

Inclusive Digital Education on Open Platforms: A Case Study of the Complexity of the Future of Education

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ABSTRACT

Open education platforms can be a valuable bridge supporting inclusive education. This article reports an international open education program conducted within the context of COVID-19. The guiding question was: What challenges lie ahead in the future of education, allowing open platforms to facilitate an inclusive digital education that considers special educational, contextual, and diverse learning needs? A case study involved 959 participants in five webinars. The results reported: (a) challenges facing open platforms for inclusive education, (b) current open practices for inclusion, (c) production of open educational resources for inclusion, (d) processes necessary for the production of open platforms, and (e) institutional requirements for inclusive digital education. The study is interest to academic, scientific, governmental, and societal communities and designers, computer developers, and decision-makers interested in educational practices promoting digital equity and inclusive education.

KEYWORDS

Complex thinking;
educational innovation;
higher education;
inclusive education; open
platforms

Introduction

Open education can facilitate inclusive education and consequently meet international calls such as the Sustainable Development Goals of the United Nations 2030 Agenda. According to UNESCO (2017), inclusion is a process of overcoming the obstacles that limit the participation of all students. Inclusive education focuses especially on traditionally excluded people (UNESCO, 2004). Notably, in 2019, UNESCO called for Open Educational Resources (OER) to foster universal access to information through quality, inclusive, and diverse open learning materials. Discussions on the future of all forms of education urge a new, just social contract in education

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(UNESCO, 2021). This new social contract describes a radically different approach to HE, focusing on openness, inclusivity, and diversity. In digital environments, open education can promote inclusion through innovation (Ramirez-Montoya, 2020). This innovation can occur in different forms, for example: digital platforms and OER.

Training for technological accessibility is fundamental for open education to contribute significantly to digital inclusion. Open and distance education, together with technological advances, can help people with disabilities to overcome barriers such as mobility and sensory problems (vision or hearing), among others (UNESCO, 2016). However, the use of technology must be accessible to all; otherwise, the inequality gap will increase (Carrim & Bekker, 2022). Scanlon et al. (2021) evaluated content accessibility guidelines on 139 web pages from 73 higher education institutions. Only one page had minimal errors (10), and the others had multiple errors. Several online education platforms do not comply with accessibility principles. One of the reasons is that teachers and developers have not prepared for the use and development of inclusive technologies for learning (Kosova, 2021). It is important to promote success stories of digital inclusion in open education.

Open education and digital inclusion come together when addressing new opportunities for inclusive, innovative platforms. Benlamri et al. (2016) identified open education contributions that fortify personal growth, social inclusion, open innovation, and sustainable economic development in the challenges of globalization and global competition in productivity and services. Adil et al. (2022) agreed that OER includes increased access to knowledge, support for lifelong learning, pedagogical benefits, and improved student learning outcomes. In this framework, this article aims to identify responses to educational challenges by analyzing a case of best practices for the future of education in international open and inclusive education supported by open platforms.

Inclusive digital education

Inclusive digital education is a field where teachers must be aware of their responsibility and need for continuous preparation, not only in the use of technology but also in attending to students' diversity in how they access content. Accessibility in the design and delivery of digital courses is a priority in higher education (Gronseth, 2018). Open distance education, through the use of OER and free software, is a sustainable method to overcome barriers in education suffered by people with disabilities because it helps them attend school, which contributes to the satisfaction of their social and educational needs (Solovieva et al., 2020; UNESCO, 2016). However, more effort is still required to achieve inclusive digital education.

The challenges of inclusive digital education with universal learning designs require special attention in a world where technological advances proceed by leaps and bounds. These challenges become accentuated in STEM disciplines (Science, Technology, Engineering, and Math) through practical activities and texts rich in symbolic notation (Pearson et al., 2019). On the one hand, this implies the need for further research, as studies have mainly focused on examining attitudes toward children with disabilities (Nikčević et al., 2021). On the other hand, further training in using accessible, educational, web-content-development technologies is needed (Kosova, 2021). Effective use of technology allows open education to be more inclusive.

