



COMPARATIVE ANALYSIS:

E-EDUCATION STANDARDS, GUIDELINES, AND TOOLKITS

Authored by

Salma Abbasi

Chairperson and CEO, eWorldwide Group &

Vice-chair, Digital Resilience Initiative, IEEE

Ashirwad Tripathy

Cofounder/President, Educating Nepal (EN)

Chair, Internet for Education Special Interest Group, Internet Society

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ABSTRACT

The use of information and communications technology (ICT) in education immediately garnered importance with the inception of the millennium development goals (MDGs) outlined by the United Nations (UNs) in 2000 and carried forward with Sustainable Development Goal 4 (SDG 4) in 2015. The outbreak of COVID-19 disrupted the entire education system where schools around the world were compelled to adopt e-education (online education or remote education) as an alternative means for continued learning. This document examines the existing standards, policy guidelines, and toolkits to determine their efficiency and sufficiency for a new imagined modality of teaching and learning. Apart from those of the UNs Educational, Scientific, and Cultural Organization (UNESCO), standards, guidelines, and toolkits from Nepal, Nigeria, and the United Kingdom (U.K.) are compared against ten of the most essential operations for effective e-education. The ten most essential components of e-education are broadly divided among six priority areas as follows:

- Digital literacy frameworks and standards.
- Effective teaching, learning, and administration for e-education.
- Digital infrastructure and connectivity.
- Remote learning quality, outreach, and affordability.
- Localization of digital content and delivery.
- Inclusive technology, solutions, tools, and resources.

The comparison between low-income and high-income economies in their implementation of remote learning has provided important insights for contemplation in redesigning the education of the future. Using a comparative analysis, this document provides useful recommendations for the effective implantation of inclusive and equitable e-education. They are as follows:

1. There is a dire need to improve national digital skills, digital competency, and the digital literacy rate.
2. The development of all human resources is necessary for the effective implementation of ICT in education, including the ICT industry, which can help develop local digital content and platforms.

3. There is a huge need for governments to invest in digital infrastructure and connectivity. Support from the International Telecommunication Union (ITU) and UNESCO must focus on disadvantaged and vulnerable communities.
4. National governments and other stakeholders must find strategies to alleviate digital poverty. E-education and remote learning can barely be effective if the students do not have access to learning devices. All forms of the digital divide must be bridged.
5. E-education provides flexibility in learning; a wide range of contents available freely on web portals can be used for teaching and learning. But it is also necessary that e-education fully incorporates national curricular guidelines for the long-term goal.
6. Monitoring and evaluation of the effectiveness of e-education at every stage must be carried out with special attention given to learning outcomes, meaningful engagement, and participation of students.
7. Inclusive e-education policies, tools, and platforms must be developed. No one—especially, marginalized and vulnerable children, internally displaced persons (IDPs), refugees, and children with special needs—should be left out of e-education. The policies and platforms must cater to the needs of all children to accommodate personalized learning.
8. More awareness of the importance of ICT in education is needed for people in low-income economies so that they are motivated toward the modern approach of digital pedagogy.

ABBREVIATIONS

<i>3G</i>	third generation
<i>4G</i>	fourth generation
<i>5G</i>	fifth generation
<i>AI</i>	artificial intelligence
<i>BBC</i>	British Broadcasting Company
<i>BCG</i>	Boston Consulting Group
<i>CAL</i>	computer-assisted learning
<i>CDC</i>	Curriculum Development Center
<i>CDI</i>	Coalition for Digital Intelligence
<i>CEHRD</i>	Center for Education and Human Resource Development
<i>CFT</i>	Competency Framework for Teachers
<i>CML</i>	Computer-Managed Learning
<i>COP</i>	child online protection
<i>COVID</i>	Coronavirus disease
<i>CRPD</i>	Convention on the Rights of Persons with Disabilities
<i>CSO</i>	Civil Society Organization
<i>CST</i>	Competency Standards for Teachers
<i>DQ</i>	digital intelligence
<i>DfE</i>	Department for Education (U.K.)
<i>ECED</i>	Early Childhood Education Development
<i>EDTech</i>	Education Technology
<i>EFA</i>	Education for All
<i>EiEWG</i>	Education in Emergencies Working Group (Nigeria)
<i>ETF</i>	Education and Training Foundation
<i>FM</i>	frequency modulation
<i>FMoE</i>	Federal Ministry of Education (Nigeria)
<i>G7</i>	Group of Seven
<i>GBP</i>	British pound (pound sterling)
<i>GDP</i>	gross domestic product
<i>GEC</i>	Global Education Coalition

