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Rock the Boat! Shaken by the COVID-19 Crisis: A Review on Teachers' Competencies in ICT

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The COVID-19 pandemic suddenly brought great challenges to the continuation of education. Institutions had to elect between pre-maturely ending their current school cycles or shifting to an online, flexible environment that had to deal with the digital divide in internet access. As part of its Sustainable Development Agenda, UNESCO developed the "Information and Communications Technology Competency Framework for Teachers" in 2018 to help institutions achieve digital literacy and reduce the digital divide. A systematic literature review (SLR) was conducted, identifying 23 studies on the use of ICT tools during COVID-19 educational disruptions in the database ProQuest Central and Google Scholar from August 2019 to August 2020. The results of this SLR showed that frameworks such as that of UNESCO could guide institutions to fast-track the development of educational strategies for post-crisis, COVID-19 implementation. Also, findings suggest an increase in the use of ICTs in learning environments, which will encourage organizations like UNESCO to develop plans and projects, such as the ICT framework further. Coping with the challenges of today's learning environments is urgent; it is already time to "Rock the boat!" Introduction.

Keywords: ICT competency, COVID−19, educational innovation, educational disruption, frameworks, higher education

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INTRODUCTION

COVID-19 is rapidly spreading around the world. Many scientists and researchers have been investigating the nature of this novel coronavirus to evaluate its short- and long-term impacts (Akram 2020). Research results show the COVID-19 pandemic has brought socio-economic disruptions and technological changes worldwide. This virus also adversely affects all educational systems around the world, forcing institutions to either pre-maturely end their ongoing school terms or adapt their operations to the requirements necessitated by COVID-19. The United Nations Educational, Scientific, and Cultural Organization (UNESCO) estimates that 1.3 billion learners across the globe are severely affected by the shutdown of schools, colleges, and universities (McCarthy 2020). As the virus spreads daily, there is great uncertainty about when and how institutions will reopen. Within this context, educational stakeholders are preparing for post-crisis. They focus on the transition of teachers and students to online learning environments to ensure continuity of the learning process (Gudmundsdottir and Hathaway, 2020). UNESCO launched The Global Education Coalition (GEA) as a platform for collaboration, leading the movement toward innovative and flexible instruction to minimize disruption to education. GEA calls for coordinated and creative actions, applying solutions that will support not only learners and teachers, but also governments. Throughout the recovery process, the principal focus has been on inclusion, equity, digital divide and gender equality (d'Orville 2020). UNESCO has given fair warning about the need to implement

Information and Communication Technologies (ICTs) in the efforts to accelerate progress and diminish the digital divide. COVID-19 has made these issues more evident to everyone. Through the development of the Information and Communications Technology Competency Framework for Teachers (ICTCFT), UNESCO has collaborated with institutions globally to assess the use of ICTs in the educational setting. The framework also serves as a guide toward digital literacy. The internet has enabled the proliferation of online content and digital resources that support teaching and learning, albeit these vary widely in quality. However, digital education media and resources, if carefully designed and implemented, have significant potential to transform learning to support the building of sustainable, flourishing societies ("UNESCO MGIEP" 2020).

As seen through literature, ICT has the potential to stimulate growth and variability, while providing new opportunities in developing countries. However, it requires educators to develop the skills and competencies to perform tasks and solve problems. Digital Literacy (DL) summarizes these aforementioned skills, while also providing the foundation of various measuring scales to rely on while evaluating an educator as digitally literate (Reddy et al., 2020; Reddy et al., 2021). Developing DL among educators will contribute towards the achievement of UNESCO´s GEA mission.

This SLR explores and summarizes the literature written about the UNESCO ICT framework and how these works tie to the current educational environment amid the COVID-19 pandemic. While conducting our review related work, such as Yun et al., shed some light on home-based learning, particularly in K-12 education where the impact technology had on the educational landscape was reviewed (Wen et al., 2021). Abiky (2021) work addresses the challenges faced by pre-service teachers while COVID-19 restrictions were in place, and how they managed to incorporate technology into the curricula to avoid disruption in the continuation of education. Zambrano (2020) research discerns the emotional intelligence of educators and its correlation to ICT skills and technology usage in virtual environments.

Studies concerning Emergency Remote Teaching (ERT) were identified and analyzed to spot similarities with our study and converging research questions. ERT, as stated by Shamir-Inbal and Blau, offers an alternative way to preserve the teaching-learning processes Shamir-Inbal and Blau (2021). ERT is not to be confused for Distance Education (DE). As suggested by Toquero C. M (2020), DE constitutes a planned activity, and its implementation is grounded in theoretical and practical knowledge, while ERT deals with surviving a time of crisis with all resources available, both offline and/or online. Regardless of the tools, techniques or strategies selected as ERT, it will help deliver educational contents and organize communication within classes (Anthony Jnr and Noel 2021). Authors of these studies seem to coincide with the magnitude of the emergency. They also examine the unstructured manner of most responses taken by educational institutions to prevent educational disruption (Toquero C. M. D, 2020; Trust and Whalen 2020; Shim and Lee 2020; Iglesias-Pradas et al., 2021).