Inclusive technological platforms

Technological platforms in digital education and OER are determinants in open and inclusive education. Training in their use is essential to exploit their full potential. Technological platforms are the building blocks of communication. They should be widely used because they enhance equity and inclusion (Guo-Brennan, 2022; Kandemir & Kiliç Çakmak, 2021; Perera et al., 2021), which has led to the development of various initiatives. For example, Ally et al. (2017) conducted a mobile learning project using tablets and Aptus, a portable system to provide access to materials without connecting to the internet, finding that this improved student learning. Arrue et al. (2019) worked with RemoTest, a platform that helps conduct inclusive remote and on-site experimental sessions; The users in the study were satisfied with the technology.

Disruptive methodologies, frameworks, and innovative models are accelerating open education. The Horizon architecture is an adaptive model with 7 axes: (a) Legacy: includes the personal interests, vocations, and objectives of those involved in the project, (b) Community: a network of people who have a particular objective in common, (c) Learnings: relevant tools and skills to manage individual or collective projects, (d) Technologies: set of technological investment and awareness to make decisions, (e) Context: socioeconomic, political, and environmental factors influencing project operations, (f) Projects: individual or collaborative enterprises designed to create value and leave a legacy, and (g) Management: where both administrative and sustainability aspects are involved (Barroso et al., 2019; Ramírez-Montoya, 2021a; Ramirez-Montoya & González-Padrón, 2021). These axes allow the consolidation of open education projects, including inclusive digital platforms.

Open education and the context of digital inclusion

Open education uses a variety of channels to promote the successful inclusion of marginalized communities. This attempt to democratize

knowledge has generated interest in the scientific and academic community. It has given rise to interesting initiatives and studies, such as those presented by Farrow et al. (2022), who classified 25 international initiatives focused on accessibility, open educational practices, OER implementation and impact, open pedagogy, MOOCs, quality, technology, and infrastructure. Regarding OER, Weber & Skyer (2022) asserted that using H5P for deaf pedagogy allows for easy management of inclusive OER and open ebooks. When these resources are high quality and have locally relevant content, they promote fundamental equity and social justice among the advantaged and disadvantaged (Cox et al., 2022). This challenge can be approached from different perspectives, including that of technology.

Emerging technologies present a world of possibilities to bring knowledge closer to everyone. However, this process is not simple due to the great difficulties that many have in accessing them. In general, the use of technologies such as big data, the Internet of Things, and social networks, among others, have impacted the teaching-learning process both in face-to-face and distance environments, including elearning, blended learning, and mlearning (Ramírez-Montoya et al., 2022). They favor educational innovation in different ways; for example, adaptive technologies allow personalized and inclusive access to existing content on the platforms (González-Pérez et al., 2022). Similarly, it is necessary to adequately share OER to increase knowledge dissemination and effectively contribute to inclusive, open education (Nova-Nova et al., 2022). How OER is shared is as important as the material itself.

Current study

The OpenEd Program, “Open and Inclusive Education: WUN (World Universities Network) and UNESCO Training and Research Networks,” emerged during COVID-19 in response to a call for proposals from the WUN network (Figure 1). The program aimed to provide open online education to mitigate the effects of the Covid-19 contingencies by establishing strategic relationships with WUN members and UNESCO chairs involved in open education. The network included designing and implementing webinars, supported by open educational resources and practices, explaining the social consequences of Covid-19 in populations most affected by the pandemic.