<i>GEI</i>	Global Education Institute
<i>GEM</i>	Global Education Monitoring
<i>GNI</i>	gross national income
<i>ICT</i>	Information and Communications Technology
<i>IDP</i>	internally displaced person
<i>IEEE</i>	Institute of Electrical and Electronics Engineers
<i>IITE</i>	Institute for Information Technologies in Education
<i>IOCT</i>	Indoor Obstacle Course Test
<i>IOE</i>	Institute of Education
<i>ISTE</i>	International Society for Technology in Education
<i>IT</i>	information technology
<i>ITU</i>	International Telecommunication Union
<i>LDC</i>	least developed country
<i>LMC</i>	Last Mile Connectivity
<i>MDG</i>	Millennium Development Goal
<i>MDRU</i>	Moveable and Deployable ICT Resource Unit
<i>MoE</i>	Ministry of Education (Nepal)
<i>MoCIT</i>	Ministry of Communication Information and Technology
<i>MoEST</i>	Ministry of Education, Science and Technology
<i>MOOC</i>	Massive Open Online Course
<i>nced</i>	National Center for Education Development
<i>NCELP</i>	National Centre for Excellence for Language Pedagogy
<i>NITDA</i>	National IT Development Agency
<i>NTP</i>	National Tutoring Program
<i>ODL</i>	open distance learning
<i>OECD</i>	Organisation for Economic Co-operation and Development
<i>OER</i>	Open Education Resource
<i>Ofcom</i>	Office of Communications
<i>PC</i>	personal computer
<i>PWD</i>	Person with Disabilities
<i>SBMC</i>	School-Based Management Committee
<i>SDG</i>	Sustainable Development Goal

<i>SENCo</i>	Special Education Needs Coordinator
<i>SSDP</i>	School Sector Development Plan
<i>TV</i>	television
<i>UCL</i>	University College London
<i>U.K.</i>	United Kingdom
<i>UNESCO</i>	United Nations Educational, Scientific, and Cultural Organization
<i>UNICEF</i>	United Nations Children’s Fund
<i>UNPRPD</i>	United Nations Partnership on the Rights of PWD
<i>U.S.</i>	United States
<i>VLE</i>	Virtual Learning Environment
<i>W3C</i>	World Wide Web Consortium

1. INTRODUCTION

In the United Nations (UN) 2030 Agenda for sustainable development, SDG 4 aims to ensure inclusive and equitable quality education and promote lifelong learning for all. Target 4.4 of SDG 4 plans to substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs, and entrepreneurship by 2030. Furthermore, the global target concept for indicator 4.4.1¹ provides for the global measurement of ICT skills for youths and adults. This is where the integration of ICT in education has become a prioritized area of intervention for most developing nations around the world. A clearer justification regarding the importance of digital literacy was discovered when education was disrupted by COVID-19 and the solution to continued learning was e-education. The global pandemic brought about far-reaching consequences by having millions of children out of school at the same time and with the uncertainty of how many would never return to school again. In the present context, the importance of e-resilience in education has been desperately felt like never before. E-education (distance learning, remote learning, or online learning) has been embedded strongly in the reimagination of education post-COVID-19; therefore, now it is imperative to lay a strong foundation for the effective implementation of e-education.

This document is a comparative analysis of e-education standards, policies/policy guidelines, and toolkits that are

¹ UNESCO, “Quick Guide to Education Indicators for SDG 4,” 2018, <http://uis.unesco.org/sites/default/files/documents/quick-guide-education-indicators-sdg4-2018-en.pdf>.

available at the national, regional, and global levels for educators, learners, and administrators. At the national level, standards, guidelines, and toolkits available in three countries—Nepal, Nigeria, and the U.K.—have been analyzed to understand the unique challenges each country faces with an e-education system. This comparative analysis also incorporates policy briefs, guidelines, sectorial notes, toolkits, frameworks, and standards in e-education developed by UNESCO and directed toward the fulfillment of the Education 2030 Agenda. Wherever available, resources from the GEI and IOE at UCL have also been taken into consideration for this study.

This document will assist in developing a high-level framework for e-resilience in education systems along with ten selected operations in e-learning. The purpose of this document is to collect and compare existing standards, guidelines, and toolkits available for e-education and to identify gaps and make recommendations to bolster education systems during the COVID-19 response and beyond. This study further explores issues relating to educational service delivery, accessibility, and affordability by being sensitive to the inclusion of women, PWDs, IDPs, refugees, and marginalized communities. This document can be useful for developing new standards, guidelines, and toolkits to address existing gaps to “bounce back better” and accomplish SDG 4 for inclusive and equitable EFA.

