Competency of Teacher Educators and Student Teachers towards E-learning Tools

Deepty Gupta* and Gaurav Singh**

Abstract

Information and Communication Technology (ICT) can bring qualitative and quantitative improvement in higher education as well as in the school education system of our country. Increasing demand of E-learning has driven the Government of India to launch many new initiatives like Study Webs of Active Learning for Young Aspiring Minds (SWAYAM), e-Acharya, Shodhganga, Shodh gangotri, Open Journals Access System (OJAS), Virtual Labs, Spoken Tutorial, etc., to make the knowledge accessible to all the learners across the nation. Similarly, in the school education system, the platforms that have been created like the National Repository of Open Educational Resources (NROER), e-Pathshala, Saransh, e-Basta, Shaala Siddhi, i-Share, e-Bhasha, Shaladarpan, etc. These tools are for teachers, students and parents. All these initiatives could be successful, if the teaching-learning community is acquainted with the skills required for these. Efforts should be made to develop the skills and enhance the competencies of teachers and Teacher Educators for handling e-Learning tools. In order to study the present status, researchers have assessed the competency of Teacher Educators and student teachers towards the use of various E-learning tools. The results showed that the competencies required for using such tools was found to be lacking in the Teacher Educators and student teachers.

* *Assistant Professor*, CIET-NCERT, Delhi 110 016, India
** *Assistant Professor*, SOE, IGNOU, Delhi 110 016, India

Introduction

Technology is a constantly evolving tool of education which affects all the stakeholders in education. It plays a major role in improving both the quality of higher education as well as its reach. There are about 799 universities, 39,071 colleges and 11,923 standalone institutions (AISHE 2015–16) in India. Current Gross Enrolment Ratio (GER) in higher education is nearly 24.5 per cent, which is to be increased by 30 per cent by 2020. Information and Communication Technology (ICT) enabled teaching or E-learning has the potential to achieve this target. This can make the courses accessible to students from home. As per the Twelfth Five Year Plan (2012–17), all universities shall be enabled to use technology to its fullest extent to offer programmes both through face-to-face mode and technology-enabled means. The Government of India has already taken steps to develop a platform named Study Webs of Active Learning for Young Aspiring Minds (SWAYAM). It offers online courses on education to the citizens of our country free of cost. It is India's official Massive Open Online Courses (MOOCs) platform specifically designed to benefit students from remote areas, working professionals as well as college dropouts.

It is possible only when teachers embrace the technology and are ready to contribute for this qualitative and quantitative improvement in higher education system. Technological change has affected Teacher Education, and for this, the importance of ICT to enhance quality in our school and Teacher Education system has been highlighted in the National Curriculum Framework for Teacher Education (NCFTE 2009). The National Council for Teacher Education (NCTE) has also come up with new curriculum frameworks in 2014, which have modified the complete structure of Teacher Education on a large scale. In terms of duration, curriculum, introduction of new courses, etc., ICT has been included as a compulsory part of the curriculum for the first time. As per the *Teacher Education Planning Handbook* (*2015–2016*), 'Technology in Teacher Education is to be actively integrated in all Teacher Education (TE) institutions. Satellite transmission communication, content develop-ment, MIS, interactive and self-paced learning should be the focus areas for bridging the divide digitally'. According to the Twelfth Five Year Plan for Teacher Education (2012–17), ICT should be explored for its digital processes and its tools that could support the creation of new models of Teacher Education for achieving the goals successfully as well as the critical challenges.

Though many researches have shown the importance of ICT and E-learning in the Indian higher education system (Nelasco, Arputharaj & Paul 2007; Rajpal, Singh, Bhardwaj & Mittal 2008; Sharma & Mishra 2010; Tripathi & Jeevan 2010; Bhatia

