

Integrating Digital Literacy Skills and Technological Intelligence in the Higher Education Curriculum of India: A New Paradigm

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ABSTRACT

Background: The twenty-first-century learners can be termed as digital natives and therefore, any discussion on the pedagogies and curriculum must concentrate on integrating digital literacy skills and the teaching and learning materials must focus on the development of the technological intelligence of the learners. The principal apprehension for all the educationists and curriculum planners is how to transform and modify higher education for preparing the learners of this century to more effectively cope with the challenges of today's labor market.

Purpose: The paper aims to answer two key questions facing higher educational educators are those of: (i) what is the present status of higher education in preparing the graduates with the necessary skills and competencies for 21st-century skills, and (ii) how can the present education system integrate the digital and technological intelligence in the curriculum?

Methods: Exploration of the current Indian higher education curriculum and critically analyzing the results of various studies conducted in a similar area and by analyzing newspapers, educational policies, public survey results, and literature regarding the trends and developments in the higher education academia.

Results: This disposition visualized the possible challenges and suggests practical measures to solve the problems and demand for a new paradigm where there is symbiotic integration of digital literacy skills and technological intelligence is highlighted.

Conclusion: There is a great need for updating and transforming the curriculum and pedagogic approaches in tune with the learning styles and demands of the learners.

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1. Introduction

Higher education is always playing a proactive role in transforming the society in every country, and therefore the higher education curriculum can be considered to be the framework and design which enables to draw the path of development (Filho et al., 2018). As the world changes due to the advancement of technology and communication, it is evident that the nature and functions of society will also change. This is a natural process that takes place in due course of time. When people and society change, as per the need of the time, the essential thing is that the stakeholders must envisage reforming the higher education curriculum (National Curriculum Framework, 2005). What is important is that mere application and insertion of ICT in the curriculum will not be sufficient, but we must develop a digital and technological culture among the students. The digital

natives and digital migrants must be well equipped with digital literacy skills by developing technological intelligence. The curriculum must encompass the basic rudiments which promote a new paradigm of synchronization of both these variables: digital literacy skills and technological intelligence (Prensky, 2001; Lai, 2011; Scott, 2015; Varghese & Gardia, 2020).

The theoretical background of the paper is the partnership for 21st century skills (P21) in which the digital skills have been enlisted as one of the skills set for the 21st century skills and the technological intelligences as one of the prime intelligences for the 21st century leaders as mentioned in the Contextualized Multiple Intelligences theory proposed by Prof. Yin Cheong Cheng, Centre Director, Centre for Research and International Collaboration, Hong Kong Institute of Education. Digital skills and technological intelligences

are the essential components for successful living in the 21st century.

2. Methodology

This paper aims to critically discuss the present status of higher education with special reference to the Indian context in enabling the learners with digital skills and promoting technological intelligences. In doing so, the authors critically examine the Indian higher education curriculum which gives an emphasis on grades and scores than skills integrations and the significance of digital literacy skills as mentioned in the Partnership for 21st-century skills, 2006. Hence the objectives of the present study were (1) to analyze the Indian higher education system in the context of preparing students with digital skills and technological intelligences, and (2) how to incorporate the digital skills and technological intelligences in the higher education curriculum. The method for data gathering and analysis was done by critically analyzing the results of various studies conducted in a similar area and by analyzing newspapers, educational policies, public survey results, and literature regarding the trends and developments in the higher education academia. A procedure is followed to discuss the status of higher education in enabling the learners with digital skills and promoting technological intelligence. The procedure is surveyed in three steps: a) Present status of higher education in preparing the graduates with 21st-century skills; b) Incorporation of digital literacy skills and technological intelligence in the curriculum; c) Suggestive road map for digital skill integration (includes: ICT Skills enhancing courses, and Co-curricular activities).

