

Digital Competence: Where do the Higher Education Teachers Stand?

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Abstract Digitalization of higher education includes the use of digital tools and technologies for educational administration, teaching-learning process, evaluation, research, and extension activities. The 21st-century educational landscape is manifested by the key concept of digital competency of professionals in the knowledge area. Education and training, therefore, need to be at a premium, and the role of teachers being very important in imparting education and constructing learning experiences need to be continuously trained and updated. The nature of digital competency is exhilarating as well as requires specific efforts by teachers to adapt the latest technology-based skills. The idea behind the study was to find the answer to the question that where do the higher education teachers stand in this technological era? Thus, the study investigates the level of digital competence among higher education teachers and to find out their level in different dimensions of digital competence. Findings revealed that the higher education teachers under study have an intermediate level of digital competence only 8.44% of higher education teachers have an advanced level of digital competence. Higher education teachers have an intermediate level of digital competence in technological /operational/ instrumental dimension, information processing and management dimension, pedagogic/ knowledge construction dimension, and digital citizenship dimensions of DIGICOMP. The study concludes that higher education teachers may acquire the required knowledge, skills, and competence and elevate their level of digital competence to successfully compete in this technology-driven world.

Keywords Digital Competence (DIGICOMP), Higher Education Teachers, Information Processing and Management, Knowledge Construction, Digital Citizenship

1. Introduction

Digitalization of higher education by integrating ICT (Information and Communication Technology) and related technologies is a notion that can empower the governing bodies to manage the advancement of any educational and managerial plan and reforms in the whole nation and provide service in a much better manner to all stakeholders. In this digitalized world, it is important to build the skill of computer and information technology among the stakeholders of higher education and improve their capacities to make use of the digital resources optimally. Today, students learn facts, skills, knowledge and attitude from computer, internet and social media. Technology has created a significant difference in various processes related to education. Digitalization of higher education includes use of digital tools and technologies for educational administration, teaching-learning process, evaluation, research and extension activities. It provides a way to work together, share resources, coproduce, co-act, and engage in activities that benefit all [1]. Teaching and learning through digital technology are playing an increasingly vital role in assisting teachers meet many of

the expectations of today's technological world by providing innovative teaching tools, access to information, global collaboration opportunities, and alternative ways to professional development consecutively results in the enhancement of educational development of many nations. Technology heralded the development and implementation of new and innovative teaching strategies in higher education. Grand-Clement[2] viewed that there are two main sets of skills: digital and technology skills and the so-called softer skills, which are increasingly needed in order to participate in our digitally connected society. Similarly, From[3] pointed out that education provided by universities and colleges has become ever more digitalized and has resulted in new challenges for university teachers in providing high-quality teaching and adapting to the needs of changing student generations. It is essential to develop a new sense of self-confidence to master technology and digital services (Gallardo-Echenique et al.,2015). Technology offers teachers the keys to unlock a huge world of opportunities available to meet this demand of education system across the world. Educators need to encourage learners to develop the skills, knowledge, ethical frameworks, and self-confidence that will serve them well in the future [4]. One of the most acceptable ways of learning being surfaced now days is learning through digital technology. Technology is constantly acting as a catalyst to revolutionize the education, and for education to keep pace with the rapidly changing technology it is imperative to make technology an integral part of educational system. Individuals with a strong foundation and enhanced understanding of digital technology and innovative processes can be poised for success in 21st century global society.

Digital Competence

The most recent concept used to describe knowledge and skills related to technology is Digital Competence (DIGICOMP). It is an emerging concept. Digital competence consists of various skills and competence; it has a wide scope and covers technology, computing, literacy, media, information and communication. The European Parliament and the Council (2006) has broadly defined it as *"Digital competence involves the confident and critical use of Information Society Technology (IST) for work, leisure and communication. It is underpinned by basic skills in ICT: the use of computers to retrieve, assess, store, produce, present and exchange information, and to communicate and participate in collaborative networks via the Internet."* Digital competence has been acknowledged among the 8 key competences required for lifelong learning by the European Union. The Digital Agenda for Europe 2020 (European Commission, 2010) confirms that digital competence is one of the key competences that are essential for individuals in

knowledge-based society. It further emphasizes to educate their citizens to use ICT and digital media making it essential specially to attract young people towards ICT.