2. RATIONALE FOR SELECTION OF OPERATIONS

The selected operations for analysis are the output of a series of webinars hosted by eWorldwide Group and IEEE Standards Association (SA). Since April 2020, continuous dialogue and discussions have been carried out with various stakeholders—for example, universities, international development agencies, governments, academia, and technical experts—which led to the launch of the IEEE Industry Connections program on digital resilience “Holistic Digital Resilience Ecosystem for Disaster and Emergency Preparedness, Mitigation, and Response: Frameworks, Toolkits, and Guidelines” in October 2020. A separate subcommittee under this program was formed for e-resilience in education systems, and ten key operations were recognized to ensure e-resilience in education systems:

1. National digital literacy frameworks for distance/online learning for educators, learners, and administrators.
2. National framework for administration, monitoring, and evaluation for online, remote classrooms, and distance learning systems.
3. National framework for digital literacy and skills for educators, learners, and administrators, including reference to gender sensitivity, marginalized communities, IDPs, and refugees.

4. Digital infrastructure for education institutions.
5. Digital connectivity for education institutions.
6. Holistic regulation for e-education systems (quality of service, affordability, and accessibility).
7. Digital content for educators, learners, and administrators.
8. Technology solutions for online education delivery across diverse geographical areas.
9. Localization of digital content in local languages.
10. Digital educational tools and resources for learners with disabilities.

The disruption of education systems caused by COVID-19 demands a more inclusive and people-centric approach to the re-establishment of continued learning. According to ITU, the broadband internet penetration rate in Nepal was 21.4% (2017) and in Nigeria was 34% (2019). This creates a huge challenge for digital learning infrastructure. It is necessary to ensure that the existing gaps do not increase further. Even developed countries like the U.K. are facing their own challenges in becoming digitally resilient. Analyzing standards, guidelines, and toolkits with reference to these ten operations can give a clear understanding of what has been done and what needs to be done. For this purpose, along with national structures and frameworks, various other key components must be analyzed with a special focus on marginalized and underprivileged populations.

3. RATIONALE FOR SELECTION OF COUNTRIES

A holistic approach is necessary to understand the multidimensional challenges and complexities prevalent in the education ecosystem. Digital literacy is not the mere transfer of information from one point to another but the transformation of knowledge from one generation to another. So, e-resilience in education systems comes embedded with various socio-technological factors. Various cultural and political environments also have a deep-rooted effect on the education system of the country. Each country faces challenges that are unique in nature. So, to broaden the understanding of e-resilience in education systems, the standards, policy guidelines, and toolkits available in three countries—Nepal, Nigeria, and the U.K.—have been analyzed in this document. These countries are at different stages of economic development and have varying socioeconomic backgrounds. They also give a contrasting overview between developing and developed countries while representing South Asia, sub-Saharan Africa, and Europe in terms of geography.

Nepal is a landlocked developing nation in South Asia with 80% of its population living in rural areas. According to national statistics, the overall literacy rate stands at 68%, and the country has recently been qualified to graduate from LDC to a developing nation. Nigeria is a sub-Saharan African nation with 49% of its population living in rural areas. It has an adult literacy rate of 62.02%. The U.K., on the other hand, is one of the G7 countries and the world's fifth-largest economy in terms of nominal GDP. The country has 17.1% of its population living in rural areas; 99% of the population is literate, with 94% connected to superfast broadband internet. These contrasts in respective demography and economy are helpful for making good recommendations for low-income countries to develop e-resiliency in education systems. The frameworks, recommendations, and standards from UNESCO have also been included for the purpose of comparative analysis because it is the standard-bearer for the UN Education 2030 Agenda.

4. COMPARATIVE ANALYSIS

As the authors reimagine innovation in teaching and learning, remote education cannot be regarded as a light bulb moment occurring during the COVID response period. For over a decade, e-learning has been pushing its way into mainstream educational approaches in the form of distance learning and as an alternate or hybrid approach to teaching and learning. CML and computer-assisted learning (CAL) have been around longer as foundational tools for e-learning. Since widespread internet connectivity, e-learning has been synonymous with online learning through technological aid.