2011; Das, Banerjee & Basu 2011; Ray 2012; Kumar 2014; Musthafa & Mohammed 2014), there is a need to carry out a research related to ICT integration and E-learning in the area of Teacher Education. Firstly, the teachers need to be equipped with the basics of E-learning tools and their integration in teaching and learning. If they are well adapted with E-learning, it will change their outlook towards E-learning. In order to utilise E-learning tools, they must have a reasonable degree of computer literacy and fluency. Review has shown that the tools being used by the teaching fraternity are digital resources like online documents, images and videos (Dogra 2011), wiki, Social Network Service (SNS) (Majhi and Maharana 2011), blogs, Wikipedia, social bookmarking, podcasting (Tyagi 2012), Internet (Bass 2010), MS Word, MS Excel (Parida 2010), word processing, telecommunication, presentation, networking (Rastogi and Malhotra 2013), MS Word, Paint Brush (Johri 2009), DOS, MS Word, MS Excel, MS PowerPoint, Access, Internet (Mohanty and Pandua 2012), whereas the tools like blogs, audio, portals, commercial databases, online discussion with students (Dogra 2011), blogs, RSS, social bookmarking, audio/video (Majhi and Maharana 2011) are not being used so frequently. Many studies exist in areas of basic ICT competencies or usage, but merely uploading a PowerPoint presentation online, is not an indicator of usage. The E-learning tools which are being used in collaborative learning, problem solving, Higher Order Thinking Skills (HOTS), reflective practitioners, portal usage, etc., should be studied.

Objectives of the Study

- To study the competencies of Teacher Educators towards E-learning tools
- To study the competencies of student teachers towards E-learning tools

Method and Procedure

In the present study, the researchers have employed the cluster sampling technique to select the Teacher Education Institutions (TEIs) running B.Ed. courses in Delhi-NCR. The regions selected were Delhi, Faridabad, Gurugram and Bahadurgarh from the State of Haryana, and NOIDA, Greater NOIDA and Ghaziabad from Uttar Pradesh. In these places, the institutions that were running B.Ed. courses were selected as a sample which was affiliated to three universities that is, Guru Gobind Singh Indraprastha University (GGSIPU), Chaudhary Charan Singh University (CCSU), Meerut, Uttar Pradesh, and Maharshi Dayanand University (MDU), Rohtak, Haryana. From the list of TEIs, 10 institutions from each university were selected randomly and the total sample size was 30 TEIs. After selecting a sample of TEIs from each university, all the 129 Teacher Educators and 1,268 student teachers present at the time

of data collection were considered as a sample of the study.

A Competency Scale was developed by the researchers to assess the competency of the Teacher Educators and student teachers. After the review, the researchers decided to assess the level of competency to use E-learning tools with a three-point rating scale (options 'Never', 'To Some Extent' and 'Completely'). The scale was divided into four dimensions having a total of 48 items (12 in each dimension). A similar tool was developed for the student teachers also. The four dimensions of the rating scale were Basic Computer Competency, Advanced Computer Competency, Basic Internet Competency and Advanced Internet Competency.

In order to collect data in a systematic manner, the researchers visited and administered the questionnaires personally with the faculty members (Teacher Educators) and students (student teachers).

Analysis and Interpretation

The data was analysed quantitatively using percentage analysis.

Objective 1: To study the Competency of Teacher Educators towards E-learning Tools

In order to facilitate the research, the objectives of the study were further categorised into the following sub-objectives.

- To study the level of Basic Computer Competency of Teacher Educators
- To study the level of Advanced Computer Competency of Teacher Educators
- To study the level of Basic Internet Competency of Teacher Educators
- To study the level of Advanced Internet Competency of Teacher Educators

As seen in Table 1, it can be interpreted that the average Basic

Table 1
Percentage Analysis of Basic Computer Competency of the Teacher Educators

University	Never (%)	To Some Extent (%)	Completely (%)
GGSIPU	9.40	20.74	69.86
MDU	8.50	21.24	70.26
CCSU	20.16	26.34	53.49
Average between the Universities	**11.63**	**22.29**	**66.09**

Computer Competency of the Teacher Educators was 66.09 per cent in all the three universities. If we compare the competencies, then the Teacher Educators of MDU possess the maximum Basic Computer Competency with a little difference than the Teacher Educators from the GGSIPU. The least competency was that of the Teacher Educators from the CCSU. Thus, the order of Basic Computer Competency of Teacher Educators from the three universities was: MDU> GGSIPU> CCSU.

As seen in Table 2, it can be interpreted that the average Advanced Computer Competency of the Teacher Educators was 42.83 per cent in all the three universities. If we compare the competencies, then the Teacher Educators of MDU possess maximum advanced computer competency with a little difference than the GGSIPU. The least competency was that of the Teacher Educators from the CCSU. The order of Advanced Computer Competency of the Teacher Educators from the three universities were MDU> GGSIPU> CCSU.

