Review Article

Digital Inclusion in Education: Mapping and Management

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Abstract

Digital technologies have an impact on transforming learning and literacy in combination with other social and economic factors. This impact implies future complexities in relation to digital inclusion. Digital inclusion in education is understood as a blend of issues on digital literacy, digital skill, and the digital divide. In this paper, mapping and management of issues of digital inclusion in education are discussed. Reviews related to access to technology and outcomes of the internet and technology used to obtain the skills are discussed to understand the grounds of digital inclusion. Digital-related determinants such as ICT experience, ICT use, and ICT training are mostly covered in 21st-century digital skills studies. Mapping of digital inclusion is strongly related to socioeconomic background, race, and gender as one dimension, the gap between capacities, abilities among low and high educated students as second dimension and the differences in outputs among students in terms of access, usage, motivation, and skills as the third dimension. Management of digital inclusion needs to be undertaken on why students are not able to evaluate and integrate digital information effectively, to critically judge the suitability of a large amount of information online, to understand the ethical and social usage of information, to interpret the reference to a paper and journal, to search databases effectively, to determine the validity of the information found online and understanding copyright issues.

Keywords: Digital literacy, Digital Skills, Digital Divide, and Digital Inclusion

Introduction

Technology has revolutionised the way we work & think and give opportunities to access the world. The power of technology is being experienced by the increasing number of educators. The increase of digitalisation in its various spheres like information, communication, social relations, entertainment, education, and economy is producing what several authors have called 'industrial revolution' (Clark, 2005). There is a rapid growth of industry due to digital interference. The focus is on making technology central to enabling change (NDLM, 2019).

In this technologically loaded world, students need to acquire more skills, adaptability to prepare them for the future workplace. So, the future of education is digital. The rapid diffusion of new technologies impacts the nature of learning and literacy. Digital technologies have an impact on transforming learning and literacy. Technology transforms learning and literacy not only by itself but also in combination with other social and

economic factors. This transitional stage implies that the future of learning in the 21st century will be quite complex. One of the complexities relates to digital inclusion.

Digital inclusion along with related terms such as digital equality and digital equity is used to emphasise the interrelated processes in determining the extent to which students are digitally included. The issues through interconnected means of digital inclusion are mapped in figure 1. Digital inclusion in education is understood as a blend of digital literacy, digital skill, and the digital divide. In this paper, mapping and management of issues for digital inclusion in education are discussed.

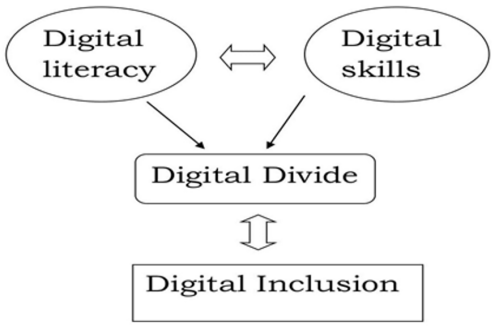

Figure-1: Interconnected Means of Digital Inclusion (Author's Conceptualisation) Digital Literacy (DL)

Digital literacy is defined as the skills and knowledge regarding the fluent use of digital tools and resources in real life situations. It is identified with the use of digital devices and websites and is included in learning and teaching activities (Lindstrom & Niederhauser, 2016). DL refers to the use of digital tools to create meaning and communicate effectively with others. DL behaviours include icon identification, digital navigation, technical operations of devices, knowledge of digital terminology, user control methods like scrolling, storage and retrieval and use of hyperlink. In addition, coding skills, scanning, creating digital texts and critical skills such as analysing, evaluating online information, blogging, online social networking, accessing and synthesising online sources are predicted as digital literacy skills.

Mapping Digital Literacy

Digital generations are engaged with technologies. Accurate knowledge of the level of current digital skills and competencies are required. Digital literates deal with the basic knowledge, skills, and attitudes needed to participate in society through online engagement. Digital literacy is developed through digital participation and situational embedding of basic digital competencies. Nevertheless, students lack the inadequate digital literacy skills needed for digital learning (Muresan & Gogu, 2013). This may be due to the fact that students are using technology for social media or

entertainment but not for learning (Shopova, 2014). Nevertheless, access to technology and outcomes of the internet and technology used to obtain the skills are the grounds of digital literacy. The following three factors guide the conceptualisation of digital literacy: access to technology, working skills, and behavioural skills (Figure 2).