An encompassing definition of digital competence has been given by Ferrari, A. (2012) in her report on DIGCOMP after analysing 15 different frameworks for the development of digital competence. *"Digital Competence is the set of knowledge, skills, attitudes (thus including abilities, strategies, values and awareness) that are required when using ICT and digital media to perform tasks; solve problems; communicate; manage -information; collaborate; create and share content; and build knowledge effectively, efficiently, appropriately, critically, creatively, autonomously, flexibly, ethically, reflectively for work, leisure, participation, learning, socialising, consuming, and empowerment."*

Digital competence is a multidimensional concept which not only consists of a complex integration of technical, cognitive and digital skills but also entails the meta-cognitive processes along with the social, emotional and ethical awareness related to the use and understanding of digital technologies. It refers to the confident, critical and creative use of the complete range of digital technologies to access, store, retrieve, create, share and evaluate information, for effective communication, for problem solving, critical thinking and creative thinking in all spheres of life. So, within the scope of present study, digital competence refers to confident, critical, creative, constructive and ethical use of ICT by the higher education teachers to achieve goals related to academic and research work, employability, learning, inclusion and/or participation in knowledge society. After reviewing various projects and resources related to ICT and digital competence [8, 9, 10 11, 12, 13] researcher identified Four Dimensions of digital competence for higher education which falls within the scope of this study. These are-

- Technological / Operational/ Instrumental dimension refers to the awareness of higher education teachers to the most relevant and common technologies and their ability to decide upon the most appropriate technology according to the purpose and need along with the ability to undertake technological operations independently and to identify and solve technical problems.
- Information Processing and Management dimension focus on the ability of higher education teachers to define information needs, access to information, management, assessment and integration of information, creating and sharing information; ability to browse, search, filter, critically process, evaluate and organise information and store and retrieve it for their personal and professional purpose.
- Pedagogic/ Knowledge Construction dimension of DIGICOMP refers to the awareness of higher education teachers about the use of ICT in the process

of teaching and learning along with their ability to perform tasks related to the process of teaching learning and research through digital tools and technology. It also includes the ability to edit, create and improve content in various multimedia formats, integrate and re-elaborate previous knowledge and content to construct new knowledge. In this dimension, focus will also be on the awareness of higher education teachers about copyright and licences apply to information; IPR and Plagiarism, and their ability to use OER, web 2.0 Tools and Online Research Tools.

- Digital Citizenship dimension is related with the awareness and ability of higher education teachers about the various aspects of digital technology related to ethics, moral, legal, safety, privacy, security, role in society, Health, Environmental concerns and netiquettes.

2. Review of Related Literature

Røkenes and Krumsvik[14] identified eight approaches i.e. collaboration, metacognition, blending, modelling, authentic learning, student-active learning, assessment, and bridging theory/practice gap to promote student teachers' digital competence and educate them in professionally using ICT for their future use in school and classroom teaching in secondary education. In order to affect change in the era of digital education, government, businesses and industry need to work together to ensure the wider accessibility of digital education, including societal inclusion, so that every individual learner, has access to the opportunity for digital learning and the benefits which digital technology can offer in this sector [2]; Training programs and educational softwares have been developed to enhance the digital skills among students [15] as well as for teachers [16] and Collaboration, experiential learning and personal relevance found to support and foster the development of digital information literacy [17]. The studies also revealed that not only students [18, 19, 20, 21] but also the teachers of primary level [22] and university faculty members [23] lack digital literacy, skills and digital competence required in the present digital era. Even the the level of digital competence among digital natives was found to be very low [24]. Digital natives and the digitally competent, skilled users also found to have no awareness about netiquettes [25] and the ergonomic hazards and techno-stress offered by the regular use of computer and internet [26,27]. Researchers recommend well planned and organized training programs related to digital literacy, skills and professional development of higher education teachers; the training models should have digital competences integrated as an intrinsic part

and may base on competence units in the intellectual, social, organizational and cultural fields, guided by critical reflection, and oriented to innovation, knowledge construction and collaboration in a digital society [28,29].

Objectives

1. To determine DIGICOMP of higher education teachers.
2. To determine DIGICOMP of higher education teachers with reference to Following dimensions of DIGICOMP-
 - 1) Technological /Operational/Instrumental dimension
 - 2) Information Processing and Management dimension
 - 3) Pedagogic/Knowledge Construction dimension
 - 4) Digital Citizenship dimension

Delimitations

The sample of the study is limited to higher education teachers teaching in universities located in the Uttar Pradesh (U.P.) state of India. Thus, the conclusions of the study will not to be extended beyond the population sampled.

Design of the Study

The present study was a Descriptive Research as information was gathered from a sample of higher education teachers drawn from a cross section of population of higher education teachers teaching in universities of U.P.

Sample and Sampling Technique - The sample for the present study was selected randomly at two levels. At first level 02 central, 02 state and 02 private (total-06) universities have been selected using random sampling method. and then at second level, 450 higher education teachers have been selected from the earlier selected 06 universities by using simple random sampling method.