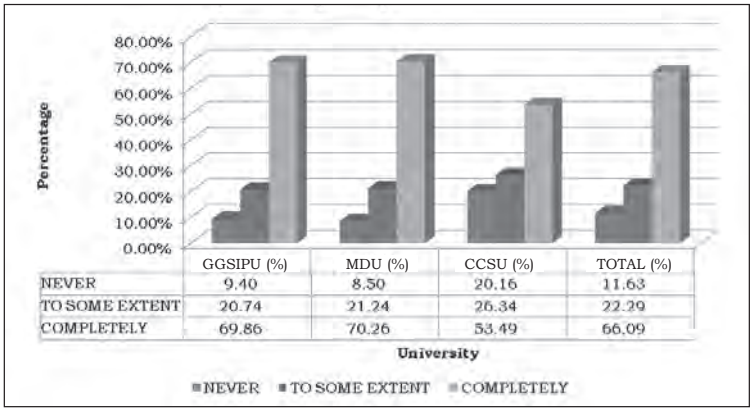

Figure 1. Basic computer competency of the Teacher Educators

Table 2
Percentage Analysis of Advanced Computer Competency of the Teacher Educators

University	Never (%)	To Some Extent (%)	Completely (%)
GGSIPU	24.29	29.96	45.74
MDU	25.16	27.78	47.06
CCSU	39.78	28.76	31.45
Total	**28.36**	**28.81**	**42.83**

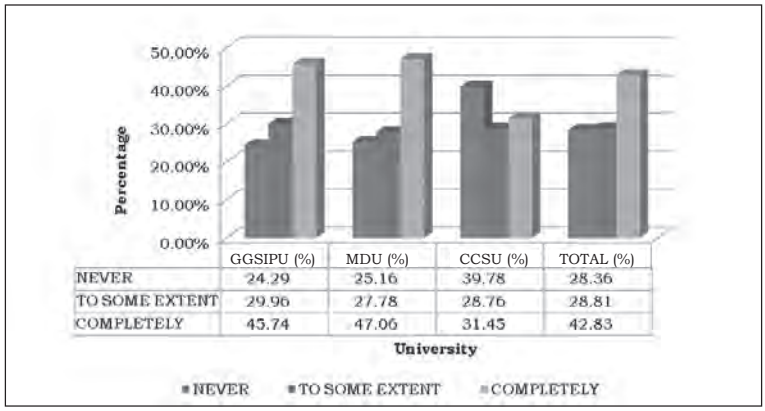

Figure 2. Advanced computer competency of the Teacher Educators

Table 3
Percentage Analysis of Basic Internet Competency of the Teacher Educators

University	Never (%)	To Some Extent (%)	Completely (%)
GGSIPU	17.38	20.39	62.23
MDU	15.20	27.12	57.68
CCSU	31.72	28.76	39.52
Total	**19.96**	**25.06**	**54.97**

As is seen in Table 3, it can be interpreted that the Basic Internet Competency of the Teacher Educators was 62.23 per cent and

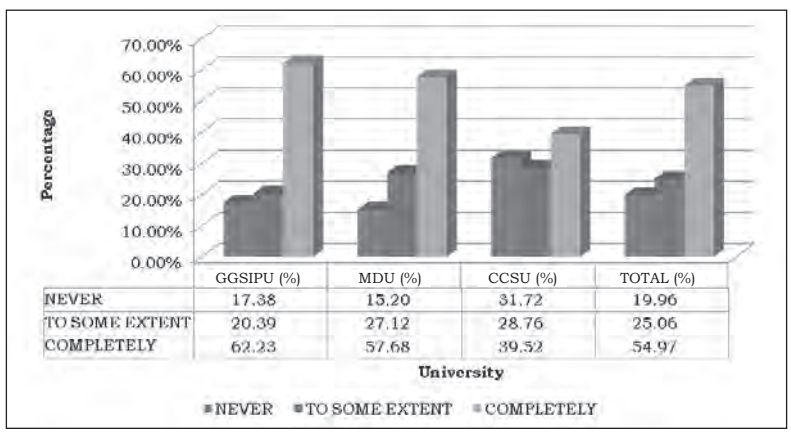

Figure 3. Basic Internet competency of the Teacher Educators

57.68 per cent in two universities that is, GGSIPU and MDU. However, it was only 39.52 per cent in CCSU. If we compare the competencies, then the Teacher Educators of the GGSIPU possess the maximum Basic Internet Competency with little difference than the MDU. The least competency was that of the Teacher Educators from the CCSU. The order of Basic Internet Competency of the Teacher Educators from the three universities was MDU> GGSIPU> CCSU.