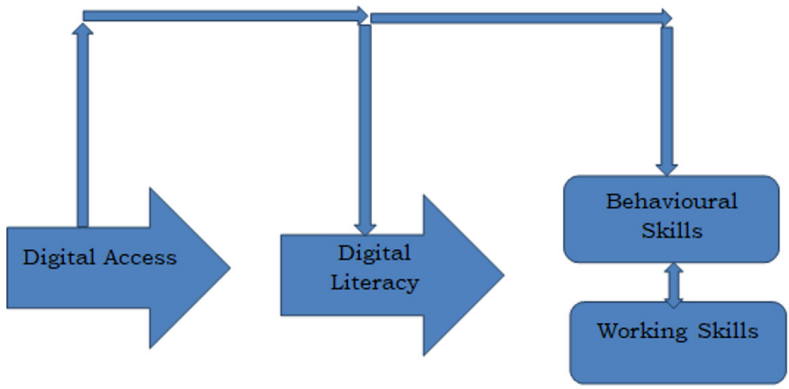

Figure-2: Three-Factor Conceptualisation of Digital Literacy
(Author's Conceptualisation)

Access to technology is essential to determine students' access to computers, internet connection, tablets, and smartphones. Working skills are based on computer basics, internet navigation, communication, and information search and management (Table 1). The elements of behavioural skills are manifested in day-to-day activities (Table 2).

Table-1: Working Skills

Fundamentals of Computer	Install software on a computer, Prepare a PowerPoint presentation
	Rename a folder, Empty the recycle bin
	Scan a document
Internet Navigation	Connect to a wireless device, Set a website as the home page
	Protect private data, Create a safe password
	Online shopping
Communication	Identify fraudulent email, Open an attachment
	Create a personal profile on a social network website, Interact with other users on an online forum

Information Search and Management	Search for information, Collect information
	Compare information from several sources, Determine the reliability of data
	Organise information for present and future use, Save a document in a specific location
	Reproduce content (i.e. copy and paste)
	Present information through a video, Understand graphical display

Table-2: Behavioural Skills

Critical Thinking	Recognise and address the originality of digital content, Autonomy, Real time thinking
ICT in Daily Life	Online participation, Internet for communication, Frequently back up files and important data, Name folders meaningfully to facilitate information retrieval
Social Interaction	Interact with online communities, Willingness to collaborate with others, Respect the norms of social conduct
Online Security	Legal and ethical issues of digital environments, Comply with the legal rules of digital content, Aware of copyright issues, Report inappropriate online activity

Managing Literacy for Digital Inclusion

A requisite for participation in the global learning society is digital literacy. So, digital participation to manage the following necessities is suggested for an inclusive learning society.

- Universal equitable and open access to digital enabled learning environments, tools, and digital resources for all.
- Development of local and vernacular quality digital content with the partner of teachers and students.
- Critical use of shared digital resources.
- Enable sharing of ICT infrastructure for the learning community.
- Promote research, evaluation, and experimentation using ICT tools
- The ethical use of ICT needs to be infused in the curriculum.
- Integration of ICT tools and Free & open-source software for content preparation
- Development of digital learning resources including audios, videos, interactive multimedia, e-books, virtual as well as augmented learning resources.
- Creation of Learning Management System (LMS)
- Creation of Management of Information System (MIS) to enable assessments, monitoring, regular feedback and enhanced learning of students.

Digital Skills

Society is shaped by technologies. Digital

information is accessed universally. The increasing importance of digital platforms has brought modifications in the skills and knowledge of digital learning. So, digital skills are important for educational systems. Digital skills determine information and technical skills. Digital skills are the abilities to use computers or smartphones allowing students to share similar knowledge among their peers. Van Laar et al. (2107) addressed digital skills as so-called twenty-first century skills. Use of information and communication technology shows more open access to a computer and internet. This demands a higher command of ICT skills and the ability to work with the internet. Such experience establishes digital skills. The digital skills determine high-level skills which are covered under 21st century skills. OECD recommends that identifying and fostering the development of 21st century skills are either supported or enhanced by ICT and digital skills (OECD, 2010). Nevertheless, during technology-enhanced settings, learners interact to learn by giving explanations or making communication on each other's contributions. Learners' online collaboration consists of meaningful interaction between peers. Thus, working through the internet highlights their collaboration and communication skills.