Tool used - A self-constructed research questionnaire-Digital Competence (DIGICOMP) Assessment Questionnaire, was used as a survey instruments to assess the digital competence of higher education teachers comprising of four dimensions for this research. The tool was constructed and standardised by following the typical protocol of tool construction, standardization and validation. Norms have also been established for the questionnaire as a whole as well as for each dimension of the questionnaire separately to interpret the findings.

Analysis of Data - The data was analysed through descriptive statistics. Results are shown in the form of frequencies, percentages, mean score and standard deviation.

3. Results and Findings

Result 1- Digital Competence of Higher Education Teachers

The analysis of data revealed that only 8.44% of higher education teachers have advanced level of digital competence whereas 47.56% of higher education teachers have an intermediate level of digital competence and 44% of higher education teachers have beginner level of digital competence as shown in Table 1. Thus, the analysis showed that most of the respondents have intermediate level of digital competence (Fig-1).

Table 1. Level of Digital Competence of Higher Education Teachers

Level of Digital Competence	Frequency	Percentage (%)
Beginner Level	198	44
Intermediate Level	214	47.56
Advanced Level	38	8.44
Total	450	100

The analysis of data further showed that the mean value of digital competence of higher education teachers is 29 as shown in Table- 2 which is very much towards the lower limit of intermediate level range i.e. 25-46. which reflects that most of the respondents of the study have intermediate level of digital competence.

Table 2. Mean Score of Digital Competence of Higher Education Teachers

	N	Mean	S.D.	Interpretation
Digital Competence	450	29	11.87	Intermediate Level

Result 2- DIGICOMP of Higher Education Teachers in Different Dimensions

The dimensions of DIGICOMP are Technological/Operational/ Instrumental dimension, Information Processing and Management dimension, Pedagogic/

Knowledge Construction dimension and Digital Citizenship dimension.

1. It could be observed from Table-3 that most of the respondents under study showed intermediate level of Technological/Operational/Instrumental dimension i.e. 46.44%, whereas 23.11% of respondents showed beginner level and 30.45% of higher education teachers under study showed advanced level of digital competence in of Technological/Operational/Instrumental dimension.
2. Analysis of data revealed that 58.22% of respondents under study showed intermediate level of Information Processing and Management dimension whereas 13.78% and 28% (Fig-2) of higher education teachers under study showed advanced level and beginner level of digital competence respectively in Information Processing and Management dimension.
3. The analysis further exhibited that in case of Pedagogic/Knowledge Construction dimension 45.56% of respondents have showed intermediate level and 42.22% have showed beginner level of digital competence. Whereas only 12.22% of higher education teachers under study showed an advanced level of digital competence in Pedagogic/Knowledge Construction dimension.
4. The study of Digital Citizenship dimension revealed that 50.89% of higher education teachers under study showed intermediate level of digital competence whereas 29.33 have exhibited beginner level of digital competence and very few respondents showed advanced level in this dimension i.e.19.78%.

There is relatively a big difference in the frequency of intermediate level and advanced level of respondents for Information Processing and Management dimension, Pedagogic/Knowledge Construction dimension and Digital Citizenship dimension i.e. 200, 150 and 140 respectively. whereas there is very low difference i.e. 15 is observed in the frequency of beginner level and intermediate level of respondents in Pedagogic /Knowledge Construction dimension.