From Table 4, it can be interpreted that the average Advanced Internet Competency of the Teacher Educators was very less that is, 18.09 per cent in all the three universities. If we compare the competencies, then the Teacher Educators of the MDU possess the maximum Advanced Internet Competency that is, 19.61 per cent with little difference than the CCSU. The least competency was among the Teacher Educators from the GGSIPU. This shows that the required competency for using E-learning tools is not fulfilled by the Teacher Educators in all the three universities.

Table 4
Percentage Analysis of Advanced Internet Competency of the Teacher Educators

University	Never (%)	To Some Extent (%)	Completely (%)
GGSIPU	46.10	37.94	15.96
MDU	46.24	33.99	19.61
CCSU	56.99	24.19	18.82
Total	**48.77**	**33.07**	**18.09**

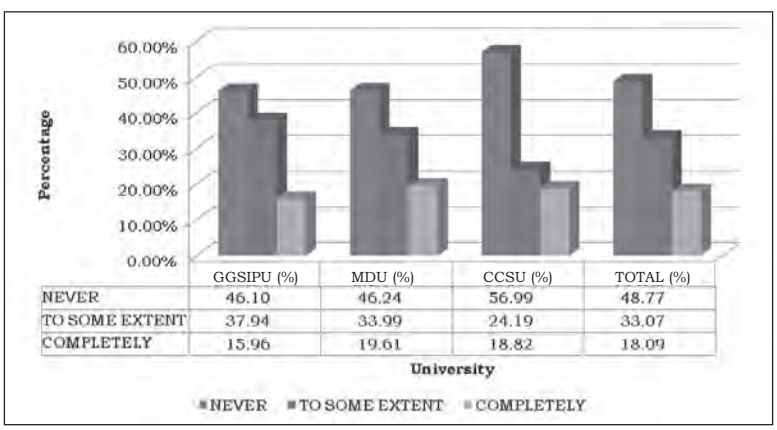

Figure 4. Advanced Internet competency of the Teacher Educators

Table 5
Overall Competency of Teacher Educators towards E-learning Tools

Dimensions of computer competency	GGSIPU (%)	MDU (%)	CCSU (%)	Average competency (%)
Basic Computer Competency	69.86	70.26	53.49	66.09
Advanced Computer Competency	45.74	47.06	31.45	42.83
Basic Internet Competency	62.23	57.68	39.52	54.97
Advanced Internet Competency	15.96	19.61	18.82	18.09

The above results showed that among all the three universities, the Teacher Educators from the CCSU have least competency in using E-learning tools. The Teacher Educators from the MDU were found to be the most competent among the Teacher Educators from the other two universities. It was also revealed that the Teacher Educators were not competent for using E-learning tools as they were very low where the dimension of Advanced Internet Competency was concerned.

further categorised into the following sub-objectives.

- To study the level of Basic Computer Competency of student teachers
- To study the level of Advanced Computer Competency of student teachers
- To study the level of Basic Internet Competency of student teachers
- To study the level of Advanced Internet Competency of student teachers

Table 6
Percentage Analysis of Basic Computer Competency of the Student Teachers

University	Never (%)	To Some Extent (%)	Completely (%)
GGSIPU	16	19	65
MDU	26	25	50
CCSU	26	23	50
Total	**21**	**22**	**57**

Objective 2: To Study the Competency of Student teachers towards E-learning Tools

In order to facilitate the research, the objectives of the study were

As seen in Table 6, it can be interpreted that the Basic Computer Competency of the student teachers was 57 per cent on an average in all the three universities. If we compare

the competencies for a particular university, then the student teachers of GGSIPU possess the maximum basic computer competency of 65 per cent which was higher than the student teachers in the MDU and CCSU, having equal basic computer competency (50 per cent).

teachers was 37 per cent in all the three universities. If we compare the competencies for a particular university, then the student teachers of GGSIPU possess the maximum Advanced Computer Competency with slight difference from the MDU and the CCSU. The order of Advanced