The mission was to contribute to open and inclusive education through distance learning through a series of webinars addressed to teachers, students, researchers, and society in general and delivered by experts and members of UNESCO Chairs related to open education. The vision was to generate new knowledge and projects aligned with Sustainable Development Goal 4 (SDG #4) and the recommendations of the 2019

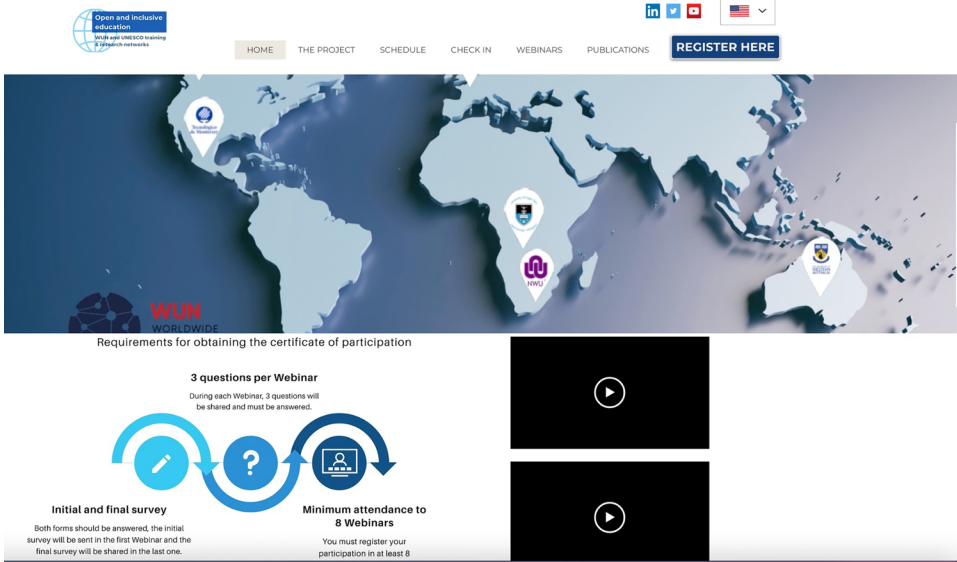


Figure 1. Web Page of Open and Inclusive Education (<https://www.wununesco.world/?lang=en>).

UNESCO declaration on open educational resources and open education. Open education encompasses designing, realizing, and evaluating learning opportunities with visionary, operational, and legal openness to improve the quality of student learning.

The project focused on disseminating webinars targeting the global community interested in educational innovation practices within the Open Education movement, which incorporates the assembly, production, use, dissemination, and popularization of Open Educational Resources, the democratization of knowledge, and the intersectoral and interdisciplinary co-construction of knowledge.

The project was strategic regarding the great damage caused by the effects of Covid-19 in the education sector, especially in the most vulnerable communities, where innovations are required to avoid educational regression and abandonment. Technological platforms have great potential to contribute to open and inclusive education and help improve the quality of education and reduce inequalities. In this sense, this study raises the following question: What challenges lie ahead in the future of education, allowing open platforms to facilitate an inclusive digital education that considers special educational, contextual, and diverse learning needs?

Method

The study uses the instrumental case study method. Yin (2009) notes that cases are situations with delimited characteristics, which can be of value for learning about phenomena of interest. The case under analysis was

the OpenEd Program “Open and Inclusive Education,” which aimed to be an instrument for learning about the particularities of open and inclusive education platforms.

Participants

The invitation to the OpenEd program was open, and 959 participants registered. The population came from 46 countries from the continents of America, Europe, Asia, Africa, and Oceania. The gender distribution was 62.6% women and 37.4% men. The educational level of the participants varied from high school to postgraduate level, with the highest percentage of participants holding masters and doctorate degrees (Figure 2).

Open Ed facilitators came from seven institutions: Athabasca University and University of Alberta (Canada), University of Western Australia (Australia), University of Salamanca (Spain), Tecnologico de Monterrey (Mexico), University of Cape Town and North-West University (South Africa).