Mapping of 21st-Century Digital Skills

Digital skills are necessary to equip the education systems with high-level skills. In literature, these skills are mostly called twenty-first-century skills or digital skills. According to Van Laar et al. (2017), 21st-century skills include (i) communication and collaboration (ii) critical thinking, creative thinking, and problem-solving. These skills are generally about what students can do with knowledge and how they can apply that knowledge in school and social life (UNESCO, 2017). Although different definitions and classifications of 21st-century skills have been put forward so far, Ferrari (2013) states that these skills include information, communication, content creation, safety, and problem-solving competencies. Information skills are the ways of browsing, searching, filtering, evaluating, storing, and retrieving information. The communication skills include interaction, sharing information & content, engagement, and collaboration through digital technologies. Creation of content consists of developing content, integrating and re-elaborating it, copyright and licenses, and programming using technologies. Safety involves protecting devices, managing & protecting personal digital data, and protecting the environment. Online problem-solving skills are resolving tasks by using digital tools, collaborative problem-solving, innovating, and creatively using technology.

The knowledge, skills, and attitudes needed to use digital technologies to search, select, and organise digital information and content are the digital skills and competencies. Basic Digital Competences encompass digital problem solving, digital citizenship, digital information seeking and organising, digital content creation, digital communication, and collaboration. It consists of fundamentals of familiarity with hardware and software, and all the

basics needed for operational usage of the most common digital tools used to interact in the digital world.

Many terms are used to reveal the level of digital skills: IT skills, ICT skills, computer skills, digital competence, or digital literacy. UNESCO (2017) has defined the term digital skills as a range of different abilities, many of which are not only 'skills' per se, but a combination of behaviours, expertise, know-how, work habits, traits, dispositions, and critical understandings. Van Laar et al. (2017) viewed digital skills as part of digital literacy. Besides the skills to operate digital devices, the skills required to perform tasks and solve problems in a digital environment are known as digital skills (Ng, 2012).

An Individual's skill in using ICT includes technical knowledge and cognitive skills required to handle hardware and software environments. Many research findings emphasise the need to focus not only on technical mastery aspects and on the conceptual understandings of technology but also on the higher-order cognitive skills and socio-relational knowledge (Calvani et al., 2012). The digital literacy of students falls in two ways: Information Literacy and Multimedia Literacy. Learners who are developing their information literate skills define different types of ability, such as subject expertise, societal participation, use of research tools, and indicators to determine the credibility of sources, and understand publications that are widely considered "standard". Multimedia literacy refers to the ability to interpret, design, and create content that makes use of images, photographs, video, animation, music, sounds, and texts (Frau-Meigs et al., 2017).

Researchers believe that students must develop the necessary digital skills for the meaningful use of the internet (Jenkins et al., 2009). Litt (2013) focused on the uni-dimensional aspect of internet skills for the arguments about digital skills. Students' digital skills are categorised under many resources: material, intellectual, social, and cultural. Inequalities are seen in the demographic, socio-economic, and psychological dimensions of individuals. The demographic variable includes age, gender, and social background; the psychological dimension covers an individual's trait and intelligence; Education, economic status, and income position of individuals are classified under socio-economic dimensions. Digital skills studies are largely limited to demographic and socioeconomic determinants (Scheerder et al., 2017). Factors such as age, gender, socioeconomic status, personality traits, intelligence, and ICT experience are responsible for determining digital skills. The intellectual determinants of skills depend upon students' learning styles, motivation, intelligence, and other fundamental skills. Similarly, social determinants concern social networking using digital media. Attitude towards culture and tradition of one's society are also determining factors of possession of digital skills.