The results of this review show what measures countries worldwide have taken during the epidemic and what they have done to address the digital divide. Identifying the features technological tools must have to enable the continuation of education is critical; this is one of the aspects covered by the framework. Also, this review provides information about the changing role of educators and teachers in the online educational environment. How is the acquisition of new skills linked to the new roles of educators is also part of this review.

To give direction to this SLR, we proposed the following research question: Amid the educational disruption caused by COVID-19 and the consequent shift in teachers' roles, what are the technical skills and competencies that educators need to acquire to adapt to current learning environments? This served as our main objective, however we divided our review into three sub-objectives to help guide our study. These sub-objectives are later addressed in the methods and materials section.

The answers to these questions will help know whether the UNESCO-ICTCFT can serve as a guide that helps educational institutions overcome the learning disruptions caused by COVID-19 and achieve post-pandemic progress and continuity of education.

The UNESCO Information and Communications Technology Competency Framework for Teachers (UNESCO-ICTCFT)

The Sustainable Development Goals are a universal call to action to end poverty, protect the planet, and improve the lives and prospects of everyone everywhere (Perdana et al., 2020). All United Nations (UN) member states adopted several goals in 2015 as part of the 2030 Agenda for Sustainable Development. Within this agenda, UNESCO recognizes that the prevalence of ICTs has a significant potential to accelerate progress, bridge the digital divide, and help develop inclusive knowledge societies based on human rights, gender equality and empowerment (Fallis 2013). To achieve this, UNESCO has developed the UNESCO-ICTCFT as a tool to guide pre- and in-service teacher training on using ICTs throughout education systems. This competency framework for teachers is intended to support national and institutional goals by providing a foundation for up-to-date policy development and capacity building in the dynamic area of ICT (Fallis 2013).

The UNESCO-ICTCFT version 3 responds to the 2030 Agenda for Sustainable Development adopted by the UN General Assembly, which underscores a prevalent global shift toward inclusive knowledge societies. It addresses recent technological and pedagogical developments in the fields of ICT and Education. It incorporates inclusive principles of non-discrimination, open and equitable information accessibility, and gender equality in the delivery of technology-supported education. Used by countries around the world, the UNESCO-ICTCFT highlights the role technology can play in supporting six major education focus areas across three phases of knowledge acquisition, as illustrated in **Figure 1** below (Fallis 2013):

Through its ICT competency framework for teachers, UNESCO underscores the importance of educators to foster

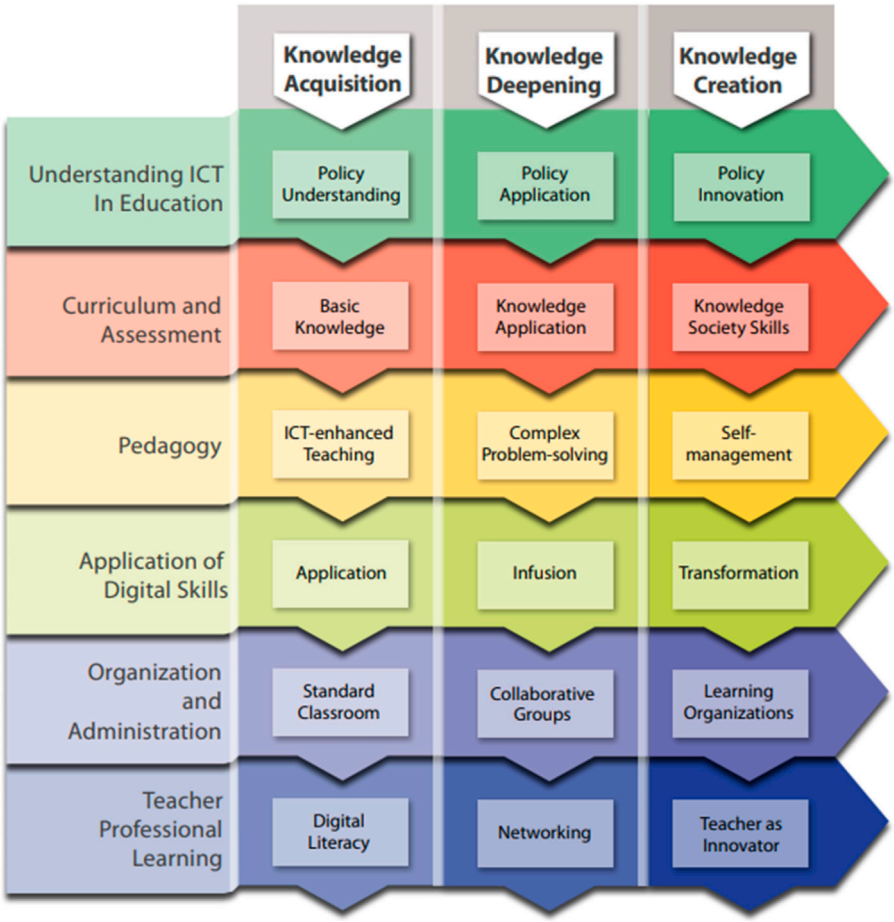

FIGURE 1 | The UNESCO ICT competency framework for teachers (Fallis 2013).