Instruments and categories of analysis

The OpenEd program held ten webinars. Participants received instruments in each session with quantitative Likert scale items and open-ended qualitative questions. This study focused on five webinars that directly addressed inclusion and open education. Likert scale instruments (Ramírez-Montoya

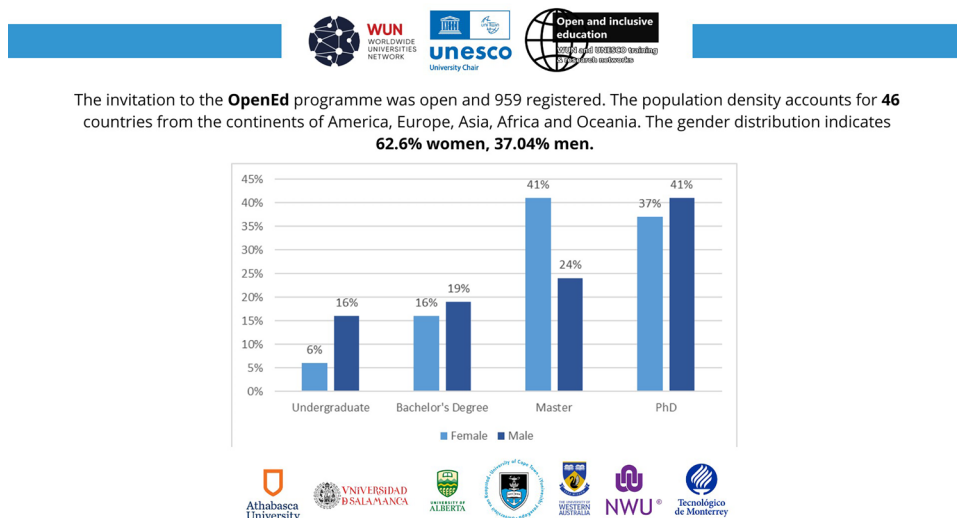


Figure 2. Profile of participants.

& Tenorio-Sepúlveda, 2021) and questionnaires with open and closed questions were administered in the five webinars.

The questions addressed the program objectives, with categories of analysis for the challenges of open and inclusive education, open and inclusive educational practices in the context of the participants, and alternatives for the future of open and inclusive education. The five webinars in this study specifically addressed the issue of the inclusion of special needs, and open and inclusive education (Table 1).

Procedure

The OpenEd program was built as a team by the project members. An open invitation was sent through various media (flyers, mailings, social networks, institutional media). The webinars were delivered remotely through an open platform with simultaneous Spanish and English translation. During the sessions, the speakers presented the topics, answered the participants' questions, and invited them to actively construct new inclusion possibilities with the support of open education. The lectures, presentations, and questionnaires were integrated and openly accessible on the program's platform (<https://www.wununesco.world/?lang=en>).

Analysis

The researchers analyzed the data through descriptive processes based on the Likert scale item responses and questionnaires. Stake (2013) recommended analyzing assertions based on the incidences of data repetition and grouping them to order the report of case presentations. In this study, we conducted the analyses of three categories (challenges, practices, alternatives) that emerged from the frequencies and presented the results and analysis of the study. We used Tableau to plot the results.

Ethics

Ethical processes in the study involved participant privacy and informed consent. Creswell and Plano Clark (2007) advise that when conducting a study, the researcher must consider several ethical dilemmas, such as the participants, the handling of the data, and the dissemination of generated knowledge. In this study, we informed the participants about data collection, removed identity data in the information processing, and processed the results objectively per the evidence collected. Likewise, we respected the confidentiality of the participants taking in to account the expectations of the funders for promoting the findings, disseminating these in various open media (technical reports, conferences, and publications).

Table 1. Webinars description.