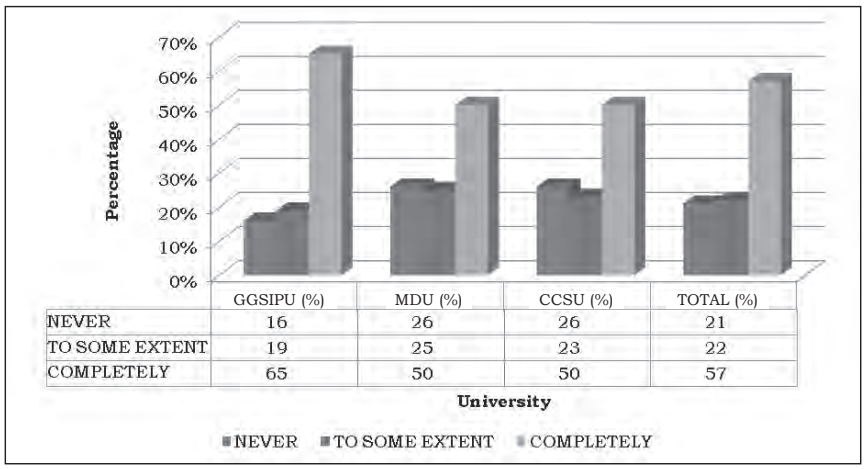

Figure 5. Basic computer competency of the student teachers

Table 7
Percentage Analysis of Advanced Computer Competency of the Student Teachers

University	Never (%)	To Some Extent (%)	Completely (%)
GGSIPU	29	28	42
MDU	43	27	30
CCSU	40	29	32
Total	**35**	**28**	**37**

As seen in Table 7, it can be interpreted that the average Advanced Computer Competency of the student

Computer Competency of the student teachers from the three universities were: GGSIPU>CCSU>MDU.

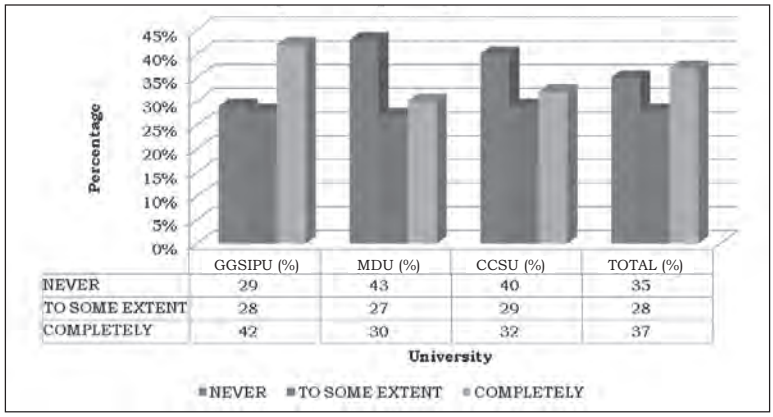

Figure 6. Advanced computer competency of the student teachers

Table 8
Percentage Analysis of Basic Internet Competency of the Student Teachers

University	Never (%)	To Some Extent (%)	Completely (%)
GGSIPU	20	21	60
MDU	39	24	36
CCSU	36	22	42
Total	**29**	**22**	**49**

As seen in Table 8, it can be interpreted that the Basic Internet Competency of the student teachers was 36 per cent in MDU, 42 per cent in CCSU and 60 per cent in GGSIPU. If we compare the competencies for a particular university, then the student teachers of the GGSIPU possess the maximum Basic Internet Competency with a good difference

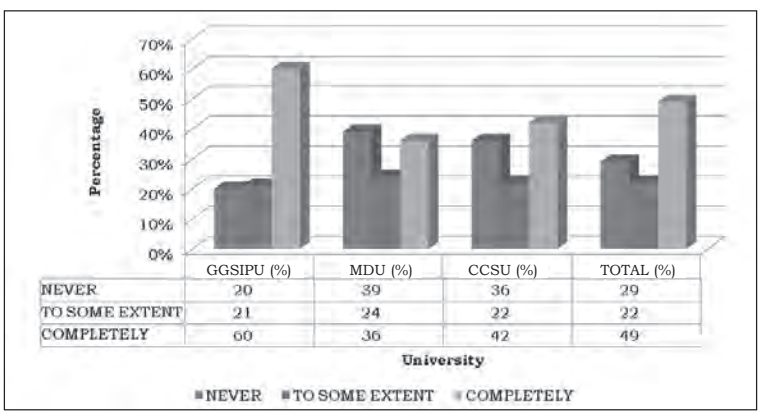

Figure 7. Basic Internet competency of the student teachers

from MDU and CCSU. The least competency was that of the student teachers from the MDU.

compare the competencies for a particular university, then the student teachers of the GGSIPU

Table 9
Percentage Analysis of Advanced Internet Competency of the Student Teachers

University	Never (%)	To Some Extent (%)	Completely (%)
GGSIPU	58	27	15
MDU	67	23	10
CCSU	62	23	14
Total	**62**	**25**	**14**

As seen in Table 9, it can be interpreted that the average Advanced Internet Competency of student teachers was 14 per cent in all the three universities. If we

possess the maximum Advanced Internet Competency with minute difference from the CCSU. The least competency was that of the student teachers from the MDU.