students' skills in collaboration, problem-solving, and creativity in the use of digital technologies. Teachers must also be equipped to manage digital technologies, allowing them to transfer these managing skills back to their students. In our digital age, these skills become part of citizenship training to participate fully in society. This digital role requires the use of ICTs for organization, communication, and research in the classroom and home, regardless of the subject taught. It facilitates access to documents and the development and modification of written, audio, and audiovisual materials, among others. This implies learners must acquire technical skills and be part of a culture that uses these technologies safely, effectively, and responsively (Saini 2020).

Rethinking Pedagogy to Explore the Potential of Digital Technology

The Mahatma Gandhi Institute of Education for Peace and Sustainable Development (MGIEP) is UNESCO's Category one educational institution in the Asia-Pacific region dedicated to education for peace and sustainable development, as enshrined in SDG Target 4.7. UNESCO-MGIEP promotes the use of digital learning platforms where teachers and students co-create and share highly interactive learning experiences. When considering its contribution to SDG Target 4.7, which focuses on education for peace, sustainable development, and global citizenship, UNESCO-MGIEP explored digital pedagogies as a means to scale transformative learning, connecting millions of learners across the world. The global review of digital textbooks, media, and other educational resources highlighted the potential of digital technology to support and improve pedagogical methods. The focus was to bring to the fore what we do and do not know about digital education, and the gaps in research and practices that must be addressed, drawing from a body of knowledge about the role that digital technology plays in inclusive education (UNESCO MGIEP 2020).

The COVID-19 pandemic has demonstrated that it is essential to provide teachers with software that integrates pedagogical theories. However, for a decade, there have been neither enough digital tools nor the accommodating culture to develop teachers' skills, specifically in active pedagogy (Bruillard and Baron 1998; Bruillard and Baron 2018). Within this context, the UNESCO-MGIEP report emphasizes that education challenges are not only technical issues, but also

FIGURE 2 | SLR phases, as suggested by Brereton et al. (2007).

demand that we envision the kind of world in which we want to live. To understand what is at stake and support transformative education, we need to adopt a historical and contextualized approach. We must avoid technological determinism and uninformed advocacy to shift from anachronistic, "analog" pedagogy to innovative, "digital" pedagogy. Technological determinism refers to the theory of how a society ′s technology can determine its values, structure and history. Depending on how they are designed and used, digital educational media and resources can either promote or undermine opportunities for "learning to learn" and "learning to think." These capabilities are essential foundations for educational innovation. Also, our ethical discernment and sense of responsibility are needed if we harness machines to shape a peaceful and sustainable society (Hosmana et al., 2020).

MATERIALS AND METHODS

We conducted a systematic literature review to identify the skills and competencies educators must acquire due to the academic disruption caused by COVID-19, which has forced a change in teachers' roles. We also wanted to know if UNESCO's ICT CFT could serve as a guide for institutions to follow to promote the use of ICT in educational settings, overcoming the disruption and ensuring academic continuity. Following the principles stated by Brereton et al. (2007), we intended this review to evaluate and interpret all available research relevant to a particular research question, topic, or phenomenon of interest. We grouped the SLR activities into three main phases (see **Figure 2**).

Plan Review

The first phase of the SLR methodology described by Kitchenham et al. (2010) involves developing and validating a strategy around specific research questions. These questions should be based on the knowledge gaps identified in the field of study (Ramírez-Montoya and García-Peñalvo 2018).

Research Questions and SLR Protocol

To generate the relevant information about which technical skills and competencies educators need in current learning environments, we established three sub-questions for this SLR to provide insight into whether UNESCO-ICTCFT can be a guide to help institutions deal with the academic disruption caused by COVID-19. Some aspects covered by UNESCO's framework were analyzed within the studies to know the impact they have on the current educational status due to COVID-19. **Table 1** shows the proposed SLR research questions.

Database and Search Terms

We selected *Google Scholar* and *ProQuest Central* for our review to include academic publications. Although there is criticism for the use of Google Scholar as a source of scientific information, as seen in Beel and Gipp (2010), Jacsó (2012), Mayr and Walter (2008), and Boeker et al. (2013), there is also evidence presented in Halevi et al. (2017) of its advantages over controlled databases. The decision to include both Google Scholar and a controlled database in *ProQuest Central* may be perceived as biased selection, which is presented as a limitation of this study. We created search strings for each of the research questions (see **Table 2**). Keywords such as "Education," "UNESCO," "COVID-19" and "Technology" were used to construct our search terms, while using a Boolean "AND" to join the main terms, and "OR" to include synonyms (Brereton et al., 2007).