The building blocks of e-education can be attributed to progress made in digital literacy programs across all nations. The current pandemic has conspicuously revealed the importance and relevance of e-education, which is likely to be on the continuum of a blended education system for many years to come. With constant improvements in technology, blended education is being practiced throughout many countries. An effective blended learning environment requires pupils who have sound digital literacy. A large amount of other research has provided evidence for a positive correlation between digital literacy and effective learning for students.

There has been an obligatory paradigm shift in the global education system since the outbreak of COVID-19. As the pandemic imposed social distancing and lockdown, an alternative approach to imparting education became imperative. School closures across 190 countries reportedly affected 1.6 billion children, accounting for 91% of children enrolled in school worldwide and a staggering 24 million learners from preschool to university at risk of not returning to school following COVID-19's disruption of physical classes. This is when the adoption of technology in education in the form of virtual classes, online learning, or remote education seemed obviously

justifiable. As the impact of COVID-19 was felt, UNESCO reacted with global and regional responses. The global responses included the following:

- High-level ministerial meetings for policy dialogue for a new form of education.
- GEC to scale up the best distance learning practices.
- Global monitoring to evaluate learning loss due to school closures across the globe.
- Technical assistance to prepare and deploy inclusive distant learning solutions with webinars, issue notes, digital learning resources, national learning platforms, and surveys.

Regional responses are carried out in Africa, the Arab states, Asia Pacific, Latin America, and the Caribbean, respectively.

It is important to note that UNESCO launched the GEC with 175 members to focus on three central concerns: connectivity, teachers, and gender. The main objective of GEC was to build a resilient education system with regard to an indispensable shift of education toward online learning. The GEC's goals are supported by the following three pillars: country-level engagement; cross-country interventions at scale; and monitoring, knowledge building, and advocacy.²

As COVID-19 broke out in Nepal, the initial response plan for education was to shut down schools to protect 8.1 million children from ECED to grade 12. The first lockdown did not entail an effective form of learning continuation; therefore, the government of Nepal released a framework for the reopening of schools in November 2020. The framework had guidelines for physical classes following safety norms for mitigating transmission of the COVID. The need for online or remote classes was seriously evident following the shutdown of schools in the second and third waves of COVID-19.

In Nigeria, as the FMoE approved school closures in the March of 2020, 50 million students throughout the country and the BAY states (i.e., Borno, Adamawa, and Yobe) were affected. A response plan by Nigeria's education in emergency was launched with the goal of ensuring an effective, inclusive, and safe return to quality learning for learners, teachers, and SBMCs.

In the U.K., the restrictions were announced by the education secretary in March 2020. Except for children of

² UNESCO, GEC, "Responding to COVID-19 and beyond, the Global Education Coalition in action," United Nations Educational, Scientific and Cultural Organization, 2020, <https://unesdoc.unesco.org/ark:/48223/pf0000374364>.

key workers and vulnerable pupils, most children started taking classes from home. Students attended virtual classes at home. An online learning delivery platform—Oak National Academy, launched with financial support from the DfE—provided sequential learning materials for students in line with the national curriculum. The government response strategy was to bring back students safely to school and make strategic investments to mitigate learning loss incurred during the shutdown of schools.

5. DIGITAL LITERACY FRAMEWORKS AND STANDARDS

Digital literacy covers a wide scope: education, creating an efficient workforce, public transparency, and bridging all forms of the digital divide. Digital literacy for children refers to knowledge, skills, and attitudes that allow children to thrive in the digital world by being safe and empowered in ways that are appropriate to their age and local cultures and contexts.³ The competency areas adopted by UNESCO's digital literacy framework cover data literacy, communication, digital content creation, safety, and problem-solving⁴—all of which have high significance for e-education. In addition to the UNESCO global framework, there are other international frameworks such as the DigComp framework from the European Commission,⁵ the DQ framework,⁶ and the digital kids Asia-Pacific framework.⁷ At a regional and national level, for instance in Canada, the British Columbia digital literacy curriculum is provided by the government while the Microsoft digital literacy standard curriculum is offered by the private sector. These frameworks are likely to have major contributions in the formation of policies and standards relating to e-education, remote learning, or distance learning.

The 2011 policy brief by UNESCO⁸ explains the content and structure of digital literacy as an integral component of a life skill. The document provides impetus for a new digital literacy framework through the perspective of learners, teachers, and policy makers. The document underpins an ICT-enabled development model by keeping collaborative knowledge construction and creativity at its core. It further emphasizes that the 21st-century digital literacy frameworks were developed to improve the social skills of students, learners, adults, and teachers with the ability to

³ Nascimbeni, Fabio, and Steven Vosloo, "Digital literacy for children: exploring definitions and frameworks," UNICEF Office of Global Insight and Policy, Aug. 2019, <https://www.unicef.org/globalinsight/media/1271/file/%20UNICEF-Global-Insight-digital-literacy-scoping-paper-2020.pdf>.