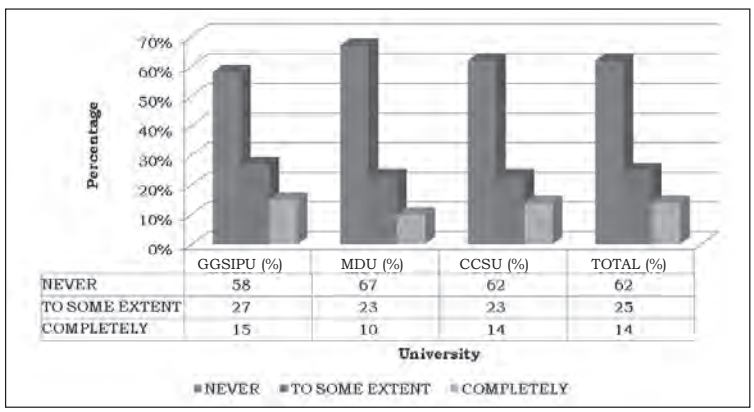

Figure 8. Advanced Internet competency of the student teachers

Table 10
Overall Competency of Student Teachers towards E-learning Tools

Dimensions of competencies	GGSIPU (%)	MDU (%)	CCSU (%)	Average Competency (%)
Basic Computer Competency	65	50	50	57
Advanced Computer Competency	42	30	32	37
Basic Internet Competency	60	36	42	49
Advanced Internet Competency	15	10	14	14

The results show that of all the three universities, the student teachers of the GGSIPU were more competent. It was also indicated that the student teachers of MDU scored very low on the dimension of Advanced Internet Competency, making them less competent to use the E-learning tools.

Discussion on the Findings

The major objective of the study was to assess the competency of the Teacher Educators and student teachers on four dimensions that is, Basic Computer Competency, Advanced Computer Competency, Basic Internet Competency and Advanced Internet Competency which are essential to use E-learning tools effectively.

The findings of the study revealed that the Teacher Educators are most competent on the dimension of Basic Computer Competency, followed by the dimensions of Basic Internet Competency, Advanced Computer Competency and Advanced Internet Competency. From the results, it can be concluded that Advanced Internet Competency which is considered to be a requisite for the usage of E-learning tools is very low. The results are consistent with the study of Das and Sharma 2012; Rajasekar and Vaiyapuri 2007; Rastogi and Malhotra 2013; Johnson 2012 and Parida 2010, who also showed that while the basic computer competency was on an average/good level, the competency of using the Internet was low. Anandan (2013) suggested that the Teacher Educators should acquire the competency of integrating the modern technologies in their practices, so that their student teachers learn to adopt the new practices. The competency is also dependent on other factors such as infrastructure, attitude, etc., as supported by Krishnakumar and Kumar (2011). They concluded that the teachers having access to the Internet within their institution, and both in the institution and at home differ significantly in their familiarity with ICT. This familiarity is more when the facility is available at both the places.

As far as the level of competency of using computer and the Internet among the student teachers is concerned, this may be acquired by them during their graduation or postgraduation (liberal courses) period, or while studying in Teacher Education programme. The competencies of various dimensions were analysed, and it was found that the overall competency in each dimension was 57 per cent, 37 per cent, 49 per cent and 14 per cent, which shows that the student teachers were not much competent to use computers and the Internet. The overall Basic Internet Competency was 49 per cent, and the student teachers were most competent to use email, and download content. The results has been supported by Goel 2006; Gulhane 2011 and Swamy 2012 who showed that the Basic Internet Competency was good/average in

terms of emailing and using search engines. According to Swamy, the students were developing ICT skills by themselves, and they needed more structured support of ICT development from their educational institutions. In line with the results, Parida (2010) and Sarsani (2006) showed that the basic computer competency was more than 50 per cent among the student teachers.