Inclusion and Exclusion Criteria

A set of detailed inclusion and exclusion criteria was designed to identify whether a study could help answer the specified research questions (Brereton et al., 2007). Many studies found that the economic and social repercussions of the pandemic were not of interest to this investigation. The scope of this review considered academic publications covering the period of the COVID-19 pandemic, thus limiting the publication date to 2019 forward. **Table 3** shows the full list of inclusion and exclusion criteria.

TABLE 1 | Research questions of the SLR.

No	Research question
RQ1	What measures have countries, regions, or districts taken to address the digital divide the pandemic has brought to light in their territories?
RQ2	What features must digital tools possess to be seen by teachers as possible support to overcome the academic disruption brought about by COVID-19?
RQ3	How was the role of teachers affected in the learning environments after the educational disruption brought about by COVID-19?

TABLE 2 | Search strings in ProQuest Central and Google Scholar.

Research question	Database	Results
(education AND technology AND teachers AND UNESCO AND skills AND digital AND (coronavirus OR COVID-19)) AND (stype.exact("Scholarly Journals") AND pd(20190705-20200,705))	Google Scholar	402
(education AND technology AND teachers AND digital AND (coronavirus OR COVID-19)) AND (stype.exact("Scholarly Journals") AND pd(20190705-20200,705))	Proquest	89
(education AND technology AND teachers AND UNESCO AND skills AND digital AND (coronavirus OR COVID-19) AND ("digital divide")) AND (stype.exact("Scholarly Journals") AND pd(20190705-20200,705))	Google Scholar	146

TABLE 3 | Inclusion and exclusion criteria.

Inclusion criteria	Exclusion criteria
Academic publications	Non-academic publications
Publishing date no older than 2019	Studies that focus on COVID-19 disruptions outside of Education
Studies that focus on COVID-19 educational impacts	
Studies that mention UNESCO-ICTCFT	

Limitations of the Study

Possible limitations of this study include the use of Google Scholar and ProQuest Central as primary sources used to conduct this study. There is an ongoing debate among SLR authors whether multiple databases should be used in a review (Zhao and Guo, 2014; Bramer et al., 2017) leading to conclude that it depends on the reader´s point of view, however this is a potential critique to this study. Another potential limitation could be the publication dates of the articles selected for the study. Given the COVID-19 pandemic started in 2019, we decided to limit the scope of the review to publications no older than 2 years (2019-presenet). It is pertinent to acknowledge that this review presents some findings of initiatives and measures taken around the globe to avoid disruption of education. The fact that the review contemplates projects of only some countries could bias the study towards generalizing results. Future work could dwell in the complete list of articles listed in the review, and a more comprehensive search as the topic develops, to perhaps offer a more conclusive perspective towards the issue. COVID-19 educational initiatives and projects are still being developed and implemented at the time of this study, enticing future research to be done.

Conduct Review

During this phase, the studies that fulfilled the search terms for each research question were input into a spreadsheet (Link: https://figshare.com/s/10db772cfffcfae091c9). The search produced 637 results, which were then filtered to eliminate duplicates. Once the duplicates were removed, a detailed review was conducted to assess the relevance of the studies to the proposed research questions. This review discarded 602 studies either as duplicates or not relevant to the research questions for this review, rendering 23 studies (see **Table 4**), that met the protocol developed in the first phase of the methodology. **Figure 3** illustrates the process that took place for the selection of the studies.

Document Review

The final phase of the proposed methodology involved creating and validating the results of the study.

SLR RESULTS

RQ1 what Measures Have Countries, Regions, or Districts Taken to Address the Digital Divide the Pandemic has Brought to Light in Their Territories?

One of the six aspects covered by the UNESCO-ICTCFT framework, "Organization and Administration," suggests ways to manage the digital assets of schools and provide safeguards for

TABLE 4 | Studies selected for the review.