⁴ Law, Nancy, David Woo, Jimmy de la Torre, and Gary Wong, "A Global Framework of Reference on Digital Literacy Skills for Indicator 4.4.2," Information Paper no. 51, UNESCO, Jun. 2018, <http://uis.unesco.org/sites/default/files/documents/ip51-global-framework-reference-digital-literacy-skills-2018-en.pdf>.

⁵ Carretero, Stephanie, Riina Vuorikari, and Yves Punie, DigComp 2.1, The digital competence framework for citizens with eight proficiency levels and examples of use, Luxembourg: European Union, 2018, <https://op.europa.eu/en/publication-detail/-/publication/3c5e7879-308f-11e7-9412-01aa75ed71a1/language-en>.

⁶ DQ Institute, "DQ Global Standards Report 2019, Common Framework for Digital Literacy, Skills and Readiness," 2019, <https://www.dqinstitute.org/wp-content/uploads/2019/03/DQGlobalStandardsReport2019.pdf>.

⁷ Shin, Tae Seob, Hyeoung Hwang, Jonghwi Park, Jian Xi Teng, and Toan Dang, "Digital Kids Asia-Pacific, Insights into Children's Digital Citizenship," United Nations Educational, Scientific and Cultural Organization, 2019, <https://www.gcedclearinghouse.org/sites/default/files/resources/190165eng.pdf>.

⁸ Karpati, Andrea, "Digital Literacy In Education," Policy Brief, UNESCO Institute for Information Technologies in Education, May 2011, https://iite.unesco.org/files/policy_briefs/pdf/en/digital_literacy.pdf.

create digital content taking center stage. Furthermore, teachers' digital literacy has been pivotal for teaching and learning, including the development of innovative digital pedagogy. UNESCO has therefore initiated ICT-CSTs⁹ and the ICT-CFTs¹⁰ with three versions from 2008 to 2018. This document addresses six aspects of teachers' professional practice along three competency stages of knowledge acquisition, knowledge deepening, and knowledge creation. The six aspects are as follows:

1. Understanding ICT in education.
2. Curriculum and assessment.
3. Pedagogy.
4. Application of digital skills.
5. Organization and administration.
6. Teacher professional learning (see Annex A: ICT Competency Framework).

UNESCO has designated the ISTE¹¹ as a reference for standards in digital literacy. The ISTE provides standards for learners, educators, and administrators in the form of competencies necessary for teaching and learning in the digital age. The standards are aligned with SDGs and have been adopted primarily by the U.S. and many other countries as a comprehensive roadmap for the effective use of technology in education. Annex B shows how the ISTE Standards categories for students, educators, and education leaders correspond to each other in facilitating digital-age learning.

Alternatively, the CDI—an association of the World Economic Forum, the OECD, the IEEE SA, and the DQ Institute—has developed DQ global standards report¹² with a vision to be the first global standard for digital literacy, skills, and readiness across the education and technology sectors. The CDI aims to establish a global framework for DQ, including a common set of definitions, language, and understanding of comprehensive digital literacy, skills, and readiness that can be adopted worldwide by all stakeholders (governments, educators, technology companies, etc.). The major highlight of this report is its comprehensive set of technical, cognitive, metacognitive, and socioemotional competencies necessary for a sustainable digital life. The framework

⁹ UNESCO, "ICT competency standards for teachers: policy framework," United Nations Educational, Scientific and Cultural Organization, 2008, <https://unesdoc.unesco.org/ark:/48223/pf000015>.

¹⁰ UNESCO, "UNESCO ICT Competency Framework for Teachers," United Nations Educational, Scientific and Cultural Organization, 2018, https://www.open.edu/openlearncreate/pluginfile.php/306820/mod_resource/content/2/UNESCO%20ICT%20Competency%20Framework%20V3.pdf#:~:text=The%20ICT%20CFT%20is%20intended,and%20other%20professional%20development%20providers.

¹¹ International Society for Technology in Education, <https://www.iste.org/>.

¹² DQ Institute, "DQ Global Standards Report 2019, Common Framework for Digital Literacy, Skills and Readiness," 2019, <https://www.dqinstitute.org/wp-content/uploads/2019/03/DQGlobalStandardsReport2019.pdf>.