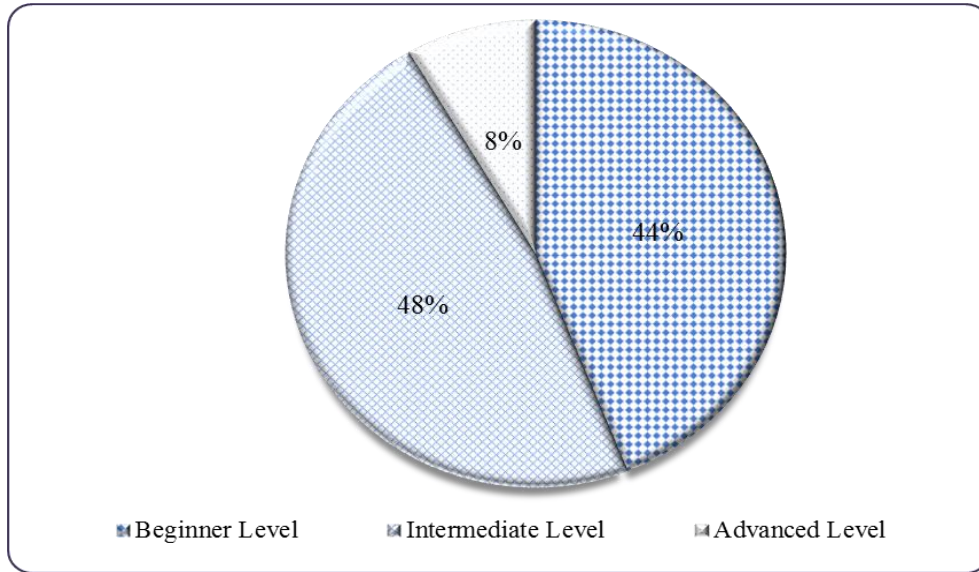


Figure 1. Level of Digital Competence of Higher Education Teachers

Table 3. Level of competence of higher education teachers with reference to dimensions of digital competence

Level	Dimensions of Digital Competence							
	Technological / Operational/ Instrumental		Information Processing and Management		Pedagogic/ Knowledge Construction		Digital Citizenship	
	f	(%)	f	(%)	f	(%)	f	(%)
Beginner Level	104	23.11	126	28	190	42.22	132	29.33
Intermediate Level	209	46.44	262	58.22	205	45.56	229	50.89
Advanced Level	137	30.45	62	13.78	55	12.22	89	19.78
Total	450	100	450	100	450	100	450	100

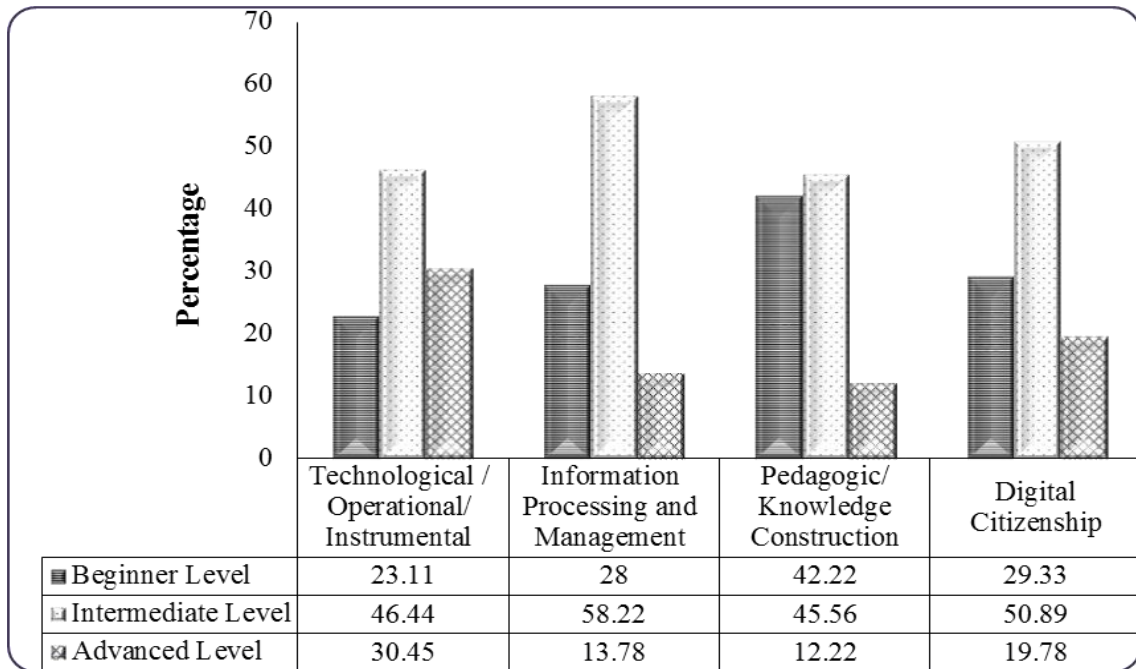


Figure 2. Level of competence of higher education teachers with reference to dimensions of digital competence

Table 4. Mean Score of dimensions of digital competence of higher education teachers

Dimensions of Digital Competence	N	Mean	S.D.	Interpretation
Technological / Operational/ Instrumental	450	7.89	3.92	Intermediate level
Information Processing and Management	450	7.83	3.24	Intermediate level
Pedagogic/ Knowledge Construction	450	5.51	2.96	Intermediate level
Digital Citizenship	450	7.52	3.05	Intermediate level

Further analysis of data expressed in table- 4 demonstrates that the mean score of Technological / Operational/ Instrumental dimension is 7.89, of Information Processing and Management dimension 7.83 and that is of Digital Citizenship dimension 7.52; all of these falls within the range of intermediate level of skills i.e. 5-10, 6-11 and 5-11 respectively. The mean score of Pedagogic/Knowledge Construction dimension is 5.51 which is very much closer to the lower limit of intermediate level i.e. 5-9. Thus, it could be concluded from the analysis of data shown in Table 4 that higher education teachers have intermediate level of competence in all the four dimensions of DIGICOMP.