No	Authors	Item type	Title
1	Adzovie et al	Conference Proceedings	E-Learning resulting from COVID-19 pandemic: A conceptual study from a developing country perspective
2	Akram, Waqar	Journal Article	Scenario Analysis and Proposed Plan for Pakistani Universities COVID-19: Application of Design Thinking Model
3	Ali, Wahab	Journal Article	Online and Remote Learning in Higher Education Institutes: A Necessity in light of COVID-19 Pandemic
4	Bhaumik, Rikisha; Priyadarshini, Anita	Journal Article	E-readiness of senior secondary school learners to online learning transition amid COVID-19 lockdown
5	Bozkurt et al	Journal Article	A global outlook to the interruption of education due to COVID-19 Pandemic: Navigating in a time of uncertainty and crisis
6	Chabbott, Colette; Sinclair, Margaret	Journal Article	SDG 4 and the COVID-19 emergency: Textbooks, tutoring, and teachers
7	CoSN	Journal Article	COVID-19 Response: Preparing to Take School Online
8	Dawadi, Saraswati; Giri, Ram; Simkhada, Padam	Journal Article	Impact of COVID-19 on the Education Sector in Nepal - Challenges and Coping Strategies
9	Flack et al	Miscellaneous	Educator perspectives on the impact of COVID-19 on teaching and learning in Australia and New Zealand
10	Huang et al	Journal Article	Guidance on flexible learning during campus closures: Ensuring course quality of higher education in COVID-19 outbreak
11	Kaden, Ute	Journal Article	COVID-19 school closure-related changes to the professional life of a k-12 teacher
12	Kaur, Naginder; Bhatt, Manroshan Singh	Journal Article	The Face of Education and the Faceless Teacher Post COVID-19
13	Keefe, Elizabeth Stringer	Journal Article	Learning to Practice Digitally: Advancing Preservice Teachers' Preparation via Virtual Teaching and Coaching
14	Onyema et al	Journal Article	Impact of Coronavirus Pandemic on Education
15	Reich et al	Report	Remote Learning Guidance From State Education Agencies During the COVID-19 Pandemic: A First Look
16	Santiago et al	Journal Article	Learning management system-based evaluation to determine academic efficiency performance
17	Sherrard, Daniel	Report	RUFORUM THOUGHT PIECE ON COVID-19 The Regional Universities Forum for Capacity Building in Agriculture (RUFORUM), www.ruforum.org
18	Szente, Judit	Journal Article	Live Virtual Sessions with Toddlers and Preschoolers amid COVID-19: Implications for Early Childhood Teacher Education
19	Toquero, Cathy Mae Dabi	Journal Article	Inclusion of people with disabilities amid COVID-19: Laws, interventions, recommendations
20	d'Orville, Hans	Journal Article	COVID-19 causes unprecedented educational disruption: Is there a road towards a new normal?
21	Krönke, Matthias	Journal Article	Africa's digital divide and the promise of e-learning
22	Romero-Tena et al	Journal Article	The challenge of initial training for early childhood teachers. A cross sectional study of their digital competences
23	MagalhÃes et al	Journal Article	Online vs traditional homework: A systematic review on the benefits to students performance

the people who use them. The suggestions depend entirely on the extent to which ICTs are integrated into the country, district, or school in question (Fallis 2013; CoSN 2020). The academic disruptions brought about by COVID-19 varied among countries, regions, and districts, making evident the digital divide globally, and that constrains the suggestions from UNESCO-ICTCFT (Reich et al., 2020; United Nations Educational Scientific and Cultural Organization, 2020). The purpose of this research question was to analyze the different measures taken by institutions or governments to limit the interruption of education while acknowledging their limitations and capabilities.

The first study was found in Italy, where the University of Bologna extended deadlines for tuition fees and distributed free SIM cards to students without access to internet (Ali 2020). These measures depend on internet access, in addition to data and devices, to provide continuity of teaching and learning (Bozkurt et al., 2020). Another study took place in Saudi Arabia, where schools and universities were ordered to close down by the Ministry of Education because of COVID-19. The government, however, directed that "Virtual schools and distance education be activated to ensure that the educational process continues in an effective and quality manner" (Onyema et al., 2020). The Philippines enacted alternative delivery plans as one of the government responses to address the educational needs of learners. However, educational and legislative emergency preparedness plans must include provisions for students with disabilities throughout this pandemic (Toquero C. M. D. 2020). These plans deal with continuity, but, most importantly, they must offer inclusiveness by respecting UDL and principles of non-discrimination, equal access to information, and gender equality in education (Fallis 2013).

One example where ICT in education has been explored is in Ghana. This country faces numerous challenges, including access to internet and data, support and guidance for students for easy navigation of courses online, the quality of technology being deployed, and access to the technology. These problems are particularly relevant to developing and underdeveloped countries (Adzovie et al., 2020). The shift to online education has highlighted the stark digital divide between those who have access to electricity, internet infrastructure, data, and devices, and those who do not. As of 2019, only 39.6% of Africans have internet access, compared to 87.7% of Europeans and 95% of North Americans (Bozkurt et al., 2020). These statistics provide