Suggestions

- Though NCTE has provided the Curriculum having the component of ICT but every university should include the latest topics on E-learning tools as per the requirement of new generation teachers and learners.
- E-learning tools should be properly integrated in all the subjects of Teacher Education curriculum of B.Ed. programme, so that the student teachers of all the streams get the competency towards E-learning tools.
- If all the teaching subjects of different languages (i.e. English, Hindi, Punjabi, and Urdu) consist of the components of E-learning tools, then the teaching-learning material in different languages can be developed by the student teachers.
- To increase the competency of Teacher Educators in E-learning tools, the curriculum of M.Ed. should also include the topics related to the concept and also the practical subjects.
- The policymakers should develop some guidelines in which the innovative approaches like blended, flipped learning, online learning in Teacher Education programmes should be elaborated.
- Policymakers should organise various workshops and in-service training programmes at the national level to train the Teacher Educators and the TEIs should also get the funding for this organisation.
- They can organise training programmes in ICT for student teachers who passed out through the various Teacher Education programmes.
- NCTE in collaboration with the state bodies can create some training centres in districts for the training of Teacher Educators and student teachers (both during and after the programme) with the help of Public Private Partnership.
- University can expose teachers for MOOCs on experimental basis for developing professional competency towards E-learning tools.
- The present study revealed that the Teacher Educators are not competent enough to use E-learning tools. So they should get some faculty development programmes in the summer vacations. Proper train-ing should be provided to Teacher Educators to use E-learning tools so that pedagogical approach can be followed.

References

Anandan, K. 2013. Modern Technologies in Colleges of Education (Seminar Paper) on Current Perspectives on Education (Tamil Nadu). Retrieved from http://www.languageinindia.com/feb2013/anandan.pdf

Bhatia, R.P. 2011. Features and Effectiveness of E-learning tools. *Global Journal of Business Management and Information Technology*. Vol. 1, No. 1. pp. 1–7. Retrieved from http://www.ripublication.com/gjbmit/gjbmitv1n1_01.pdf

Das, A., D.K. Banerjee and K. Basu. 2011. Implementation of E-learning in West Bengal to Enhance the Present GER in Higher Education. *International Journal of Innovation, Management and Technology*. Vol. 2, No. 3. pp. 257–261. Retrieved from http://www.ijimt.org/papers/141-M573.pdf

Das, A. and S.K. Sharma. 2012. Impact of Information and Communication Technology Usage and the Perceptions of Teachers of Social Sciences. *Journal of Computer Science Engineering and Information Technology Research (JCSEITR)*. Vol. 2, No. 1. pp. 57–70. Retrieved www.ijirset.com/upload/august/67_The%20Role.pdf

Dogra, B. 2011. Initiating the Indian school Teachers into the OER Movement: A Need Analysis. *COMOSA Journal of Open Schooling*. Vol. 2, No. 2. pp. 21–31. Retrieved from www.nos.org/media/documents/comosajournal/July-Dec2011.pdf

Goel, D.R. 2006. Quality Concerns in Teacher Education. CASE, MSUB, Vadodara.

Gulhane, G.L. 2011. Integrating ICT in Teacher Education. *MIER Journal of Educational Studies, Trends and Practices*. Vo1. 1, No. 2. pp. 197–203. Retrieved from http://www.mierjs.in/ojs/index.php/mjestp/article/view/54

Johnson, N. 2012. Availability and use of ICT among Teacher Educators in Karaikal region. *International Journal of Educational Research and Technology*. Vol. 3, No.1. pp. 37–39. Retrieved from http://soeagra.com/ijert/ijert_march2012/7.pdf

Johri, D. 2009. A Study of ICT using Competencies, Usage Patterns and E-barriers among Teacher Educators and Teacher Trainees. Ph.D., M.J.P. Rohilkhand University, Bareilly.

Krishna Kumar, R. and R.M. Kumar. 2011. Attitude of Teachers' of Higher Education towards E-learning. *Journal of Education and Practice*. Vol. 2, No. 4. pp. 48–54. Retrieved from http://www.iiste.org/Journals/index.php/JEP/article/view/440

Kumar, A.C. 2014. Quality Enhancement of Open and Distance Teacher Education through E-learning 2.0. *Issues and Ideas in Education.* Vol. 2, No. 1. pp. 1–15. Retrieved from http://iie.chitkara.edu.in/pdf/papers/mar_2014/01_IIE_Ajith.pdf

Majhi, S. and B. Maharana. 2011. Familiarity of Web 2.0 and its Application in Learning: A case study of two Indian Universities. *International Journal of Library and Information Science*. Vol. 3, No. 6. pp. 120–129. Retrieved from http://www.academicjournals.org/journal/ijlis/article-abstract/92fcb173105

Mohanty, S.P. and M. Pandua. 2012. Information and communication Technology Literacy among the Higher Secondary Teachers in relation to their Type of Management and Stream: An assessment, *International Journal of Educational Research and Technology*. Vol. 3, No. 2. pp. 119–124. Retrieved from http://soeagra.com/ijert/ijertjune2012/14.pdf

Ministry of Human Resource Development. 2012–2017. *Twelfth Five Year Plan.* Vol. III. Government of India.