Webinar	Webinar objective	Categories of analysis	Instruments & Questions	Number of responses from participants
Open and inclusive education: WUN and UNESCO Training & research networks (Ramírez-Montoya, 2021b)	To build links for open education that supports equity, diversity, and flexibility within the framework of a project that integrates the visions of WUN and UNESCO to provide solutions for lifelong learning and sustainable development	Challenges of open and inclusive education Open and inclusive educational practices in the context of the participants	Questionnaires/What do you see as the biggest challenge facing open education according to UNESCO's recommendations? Likert scale instrument/ Value participating in education projects that address diverse needs (e.g., disability, vulnerable communities) and How is it perceived in the open education competence? Likert scale instrument/ Knowledge of virtual platforms where open educational resources can be found, for example, MERLOT, OER Commons, and Procomún.	205
Ebook Creation - Current Considerations for Deaf and Hard of Hearing (DHH) Students (Weber, 2021a)	To explore Universal Design Principles and Accessibility frameworks developed by UNESCO and current systems in place to provide ebooks to DHH students. To discuss ways to go beyond the standard provision of accessibility to promote multi-lingual language acquisition in DHH children and youth.	Open and inclusive educational practices in the context of the participants Challenges of open and inclusive education	Questionnaires/What open education practices are in place within your organization, school, or institution that serve the visually handicapped Questionnaires/What are the biggest challenges facing the development of ebooks or accessible digital texts for the deaf and hard-of-hearing? Questionnaires/Please indicate, in the order of importance, the necessary processes required to produce accessible digital texts (ebooks) for deaf and hard-of-hearing learners (1 being of major importance and 4 being of minor importance)	206

(Continued)

Table 1. Continued.

Webinar	Webinar objective	Categories of analysis	Instruments & Questions	Number of responses from participants
The use of Open Educational Access publishing platforms to create ebooks for the deaf and hard of hearing (Weber, 2021b)	To review research-based design principles for ebooks for deaf children, considerations for further development, and a planning pathway for ebook creation using available OER platforms. To introduce samples of an ebook interface made available through PressBook featuring content for multi-lingual deaf persons.	Alternatives for the future of open and inclusive education.	Questionnaires/Please indicate, in the order of importance, your institution's training needs related to developing a visual-centric ebook.	218
Open, inclusive education and social justice: The role of open textbooks (Cox, 2021)	Discussion of the nexus between open, inclusive education, social justice, and open textbooks. These concepts will be unpacked. The key findings of research in this area will be shared and debated. Participants will leave with a deep understanding of social justice and open education.	Alternatives for the future of open and inclusive education.	Questionnaires/Where do you think marginalized voices, including students, play a role in Open Textbooks?	178
Horizons Architecture for open and inclusive education (Ramírez-Montoya, 2021c)	To build links for open education that supports equity, diversity, and flexibility within the framework of a project that integrates the visions of WUN and UNESCO to provide solutions for lifelong learning and sustainable development.	Alternatives for the future of open and inclusive education.	Questionnaires/Which of the Horizon Architecture components do you consider to be the most strategic for you to achieve visionary open and inclusive education projects?	159

Results

Challenges of open and inclusive education

We asked the participants about their biggest contextual challenges (based on the UNESCO (2019) OER recommendations). **Figure 3** shows the greatest challenges facing open education in UNESCO's recommendations, broken down by gender and highlighting inclusion and equitable access to quality OER.

In the participants' comments, the following stand out: (a) the lack of training and awareness of OER in their institutions, (b) the gap in knowledge and access to technological tools in various countries, (c) the lack of OER in different formats and languages, (d) the need to obtain international funds to apply them locally, and (e) the long and slow processes required to develop and implement policies.

In particular, the main challenges in producing inclusive digital resources for deaf and hard-of-hearing people (**Figure 4**), are primarily ensuring effective, inclusive, and equitable access to quality OER designed for them.

Participants' contextual open and inclusive educational practices

The participants assessed their collaboration in educational projects that address diverse needs, such as disability or belonging to vulnerable