4. Discussion

Results obtained from the first objective of the study depict that 47.56% of higher education teachers have an intermediate level of digital competence which is in accordance with the findings reported by [30] that 45% of the users are intermediate users which means that they work in cyber ethos to fulfil their main purpose only. However, it has been also revealed from the study that 44% of higher education teachers have beginner level of digital competence which is slightly lower than the percentage of respondents of the intermediate level; this result is in contrast with the findings reported by [30] where only 22% users were found to be beginners. Present study further revealed that 8.44% of higher education teachers have advanced level of digital competence which in comparison to the survey conducted by *NCES* (National Centre for Educational Statistics) is poor, according to *NCES* 49% are active and advanced users of computer and internet; similar results were conveyed by **Gibson & Oberg [31]** and **Khare and Dangwal [30]** which stated that around 33% and 30% users respectively are advanced and proficient internet users. The respondents of the study includes both digital immigrants and digital natives; as digital immigrants may not feel comfortable working on computer and internet while digital natives are comparably more confident and may work comfortably on computer and internet without much guidance from others, they prefer to go online for all their daily activities, regular work and to keep themselves updated by acquiring more in depth knowledge; it may be a reason because of which 44% of higher education teachers have beginner

level of digital competence.

Further the analysis of data in terms of dimensions of digital competences showed that higher education teachers have an intermediate level of competence in Technological / Operational/ Instrumental dimension, Information Processing and Management dimension and Digital Citizenship dimension whereas in Pedagogic/ Knowledge Construction dimension it just crosses the range of beginner level and reaches the lower limit of intermediate level, Pedagogic/ Knowledge Construction dimension is one of the essential aspect of digital competence for teachers as it provides them the ease and comfort in using digital technology with sheer effectiveness and efficiency. Many researchers viewed that in the present digital age, it has become essential to include information and digital competence training in higher education as over the decade, virtual spaces have taken on a greater degree of protagonist in higher education and created different parts of educational approaches such as e-learning, web-based teaching, blended learning etc.[32]; these new technologies point towards a “teaching culture revolution”[33]; **Grünwald et al. [23]** The most important digital competence areas which need to be developed include creating and editing digital material, using different classroom technologies, finding and using different learning tools and evaluating students’ performance in digital learning environments, using blogs and wikis, social bookmarking, finding authentic web-based content, using video and audio content, understanding privacy and copyright issues. Digitalization has increasingly introduced a new dimension in teachers’ pedagogical skills and competences which may be termed as Pedagogical Digital Competence (PDC) [3]; to provide rich, diverse and flexible learning opportunities to digital generation; the use of electronic fundamentals like multimedia, productivity applications, cloud computing, etc has become a necessity. Adoption of Digital Pedagogy which moves the focus from only ICT tools and skills, to a mode of working in the digital world may assist every teacher to ensure technological integration, pedagogy and subject area content effectively in their classroom teaching. [34]

5. Conclusions

To successfully sustain in the contemporary

competitive environment life-long learning has become a driving force. Consequently, to fortify and advance this knowledge-driven growth, new technologies, skills and competences are needed. The present study provides the knowledge about the level of digital competence of higher education teachers that they have in this technological era; it showed that higher education teachers have an intermediate level of digital competence whereas in terms of dimensions of digital competences, the study revealed that higher education teachers have an intermediate level of competence in Technological / Operational/ Instrumental dimension, Information Processing and Management dimension and Digital Citizenship dimension, and reaches the lower limit of intermediate level in Pedagogic/ Knowledge Construction dimension. They may acquire the required knowledge, skills and competence and elevate their level of digital competence to successfully compete in this technology driven world. ICT has become the centre of learning and it has the potential to drive innovative and effective ways of teaching-learning and research; integration of multimedia, simulation tools, digital learning tools, online research tools, digital libraries; easy and instant access of information generates greater opportunities which were otherwise not feasible. There are better possibilities to improve quality of higher education through these innovative tools; teachers are required to facilitate learning in multiple modalities—greater diversity of spaces, resources, methods for learning, and most importantly inclusion of digital media. Technological progressions are considerably faster than our abilities of acquiring, acquaintance and competence; hence its maximum utilization in the field of education depends on how much we keep abreast with new trends of technology.

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