3. Results and Discussions

3.1. *The Present Status of Higher Education in Preparing the Graduates with 21st Century Skills*

The twenty-first century is termed as the knowledge era in which knowledge has become the driver of economic growth and led to a major transformation in work and other practices. The digital revolution of the present time eventually led to the different challenges before the whole education system along with the emerging need for new kinds of digital literacy skills. As India tries to enter a globalized economy in fields that need

highly trained professionals, the excellence of higher education becomes increasingly significant. We can observe from other developing countries that they are always upgrading their higher education curriculum from time to time in terms of technology with the aim of developing world-class universities (Lee, 2013). It feels so pathetic that the present system of higher education and the higher education curriculum does not serve the purpose for which it has been designed. Therefore, the downsides of the higher education curriculum emphasize the need for reforms to develop it worthy and beneficial to all. Most stakeholders approve that Indian higher education confronts major challenges and issues in both quantitative and qualitative ways because of its lack of innovation and research outlook, scientific temper, and quality assurance (Agarwal, 2006; Sharma, 2020). Now there is a pressing demand to work for the improvement of all the educational segments to face the need of the evolving opportunities and challenges of the 21st century.

The most terrific situation before the Indian higher education is that it fails to develop a curriculum or programme of learning in the context of the twenty-first century when the concerns of technology with its latest advancements, ecology, the welfare of humanity and the planet is equally significant, and it is only a curriculum which relates and joins all these concerns and addresses them through critical thinking that will help us to make a crucial breakthrough (Agarwal, 2006; Colwill & Gallagher, 2007). The outcome of the curriculum must have a technological effect, and hence the students should be able to possess digital skills, which will gradually sprout a digital culture among the learners.

Higher educational curriculums are envisaged to prepare the learners to attain the knowledge, skills, and competencies precisely for the specific career irrespective of gender, castes, and regions. But a closer look into the Indian higher education enrollment in the professional courses, there is visible gender disparity remains. The All-India Survey on Higher Education (AISHE) (2019) data clearly indicates that enrolment in professional courses is more in the private institutions than in the government-funded higher education institutions both at under graduation and at the post-graduation levels. The female enrolment in professional education is low when compared with their enrolment in the social science and humanistic subjects both at under-graduate and post-graduate

levels. This gap is comparatively higher in enrolment in professional courses in private institutions as mentioned in Figure 39 (AISHE, 2019).

When we highlight the issues and challenges of higher education curriculum, there are other basic problems facing higher education in India today that must be dealt with here. They are insufficient infrastructure and facilities, a number of vacancies in faculty positions, low enrolment rates of the students, outdated teaching methods, deteriorating research standards, unmotivated students, congested classrooms, and widespread geographic and also ethnic imbalances. Many colleges in rural areas are non-viable and less enrolled and also have very poor infrastructure and facilities having a few teachers (AISHE, 2019). The percentage of institutions having various Infrastructure facilities for skills development is presented in Table 1 which is self-explanatory.

Some of the important challenges before the higher education system are the need for continuous up-gradation of the curriculum in order to be on par with the fast development of science and technology; globalization and the subsequent competitions from the international universities; implementing ICT in higher education policy will not be able to totally overcome all these issues though it may play a salient role in information and resource sharing. This type of challenge can be, to an extent, diminish if the government makes a policy of education that stresses the importance of inculcation of technological methods of transacting curriculum (Agarwal, 2006). SWAYAM is such a type of endeavor where we see the whole educational transaction is done digitally. Hence, upgrading higher education through digitalization and enabling the students and teachers to be sensible users of digital technology and ICT is the need of the time (Çebi & Reisoğlu, 2020; Sharma, 2020). What we need is the up-gradation of the curriculum, which encourages a generation of learners who are digitally literate and technologically intelligent. Therefore, we can assume that technological intelligence and digital literacy skills would enable the learners to develop a digital culture in their learning environment. Now it is the demand of the time to modernize and upgrade our education curriculum so that our higher education system can be advanced and thereby the country can get more technically graduated young people who can help our country to a developed nation. Therefore,

it has been observed that there is a great want for revolution in higher education, and that is possible only through a perfect synchronization of digital literacy skills and technological intelligence in the higher education curriculum.

Table 1: Percentage of Institutions having various Infrastructures (AISHE, 2019).