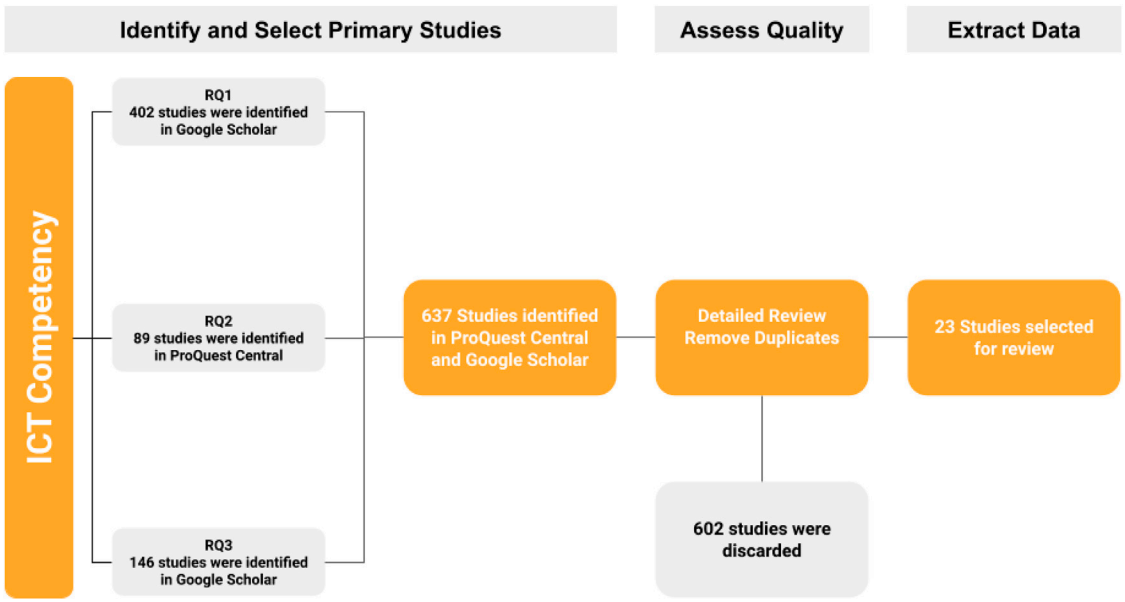

FIGURE 3 | The review phase.

some context as to how context affects DD, but it does not account for effective use of digital tools. It is one thing to have access to digital resources, it is another to use them effectively. While there are several collaborative platforms for remote learning that do not require an internet connection, the access to the internet vastly increases the range of tools that schools, educators, and students can use to study and share knowledge (Krönke 2020). Pakistan has acknowledged the importance of technology, and thus has allocated the budget of 77.3 billion PKR for educational affairs and services during the fiscal year 2019—20. Of this, 28.64 billion PKR has been allocated for HEI, 2.83 billion PKR for the primary education section, and 6.72 billion PKR for the secondary education sector (Akram 2020).

Unless scholarships and other educational opportunities are maintained and hopefully increased, fewer economically disadvantaged students will have the chance to access higher education (Sherrard 2020). Given this circumstance, access to digital assets in an institution is crucial to the delivery of education throughout the pandemic.

RQ2 what Features Must Digital Tools Possess to be Seen by Teachers as Possible Support to Overcome the Academic Disruption Brought About by COVID-19?

The application of digital skills in the learning environment is another aspect covered by UNESCO-ICTCFT. Either a simple word processor or a more complex networking app plays a role in strengthening and enhancing learning. UNESCO suggests the learning community should determine the tools appropriate to the task at hand (Fallis 2013), which is the continuation of education. We aimed to recognize what features the learning community identified as favorable for digital tools to serve as possible solutions to the academic disruption brought about by COVID-19.

Santiago et al. (2020) identify innovative teaching-learning processes using ICTs in Personal Learning Environments (PLEs), which allows students to study off-campus without the need for a teacher-student encounter. This e-learning model also serves as a way to expedite the learning process (d'Orville 2020). The COVID-19 pandemic has led to physical distancing, but the use of digital tools means school activities do not have to stop (Magalhães et al., 2020).

Heidi Gautschi (Schwartz et al., 2020), an Associate Professor of Media Literacy at Haute Ecole Pédagogique de Vaud (Switzerland), used "learnflow.ch" to design an online course providing the necessary skills and knowledge for students during the pandemic. She suggested the essential content and features an online course should have: it should deliver course content in easy-to-digest pieces, provide simple and effective activities, offer students mechanisms to evaluate other students' work, have clear boundaries for student communication, avoid teacher overextension, and remind students, colleagues, and parents to be compassionate (Schwartz et al., 2020).

Dawadi et al. (2020) identified four types of students in terms of their access to digital services and internet: 1) Students without access to any form of digital means and internet, 2) students whose parents have access to mobile devices) students whose parents have adequate access to mobile phones, but limited access to the internet and other digital devices, and d) students whose family members have access to several digital devices, internet and sufficient digital literacy to use. Recognizing which group is being attended should be a factor to consider when evaluating digital tools (Santiago et al., 2020). Flack et al. (2020) recommend institutions identify what good distance learning looks like and

what innovations are occurring in schools across their region. This promotes an accessible multi-platform approach that combines the right features, including support for learning in even their under-resourced institutions.

Any form of digital learning resource should be assessed and selected with the following criteria in mind, as stated by Huang et al. (2020): *licensing*, whether it is open or agreed that the resource could be disseminated and adapted legally; *accuracy and quality,* meaning educators should consider reliable resources and platforms with known publishers or content; *interactivity* referring to resources with interactive elements that help increase the learning engagement and motivation of students; *adaptable resources* that allow contents to be modified and mixed to fit a specific learning context; and finally, *culturally relevant and sensible resources* that do not offend any given race or culture.

RQ3 How was the Role of Teachers Affected in the Learning Environments After the Educational Disruption Brought About by Covid-19?

