had a significant impact on the way the academic community used, stored, and preserved information (Thanuskodi, 2011). The college faculty needs to enhance their ICT Skills to adopt the modern methods of teaching. The college faculty has enough knowledge of computer, but still there is enough scope to enhance and apply their Skills in imparting education to students. Integration of ICT into teaching and learning cannot be made possible without functional competencies of college faculty. Kay (2006) suggested that introduction of technology to pre-service teacher training programs, introducing yearly technology courses and offering workshops. Training course and programs should be in accordance with the existing subjects and cultural values to make the integration more successful.

## Research limitations and implications

A limitation of the study is that the college academic competencies and skills of using ICT were measured by using their self-assessments. As a consequence, the results of the study do not necessarily represent their actual competence or practices of using ICT, as in studying ICT skills; the problem of social desirability is unavoidable. In order to control for the possibility that some of the college academics might overestimate or underestimate their competence, investigators included a multiple-choice test in the questionnaire, designed to measure the college academics' knowledge of some basic concepts of ICT, e.g., operating systems, computer memory etc. Findings of the current study cannot be generalized on college academics working in private sector as data was collected from public sector colleges only.

## Future research

It was found that there is a huge gap of literature in the integration of ICT in education so a comprehensive research is necessary to understand where the country is in terms of ICT integration in education. It is also necessary to identify factors that affect teachers' use of ICT and the barriers that act otherwise especially in the education sector.

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