Infrastructure	University	College	Stand Alone Institutions
Computer Centers	90	86	90
Connectivity NMEICT	39	22	20
Skill Development Centre	59	47	49
Capacity Building and Training Aware Programme Conducted	56	43	47

3.2. Incorporation of Digital Literacy Skills and Technological Intelligence in the Curriculum

There is a pressing demand for preparing and enabling the youth to effectively address the challenges of the 21st century, and hence the policymakers and curriculum planners of higher education should consider seriously regarding this issue (Dwyer & Wyn, 2001). This poses challenges before the educators, and the problems faced by the policymakers and other stakeholders are the uncertainties and ambiguities in the globalized world for reforming the higher education curriculum. The advancements in the ICT have again accelerated the educational changes and unlimited opportunities in life-long learning (OECD, 2005; Çebi & Reisoğlu, 2020). Therefore, there is an urgent need to develop a new paradigm for higher education where there is proper synchronization of digital literacy skills and technological intelligence.

Digital literacy skills encompass more than the mere skill to use software or operate a digital device but they include a large diversity of complex cognitive, motor, sociological, and emotional skills, which learners must possess to function effectively in digital environments (Leahy & Wilson, 2014). This newly emerging concept of “digital literacy” may be utilized as a measure of the quality of learners’ work in digital environments and provide scholars with a

more effective means of communication in designing better user-oriented environments. Digital literacy skills simply mean the effective and appropriate use of technology. It includes information, media, and information and communication literacy (Trilling & Fadel, 2009).

Information Literacy-The implication of information literacy in the life of a 21st-century learner is due to the abundance of information available to him/ her. The teachers, students, and parents have access to the enormous depository of information at their fingertips. Hence, the challenge is how to deduce and understand the genuineness and validity of the knowledge which is readily available. Henceforth, to be 'information literate' would mean the possession of information skills to locate, analyze, assess and use correct and valid information from authentic sources. In higher education, where the student is expected to be a self-directed learner, the learners have to make sure the information they use is credible, accurate, and reliable (Trilling & Fadel, 2009). They must have the ability to select the most significant and valuable information and the ways through which they can consolidate and exhibit it to others for their use.

Media Literacy- the nature of 21st-century learning is connecting, creating, and contributing the knowledge by the learner. Hence the learners who are bounded by digital media and technologies need to understand how to use the resources they receive from various media and use media production apparatuses to create enthralling media products and messages (Trilling & Fadel, 2009). Hence media literacy skills enable a person to access, examine, and produce messages and information in multiple ways. When learners are encircled by various kinds of media messages, they need to know how to effectively make use of the media resources available to them for their learning. In this context, Partnership for 21st century skills (2010) explains media literacy as the ability to analyze media and create media products. The ability to analyze media messages means examining the methods of how people interpret and understand the media messages and the creation of media products means the ability to use various media creation tools.

Information and Communication Technology Literacy is an indispensable skill of the 21st century. The 21st-century learners have been growing up

digital from their childhood onwards, surrounded by digital media from birth (Trilling & Fadel, 2009; Leahy & Wilson, 2014). In most of cases, the present day learners are very efficient in applying digital technology than their parents and teachers; even then they will need guidance on how to make use of and incorporate rightly for their learning purpose (Aabla, 2017). Hence, a curriculum designed for them must incorporate methods of how to exploit the new ICT tools to provide better education in the way the learners want is the application of technology as a prime tool for learning, teaching, and communication in real-life situations. This skill implies the application of technology and communication networks for accessing, managing, and creating knowledge (CBSE, 2020). ICT literacy skill enables a person to use information and communication tools, social media, and internet facilities to access, manage and use for effective functioning in the knowledge economy.

These digital literacies are also powering the learning styles of learners and are essential to prepare a learning approach in the modern educational scenario (Trilling & Fadel, 2009, Varghese & Musthafa, 2021).