Managing Skills for Digital Inclusion

Universal access requires that all students should have access, affordability, and the ability to avail and use the internet. These factors are essential in response to human rights

(UNESCO, 2018). The management of 21st century digital skills is vital for members of the learning society to ensure the practice of accessibility. This involves carrying out meaningful activities in a program of media and information literacy. The universal use of digital tools and the internet is an essential requirement for creating, communicating, problem-solving, and socialising for both formal and informal learning. For creating a digital environment, it involves understanding how to use, design, edit, and create pictures, audios, and videos. Managing online applications for students' learning are based on the following dynamics:

- Understand the basic ICT concepts of hardware, software appliances, and networks.
- Know the fundamentals of operational usage of digital tools.
- Awareness of the commonly used digital devices and applications
- Use digital device and internet
- Structure your own digital environment depending on accessibility, and settings.
- Identify needs and select an appropriate digital solution and apply it.
- Solve technical problems.
- Develop self-efficacy using digital technologies.

Digital Divide

The digital divide is characterised by distinguishing those who 'have' technologies from those who 'have not' got them. This describes observed inequalities of access to computers, to the internet and associated digital technologies. The digital divide is reduced by the goal of universal access to information and acquiring actual skills with the availability of technology.

Mapping Digital Divide

Inequalities in the availability of technology and internet access in different parts of the country are major considerations of the digital divide. These considerations are strongly related to socioeconomic background, race, and gender. Jones (2013) stated the digital divide in referring to technology-related social stratification based on racial, gender, and class distinctions as a gap of both access and uses of technology. This is termed as the first level of the digital divide. The second level of the digital divide is the phase of inquiry to know the actual differences in usage and skill outcomes. The majority of the students' population having access to technology possesses insufficient skills. This causes digital exclusion among them. Research shows that low-level educated individuals spent more hours on the internet but were unable to benefit out of that (Van Deursen and Van Dijk, 2014). It is due to the fact that they tend to engage more in social networking and gaming. On the other hand, high proficiency students take maximum benefits in minimum use of the internet. They use the internet for their development of knowledge and skills. This explains the gap between capacities, abilities among low and high educated students. This is the third level of the digital divide which concerns the

differences in intangible outputs among students. The gap influences digital inclusion in terms of access, usage, motivation, and skills.

According to Norris (2003), the digital divide stands for every discrepancy within the online community. He distinguishes digital divide in three ways: First, "global divide," referring to the divergence between the developed and the developing countries in the use of the internet; second, "social divide," the division between the information-rich and the poor in every nation; third, "democratic divide," a gap that exists between those who engage in social life through on-line and those who do not. He argues that socio-economic factors control on-line technology.

Seong-jae (2010) identifies the digital divide as disadvantages of those who are unable to make use of technologies in their day to day life. The less privileged groups tend to use ICT for entertainment purposes whereas the educated employ for learning effectively. Jenkins (2009) termed the 'participation gap' to describe basic inequalities and lack of opportunities for participation in access to technologies. Besides, the digital divide is viewed as educational and social inequity among the oppressed and less privileged of the society. Clark and Gorski (2002) mentioned that educationally oppressed are one of the dimensions of the digital divide. The digital divide refers to both the gap of access to technology and learner usage of technology. This creates a gap in pedagogical practices. By which, the students are excluded by the curriculum, pedagogy, assessment, and other facets of formal schooling. This is an alarming situation in India and around the world.

Managing the Digital Divide towards Inclusion

The digital divide entails differences in access based on socioeconomic divisions (Van Deursen & Van Dijk, 2014). Inequalities in the availability of technology and internet access are due to issues of socio-economic background. Most studies on the digital divide are based on basic demographic and socioeconomic predictors of access such as gender, age, education, income, and employment status (DiMaggio et al., 2004). When individuals gained access to the technological infrastructure, their lack of skills and usage habits were noticed for the cause of digital exclusion. The digital divide approach based on inequalities in internet access has evolved into a divide that includes variation in skills to use the internet (Fuchs, 2009; Selwyn, 2004). The gaps in student's capacity for accomplishing learning outcomes in turn influences digital inclusion. Several studies have demonstrated that once access to technology is equal, the differences in how effectively it is used relate to economic, cultural, and social variables (Jara et al., 2015). Institutions should manage future literacy for the global knowledge society by teaching digital literacy, knowledge assessment, and skills of digital communication & cooperation. Digital learning opportunities as well as competencies and skills related to problem-solving, communication, and critical thinking are the magnitudes of digital equity and inclusion.