Our last research question details the pedagogical and teacher professional learning aspects of UNESCO-ICTCFT. We decided to analyze any information pertaining to the change in roles for teachers and the skills associated with these changes that support effective teaching and learning methods. We wanted to know the repercussions that the new skills have on the learning objectives specified in a defined curriculum. Most importantly, how does a role/skill shift allow teachers to reinterpret the curriculum to function effectively within knowledge societies, and how are authentic assessment strategies devised to monitor development, progress, and outcomes (Fallis 2013)?

Some studies addressed the sudden shift of roles COVID-19 brought to teachers and educators (Chabbott and Sinclair 2020). As Bozkurt et al. (2020) mention, learners had to suddenly regulate their own learning and become digitally savvy. Educators have had to switch to online teaching overnight regardless of their comfort level, familiarity, and training in digital technologies. Children's lives also got turned upside down, substituting on-screen contacts for teachers and friends, while parents, caregivers, and older siblings suddenly found themselves in emergency homeschooling roles (Szente 2020). Some authors, like d'Orville (2020), state that this change in roles due to disruption and uncertainty led to digital technology being used to create personalized solutions for each student based on his/her knowledge and learning style.

It is important to recognize the different settings of institutions and stances they took toward this change in learning dynamics. As Chabbott and Sinclair (2020) state, mobilizing households in densely populated and fragmented urban neighborhoods requires different skills and approaches than in smaller, stable towns or sparsely populated rural areas. The role parents play in distance learning as supports was mentioned throughout the studies. For example, Flack et al. (2020) state that guardians need time and resources to help their students, which means they must master the preferred digital learning platforms promptly. Having to deal with learning platforms on short notice adds pressure on teachers and parents, especially those with limited digital skills and limited resources for continued education (Onyema et al., 2020).

The acquisition of skills by educators and teachers needs to be flexible and mobile as learners move from a traditional system to online learning (Bhaumik and Priyadarshini 2020). This may cause some teachers to struggle, as their roles are changed from a primary input provider to a facilitator of learning who "rocks the boat" drastically, often outside of their comfort zones (Kaur and Singh Bhatt 2020). No longer are teachers viewed as knowledge transmitters who merely prepare lesson plans and deliver them in class. Now they need to continually adapt, change, and shift to meet the changing needs of their students (Keefe 2020). One global trend is the inclusion of sustainability in education, which is why teachers and students are increasingly focused on the acquisition of skills or attributes that lead to academic success (Santiago et al., 2020).

While some studies focused on the multiple and complex factors that influence the integration of ICT in educational settings, others focused on the ways teachers integrate them in teaching and learning. Whether technologies are used or integrated into the classroom depends on the intentions and capacities of teachers to learn and integrate them, more than whether the technology is available or not (Romero-Tena et al., 2020). The shift toward distance learning and virtual settings was not new, but the sudden shift in role to many teachers during the crisis was new (Kaden 2020).

DISCUSSION

Following UNESCO-ICTCFT, our review identified how institutions could address COVID's academic disruption by focusing on some aspects covered by the UNESCO framework. The results of this review aim to show what measures countries worldwide have taken during the pandemic and how they are dealing with the digital divide.

This SLR was helped mainly by the Organization and Administration section of the framework, which acknowledges the digital divide and encourages educators and institutions to find innovative ways to address it using educational assets. The digital gap between the "haves and have nots" was even more present when students and teachers were confined to work from "home," heavily relying on technology to overcome the interruption to education. Bozkurt et al. (2020) mention that those privileged to have data, devices, and digital literacy can shift to emergency remote education far more easily than those who do not have such affordances. Examples of how COVID-19 accelerated ICT implementation plans worldwide include Belgium moving all their lectures online, Pakistan shifting to virtual learning environments, and governmental dependencies in Africa provisioning smartphones and computers to students (Akram 2020; Krönke 2020).

At the basic level of Organization and Administration in the UNESCO framework, teachers are encouraged to physically arrange the classrooms and labs to accommodate the integration of ICT into their lessons. In the current situation,

the classrooms and labs suddenly moved to online environments, potentially limiting educators' leeway in this matter. Nevertheless, the framework advises teachers to devise implementation strategies to identify and set up technological tools that enhance teaching and learning, regardless of the medium. Identifying the features that these tools need to have to facilitate the continuation of education is a critical detail covered by the framework.

Although different technologies were implemented to address the educational disruption caused by the pandemic, they all revolved around simplicity and effectiveness. That being said, it is also true that technologies must facilitate social distancing to prevent the virus from spreading. In our review, we saw that institutions and organizations tailored ICTs to their infrastructure. They ranged from robust online course platforms to more traditional technologies like radio and television (Dawadi, Giri, and Simkhada 2020; Schwartz et al., 2020). Studies agreed that it was important to identify the level of access to technology at the institution in question, as this would help determine equitable educational resources.

Therefore, the framework requires educators to identify the hardware and software solutions that could be integrated into digital learning environments. Moreover, it looks to an environment of blending and coexistence where students learn to self-regulate and collaborate. Also, it provides information about the change in the role that educators and teachers undergo in the online environment, and suggests the skills linked to the new role that they must acquire.