Digital literacy skills are totally based on the level of technological intelligence within a person. Why is technological intelligence important? It is because different parts of the world are now in the process of globalization in technological and learning aspects. The world is moving very fast to become a global village, in which India is rapidly networked and globalized through various types of technological intelligence and communications in educational settings. In this context, the level of intelligence of the learners to grasp and operate the latest technological influxes must be improved. The aim of the present era higher education curriculum must be redesigned to produce the technological person who is endowed with technological intelligence. It refers to the ability of the learners to think, act and manage technologically and maximize the benefits of various types of technology. As a result, the graduates may become technologically intelligent leaders who can contribute to the technological development of society. Technological intelligence is a prerequisite and essential factor for the development of digital literacy skills. And the latter enhances the technological intelligence in the learners (Cheng, 2000).

Hence, it is noticed that there is a critical need for the addition of digital literacy skills and methods to improve technological intelligence in the curriculum. For that, it is essential to integrate the teaching, innovation, and research components for enhancing the professional competence of graduating students. Further observed that it is essential to provide congenial conditions for promoting the creative thinking ability amongst the students. Also, there is a requirement for flexibility in the curriculum for meaningful learning outcomes which is the need of the hour for creating human resources with better employability.

3.3. Suggestive Roadmap for Digital Skill Integration

The present world scenario and educational needs of the graduates in higher education settings are entirely different from that of the previous century. The skills needed to compete in the 21st century are much more complex and compound in nature (Kay & Greenhill, 2011). Hence a curriculum that is constructed for the learners of this century must incorporate the elements, competency, and skills needed for surviving the challenges of this century. The chief purpose of designing a higher education curriculum is developing self-sufficient and complete human beings (Barr & Tagg, 1995). Therefore there needs a total reformation and redesigning of the curriculum for the digital natives in which digital literacy skills and technological intelligence must be given priority. For this, the following measures can be given primacy:

In this century, the graduates from higher education should not be confined to mere technicians or experts of certain areas but are intelligent leaders and citizens for the development of society. They must be technologically intelligent leaders because the total nature of the century is oriented towards digitalization (Cheng, 2000). Therefore the higher education curriculum for the 21st century must focus on developing critical thinking, creativity, and innovation. This happens through collaborative and teamwork educational settings in which communication, information, and media literacy skills are incorporated (Kay & Greenhill, 2011; Pushpanadham, & Chirumamilla, 2017).

The digital literacy skills and technological intelligence integrated curriculum help in achieving educational goals more precisely and accurately. By

integrating technology, teachers and learners find themselves capable of finding out one's teaching methods and learning styles. The introduction of ICTs in higher education has large implications as it makes education more accessible, interesting, efficient, and innovative. But the mere use of software, PPTs, audio-video materials while teaching is not the proper way. Hence appropriate directions are necessary to enable the learners and teachers to be ethical digital natives and make a clear understanding of the digital culture of the 21st century and it will intensify the learning experiences among the learners.

The traditional higher education curriculum was never flexible and did not have any concern for individual differences. Similar contents were provided to all the students irrespective of their individual differences and compelled them to learn the things the way the teachers decide. As a result, the main aim of higher education regarding the development of critical thinking, creativity, and productivity lags behind. But this issue can be effectively handled by redesigning the higher education curriculum with synchronizing digital literacy skills and technological intelligence. This approach will lead to designing various courses in online mode, the model which the digital natives would easily grasp and appreciate which will reduce the limitations of individual differences, promotes various learning styles, and enhances interest among the learners.

Technology infrastructure will be the topic of discussion in the educational scenario in the future. Good computing, networking, and connectivity infrastructure for higher education institutes are essential for the higher education courses to be carried out in this century. In the coming years, to bridge the digital divide among educational institutions and students, the curriculum must impose the relevance of the digital aspects in it. This would mean a simpler digital and technological environment must be created in each and every educational institution (Cheng, 2000).