———. 2016. *All India Survey on Higher Education.* Government of India.

Musthafa, M.N.M.A. and N.T. Mohammed. 2014. Marching towards Access and Equity in Higher Education – An Exploration of Infinite Possibilities of MOOC. *Issues and Ideas in Education*. Vol. 2, No. 2. pp. 203–216. Retrieved from http://iie.chitkara.edu.in/abstract.php?id=39

Nelasco, S., A.N. Arputharaj and G.A. Paul. 2007. E-learning for Higher Studies of India (Seminar paper) Fourth International Conference on E-learning for Knowledge-based society November 18–19, 2007 (Bangkok, Thailand), 16.1-16.7. Retrieved from http://www.e-learningap.com/eLAP2007/Proceeding2007.htm

2012–2017. Five Year Plan for Teacher Education.

Parida, S. 2010. Utilisation of Information and Communication Technology (ICT) Tools by Staff and Students in Universities. Retrieved from http://www.inflibnet.ac.in/ojs/index.php/KJAS/article/viewFile/1001/905

Rajasekar, S. and R.P. Vaiyapuri. 2007. Higher Secondary School Teachers' computer knowledge and their attitude towards computer. *Journal of All India Association for Educational Research*, Vol. 19, No. (1, 2). pp. 70-76. Retrieved from http://www.ncert.nic.in/publication/journals/pdf_files/indian_education_abstracts/july_2008_IEA.pdf

Rajpal, S., S. Singh, A. Bhardwaj and A. Mittal. 2008. E-learning revolution: Status of educational programs in India. Proceedings of the International Multi Conference of Engineers and Computer Scientists 2008. Vol. 1, IMECS 2008, 19–21 March, 2008, Hongkong. Retrieved from http://www.iaeng.org/publication/IMECS2008/IMECS2008_pp846-851.pdf

Rastogi, A. and S. Malhotra. 2013. ICT skills and attitude as determinants of ICT pedagogy integration, *European Academic Research.* Vol. I, No. 3. pp. 310–318. Retrieved from http://www.euacademic.org/UploadArticle/22.pdf

Sarsani, M.R. 2007. The attitude of teacher student towards the teaching of computer education at B.Ed. level (Seminar paper) on Preparing Teachers for a changing context (UK and China). *I-manager's Journal on School Educational Technology*, Vol. 2, No. 3. pp. 1–21.

Sharma, R.C. and S. Mishra. 2010. Applications of e-tutoring at Indira Gandhi National Open University. In Gary A. Berg (eds), *Cases on Online Tutoring, Mentoring and Educational Services: Practices and Applications*. pp. 85–200. California State University, USA. Retrieved from http://203.128.31.71/articles/1605668761%20Online%20Tutoring1.pdf

Swamy, R.N. 2012. Towards Improving the Quality of Education by Integrating ICT in Teacher Education.*CSI Communications.* March 2012, pp. 19–26. Retrieved from http://csidl.org/bitstream/handle/123456789/289/Towards%20Improving%20Quality%20of%20Edu.pdf?sequence=1

Tripathi, M. and V.K.J. Jeevan. 2010. E-learning Library and Information Science: A Pragmatic View for India. *DESIDOC Journal of Library and Information Technology.* Vol. 30, No. 5. pp. 83–90. Retrieved from http://www.publications.drdo.gov.in/ojs/index.php/djlit/article/download/618/284

Tyagi, S. 2012. Adoption of Web 2.0 Technology in Higher Education: A Case Study of Universities in National Capital Region, India. *International Journal of Education and Development Using Information and Communication Technology (IJEDICT).* Vol. 8, No. 2. pp. 28–43. Retrieved from www.editlib.org/p/42347/article_42347.pdf

UNESCO. 2013. Case Studies on Integrating ICT into Teacher Education Curriculum in Asia. UNESCO, Bangkok.