The abrupt and rapid change to dynamic distance learning brought teachers a sense of being replaceable. However, as Wright (2013) states, with or without technology, teachers will remain inherently indispensable, but will endure qualitative evolution in the education of students. As more and more ICTs are implemented in the learning process, institutions must prepare candidates with the digital competencies they need and examine how regulatory teacher preparation can be met in a virtual environment (Keefe 2020). This preparation will never cope with the students' rate at which they gain access to knowledge, or even how they learn a technical skill through a few clicks. Therefore, a re-evaluation of the responsibilities and duties of an educator needs to happen (Kaur and Singh Bhatt 2020).

Needless to say, new pedagogical skills play a role just as important as technology in engaging future digital teaching and learning methodologies. As discussed, UNESCO encourages educators to take up alternative student-centered pedagogies, ideally favoring problem resolution, collaboration, and cooperation. Teachers should design and support ICT learning activities, which can help students achieve self-management. Students could potentially determine their own learning parameters, which will be monitored and supported by their teachers.

Educators will shift from knowledge transmitters and input providers into facilitators of content. Consequently, institutions will place a greater focus on students' engagement and motivation to learning. This in turn will require teachers to develop interpersonal skills and values to sympathize with students' needs while effectively managing their groups (Kaur and Singh Bhatt 2020). Openness for educators will be key to supporting innovative learning methodologies, as ICT by itself will not suffice, as Bozkurt et al. (2020) state that "teachers should demonstrate their emotional presence, build a sense of community, support and care for students," allowing them to show empathy for their students.

It is important to acknowledge this shift in educators' roles, but it is even more important for institutions to support teachers in achieving digital literacy through professional development. Furthermore, the framework suggests educators should develop a personal learning network, allowing them to share expertise and resources and interact with peers who share their interests. Given the current situation, being able to connect with other educators and share experiences on how they or their institutions handle educational disruption is paramount. Lave and Wenger (1991) work states the importance of situated learning in communities of practice, specifically on how old-timers (experienced tenured teachers) could influence newcomers (recently promoted teachers) into growing and carrying on the community, thus preserving knowledge and skills shared among the community. These interactions will, in turn, foster innovation throughout the institution, promote continuous learning among colleagues, and finally, as intended by the framework, support the ICT strategy developed by the organization.

CONCLUSION

There is no assurance when and how the pandemic will end, and, more importantly, what effects it will have on educational settings. COVID-19's disruption brought many challenges to teachers, as existing lesson plans were no longer adequate. Teachers were challenged to learn new technologies quickly, while suddenly removed from their students. Many teachers will consider this the most traumatic and transformative event of the modern era. Any post-pandemic changes that prevail will surely depend on frameworks like UNESCO's to monitor and evaluate an institution's use of ICTs, but most importantly, to prepare organizations to respond adequately to future disruptions to education.

To orientate this SLR, we had proposed the initial research question that, given the shift in educators' roles due to the educational disruption brought about by COVID-19, which technical skills and competencies do educators need to adapt to current learning environments? We can conclude by the studies that the skills and competencies acquired depend on the organization's access to ICT and the level of competency of educators and teachers. Surely, UNESCO's intention with its ICT CFT was not to offer a short-term solution to organizations for the educational disruptions of COVID-19, but rather to serve as a framework to determine the level of ICT implementation needed within an educational organization, as part of UNESCO MGIEP, 2020 Agenda for Sustainable Development. Projects and plans in different domains, not just education, have been fast-tracked around the globe. The institutions rely heavily on technology to achieve their goals, while also observing the social distancing imposed by the COVID-19 pandemic. Organizations committed to UNESCO-ICTCFT have had

advantages because they became familiar with the framework and how the different aspects of ICTs impacted their institutions.

Our SLR results showed that frameworks such as UNESCO's could serve as guides for institutions to fast-track the development of educational strategies post-crisis COVID-19 to cope with the new learning environments.

RECOMMENDATIONS FOR FUTURE RESEARCH

These times of uncertainty allow no predictable outcome for the educational disruption caused by COVID-19. Institutions are cautious about reaching for what could be considered disruptive solutions, reluctant to break traditional and successful educational models. When the pandemic ends and schools return to traditional settings, we can see better what measures and dynamics will remain and become part of the everyday educational settings. One thing for sure, regardless of the outcome, there will be an increase in the use of ICTs in learning environments, which will encourage organizations like UNESCO to develop plans and projects, such as the ICT framework further. COVID-19 has brought great challenges to the educational setting, prompting organizations, students, researchers, and educators to find innovative solutions to overcome the disruption of educational continuity. The field of education has suffered losses, but we must not allow ourselves to be empty-handed once the pandemic is over. There is a need to disrupt the current educational setting. It is time to "Rock the boat!"

AUTHOR CONTRIBUTIONS

HM and M-ZG contributed to the design and implementation of the research, to the analysis of the results and to the writing of the manuscript.

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