The question of how to integrate these skills in the higher education system is very relevant and for that, there need various approaches. The approaches include developing a curriculum incorporating 21st-century skills and digital skills having a special reference, implementing skills-centered pedagogy in higher education institutions, nurturing digital skills

through various co-curricular activities, etc. Some of the approaches are the following:

- **ICT Skills enhancing courses-** the maximum development of the skills like learning, life, and digital skills can be enhanced through the proper application of 21st-century skills in the curriculum. This demands skills-based courses at the level of higher education. Webb (2002) viewed that ICT literacy including the awareness, skills, and application of information and communication technology must be nurtured through teaching ICT as a separate skill-based course. In a broader term, learn ICT as a subject, learn with the help of ICT, and apply ICT as a tool for learning. In all cases we make the learners master the digital literacy skills.
- **Competency centered pedagogy-** if there is a framework to promote innovative and integrated methods of applying digital skills in the teaching, learning, and daily life practices, to an extent, the ICT skill deficiency of the youth can be reduced. A competency-based approach would definitely allow the learners not only to attain subject mastery but also enable them to use these skills to access, manage, evaluate, and reuse the information that is available in the knowledge repositories.
- **Co-curricular activities-** as the common notion about learning is that most of the knowledge attainment happens outside the classroom, the relevance of co-curricular activities may help to enhance digital literacy skills among the learners. The extracurricular activities must be designed in such a way that the learners must have the opportunity to get mastery in online education and enrichment in the use of various digital technologies.

Finally, it is stated that considering the above ICT skills enhancing courses, competency-centered pedagogy, and co-curricular activities, the digital & technological skills have been incorporated in the higher education system.

Conclusion

Through information and communication technologies, the world in the twenty-first century has experienced a knowledge explosion. As a result, there are number of job opportunities, and transformations in the economic and educational areas happen abruptly. This also makes the entire world to face complex business, political, scientific, health, and environmental problems. Therefore, there is a great need of a new generation who can realize the various upcoming opportunities and possibilities and act according to the demands of the century.

The higher education curriculum of the 21st century must focus on various means to connect and enrich learners rather than stagnating on certain thoughts and ideas. It must enhance collaboration and assure learning outcomes to create knowledge rather than simply transmitting knowledge (Kay & Greenhill, 2011). The prime duty of educational agencies of government is to understand the changing needs of the learners and respond to the local and global trends in education. By revising and updating the curriculum, introducing new programs and by promoting technological advancements in education, the educational authorities can make students future-ready because the digital revolution has hit education greatly, with more and more classrooms plugged into the whole online world. But are our educational institutions making benefit of most of the new technologies? Rethinking education in the age of technology would definitely make it possible that the knowledge revolution has transformed our education system, our lives, and therefore we must also transform our education system. To keep pace with a globalized technological culture, we must rethink how we educate the next generation, or else India will be 'left behind. The higher education curriculum of the present century must go well beyond the walls of the classroom in order to comprise online social networks, distance learning with 'anytime, anywhere access, digital homeschooling models, online learning environments, and more.

After going through the current Indian higher education curriculum and critically examining the results of development in the higher education academia through various studies (educational policies, research studies, public surveys, etc.). It is concluded that there is a vital necessity for updating and transforming the curriculum and pedagogic methods in tune with the learning styles and demands of the learners.

Authorship contribution

The first author has selected the topic for the study, reviewed various related literature and drafted the manuscript under the guidance, suggestions, and supervision of the second author.

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Conflict of Interest

There is no conflict of interest

Declaration

It is an original data and has neither been sent elsewhere nor published anywhere.