As more computers and internet access

become available, the differing uses and effects of technology that characterize the digital divide have become the focus of inclusiveness. The steps to bridge the digital divide are as follows:

- Providing integrated and global solutions through e-government reaching out to all rural students.
- Efforts to bridge the digital divide through various means such as infrastructure development, setting up e-governance, Community Information Centre, e-libraries, partnership with academic institutions
- Innovative projects to use technology for rural development
- CT infrastructure, creation, storage and retrieval of digital resources, use of software, technical support, networking using telecommunication and satellite-based communication to enhance learning

Digital Inclusion in Education

Technology pervades digitalisation. Information is offered through the internet which increases the outcomes of digitalisation. Therefore, students need to update their ICT knowledge and skills continuously. They need to strive for their renewing of skills through both formal and informal learning environments. In the education sector, students need to learn, unlearn, and re-learn to retune and upskill themselves throughout their lifetime (Anthonysamy et al., 2020). The diversity in using ICT represents the socio-cognitive motivations of students. Their interest in ICT, perceived ICT competence, working autonomously and social relatedness plays a major role in digital education.

Mapping

The context and purpose of using ICT are many: for socialisation, entertainment, leisure time activities, and learning. ICT skills for learning are a major component of achieving digital equity among the masses. Many students do not master ICT use; they have only basic levels of competence in information literacy, they do not have problem-solving skills in technology-rich environments (OECD, 2013). The variation of use by students in the extent of availability of ICT is due to variations in pedagogical and technical support. Technology-based learning facilitates in organising & evaluating information, argumentation, and presentation of knowledge (Spektor-Levy and Granot-Gilat, 2012). ICT knowledge and skills are understood as an essential requirement of basic education. Using ICT successfully to solve information-related tasks requires specific technical knowledge as well as generic cognitive skills.

Students fail; causing digital exclusion:

- not able to evaluate and integrate digital information effectively (Tang & Chaw, 2016)
- not able to critically judge the suitability of a large amount of information online (Ng, 2012)
- not able to understand the ethical and social usage of information
- not able to interpret the reference to a paper and journal
- not able to search databases

effectively (Shopova, 2014)

- not able to determine the validity of the information found online
- not understanding copyright issues when using digital information for sharing purposes.

Digital inclusion is important for those who understand the role of the internet and digital technologies in the emerging knowledge-based society (Norris, 2003; Selwyn, 2004). However, many students do not have access to the internet and related technologies. This results in them being digitally excluded.

Managing Digital Inclusion

The issue of socio-economic status is a challenge for students' learning. The educational institutions should identify their students' level of competence and take steps to minimise the gap in their ability differences. These challenges, summarised from literature, can broadly be classified into the following areas:

- Institutional and financial factors including availability, affordability, and access to resources, and socio-economic status
- Socio-cultural factors including societal, institutional, and family support
- It establishes dispositional and attitudinal elements; developing a 'mind-set' towards technological innovations.
- Language and cultural barriers
- Individual factors such as schooling experiences and performance, aspirations and expectations, self-confidence, and self-esteem.

Diverse students with digital diversity can be recognised through critical pedagogy. Premises of critical pedagogy interrogates education in exploring economic, linguistic, and institutional barriers to digital inclusion. Teemant and Hausman (2013) recommended critical pedagogical practices that focus on the potential for democratizing effects and strengthening learner activity. The shift is articulated towards inquiry-based, student-centred learning that promotes higher-order technology uses and study of issues relevant to learner lives and situations.

Conclusion

An analysis of the digital divide highlights how digital inequality compounds the discrimination faced by the poor and the technologically illiterate. Education technology is accessible, available, and affordable only to certain privileged sections of the society in the education system. The deprived section excludes from the information society causing digital exclusion. The majority of the student population does not get access to the internet as they live in remote and interior villages. Therefore, ICT technology is inaccessible, unavailable, and unaffordable to the rural poor and the marginalized. This results in the gross neglect of the needs of the neediest. This is the challenge of digital inclusion and equity. Research on performances in ICT skills of students is, therefore, turned into research on the digital divide and digital inclusion.

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