References

- Aabla, B. (2017). A Review on 21st Century Learning Models. *International Interdisciplinary Journal of Education*, 6(1), 254-263. <https://doi.org/10.12816/0037231>
- Agarwal, P. (2006). Higher Education in India: The Need for Change, Working Paper, No. 180, *Indian Council for Research on International Economic Relations (ICRIER)*, New Delhi. https://eaber.org/wp-content/uploads/2011/05/ICRIER_Agarwal_2006.pdf
- AISHE. (2019). All India Survey on Higher Education (2018-19). Retrieved from <https://ruralindiaonline.org/en/library/resource/all-india-survey-on-higher-education-2018-19/>
- Barr, R. B., & Tagg, J. (1995). From Teaching to learning: A new paradigm for undergraduate education. *Change*, 27(6), 13-26. <https://doi.org/10.1080/00091383.1995.10544672>
- CBSE. (2020). 21st century skills: A Handbook: New Delhi, Central Board of Secondary Education. Retrieved from: https://cbseacademic.nic.in/web_material/Manuals/21st_Century_Skill_Handbook.pdf
- Çebi, A. & Reisoğlu, I. (2020). Digital Competence: A Study from the Perspective of Pre-service Teachers in Turkey. *Journal of New Approaches in Educational Research*, 9(2), 294-308. <https://doi.org/10.7821/naer.2020.7.583>
- Cheng, Y. C. (2000). A CMI-Triplization paradigm for Reforming Education in the New Millennium. *International Journal of Educational Management*, 14(4), 156-174. <https://doi.org/10.1108/09513540010371975>
- Colwill, I., Gallagher, C. (2007). Developing a curriculum for the twenty-first century: the experiences of England and Northern Ireland. *Prospects*, 37, 411-425. <https://doi.org/10.1007/s11125-008-9044-3>
- Dwyer, P. & Wyn, J. (2001) *Youth, Education and Risk: Facing the Future*. Routledge Falmer, London.
- Filho, W. L. et al. (2018). The role of transformation in learning and education for sustainability. *Journal of Cleaner Production*, 199, 286-295. <https://doi.org/10.1016/j.jclepro.2018.07.017>
- Kay, K. & Greenhill, V. (2011). "Twenty-First Century Students Need 21st Century Skills". In G. Wan, D. M. Gut (Eds.), *Bringing Schools into the 21st century, Explorations of Educational Purpose 13*. New York: Springer
- Lai, K. W. (2011). Digital technology and the culture of teaching and learning in higher education. *Australasian Journal of Educational Technology*, 27(8). <https://doi.org/10.14742/ajet.892>
- Leahy, D., & Wilson, D. (2014). Digital skills for employment. In D. Passey, & A. Tatnall (Eds.). *Key competencies in ICT and informatics: Implications and issues for educational professionals and management* (pp. 178-189). Berlin Heidelberg, Germany: Springer.
- Lee, J. (2013). Creating world-class universities: Implications for developing countries. *Prospects*, 43, 233-249. <https://doi.org/10.1007/s11125-013-9266-x>
- NCERT. (2005). National Curriculum Framework 2005, New Delhi: National Council for Education Research and Training. Retrieved from: <https://ncert.nic.in/pdf/nc-framework/nf2005-english.pdf>
- OECD. (2005). The Definition and Selection of Key Competencies: Executive Summary. Retrieved from <https://www.oecd.org/pisa/35070367.pdf>
- Partnership for 21st Century Skills. (2010). 21st Century Readiness for Every Student: A Policymaker's Guide. Retrieved from: <https://files.eric.ed.gov/fulltext/ED519425.pdf>
- Premsky, M. (2001) Digital natives, digital immigrants, part 2. *On the Horizon*, 9(5), 1-6.
- Pushpanadham, K. & Chirumamilla, N. (2017). Scaffolding Learning in Higher Education: Some Digital Initiatives. *University News*, 55(51), 14-19.
- Scott, L. C. (2015). *The futures of learning 2: What kind of learning for the 21st century?* Paris: UNESCO Education Research and Foresight.
- Sharma, S. C. (2020). 'Inducing quality and relevance in Indian higher education institutions some thoughts' in Pankaj Mittal and Sistla Rama Devi Pani (Eds.). *Reimagining Indian Universities*. New Delhi: Association of Indian Universities.
- Trilling, B., & Fadel, C. (2009). 21st century skills: Learning for life in our times. San Francisco, CA: Jossey-Bass
- Varghese, J. & Gardia, A. (2020). Heutagogic Approach in Teaching and Learning in SWAYAM. *Education India Journal: A Quarterly Refereed Journal of Dialogues on Education*, 9(1), 42-50.
- Varghese, J., & Musthafa, M. A., (2021). "Investigating 21st Century Skills Level among Youth." *GiLE Journal of Skills Development*, 1(2), 99-107. <https://doi.org/10.52398/gjsd.2021.v1.i2.pp99-107>
- Webb, M. E. (2002). Pedagogical Reasoning: Issues and Solutions for the Teaching and Learning of ICT in Secondary Schools. *Education and Information Technologies*, 7(3), 237-255.



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