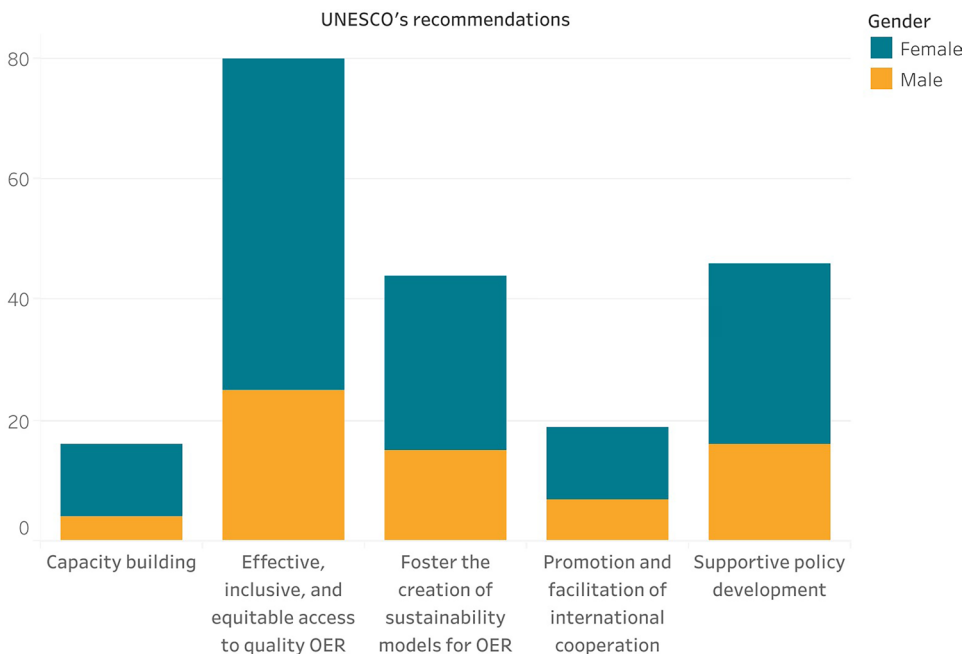


Figure 3. Challenges of open education from a gender perspective.

communities. We categorized the data according to their perceived level of open educational competency (Figure 5). We considered the responses: (a) null if they had no knowledge of open education to apply in educational practices; (b) low if they had some knowledge of open education that they applied incipiently in educational practices; (c) medium if they had moderate knowledge of open education to apply in educational practices; and (d) advanced if they had extensive knowledge of open education and applied it in different educational practices.

In contrast, Figure 6 shows the participants' perception of their knowledge of these types of platforms that host resources of inclusion, categorized by the respondents; educational background. Although some professionals do not know about them (strongly disagree), those who know about them predominate (agree). This information can help design training related to developing and using inclusive educational platforms.

Alternatives for the future of open and inclusive education

In the participants' perception of needs heard from marginalized voices, the future of open education regarding open textbooks lies in the co-creation and production of materials (Figure 7). Agreement on co-creation was predominant, regardless of the participants' countries of origin.

Students represent one of the marginalized voices. Participating in the different stages of OER development can make these voices heard. The activities they can perform include translating resources, state-of-

Challenge	Academy	Government	Sector Industry	Social	Not applicable
Determining visual design frameworks that support accessibility	11	1	1	1	3
Effective, inclusive, and equitable access to quality OER for deaf learners	55	3			1
Foster the creation of sustainability models for OER that are deaf led	24				1
Promoting deaf leadership in the production of accessible digital texts (e-books)	16	3	2		
Promotion and facilitation of international cooperation	21				1
Software capabilities	8	3		1	
Supportive policy development	43	1		1	6

Figure 4. Challenges in developing ebooks or accessible digital texts for the deaf and hard-of-hearing.

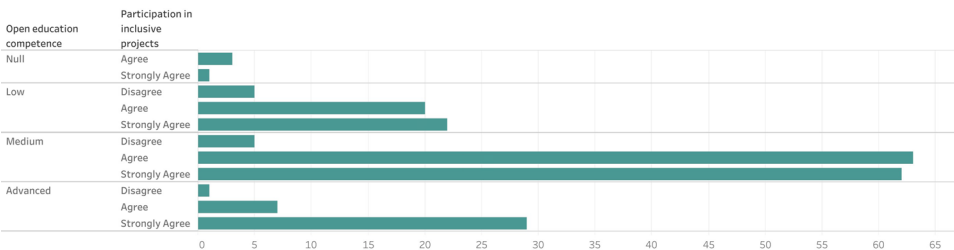


Figure 5. Assessment of participation in inclusive education projects.

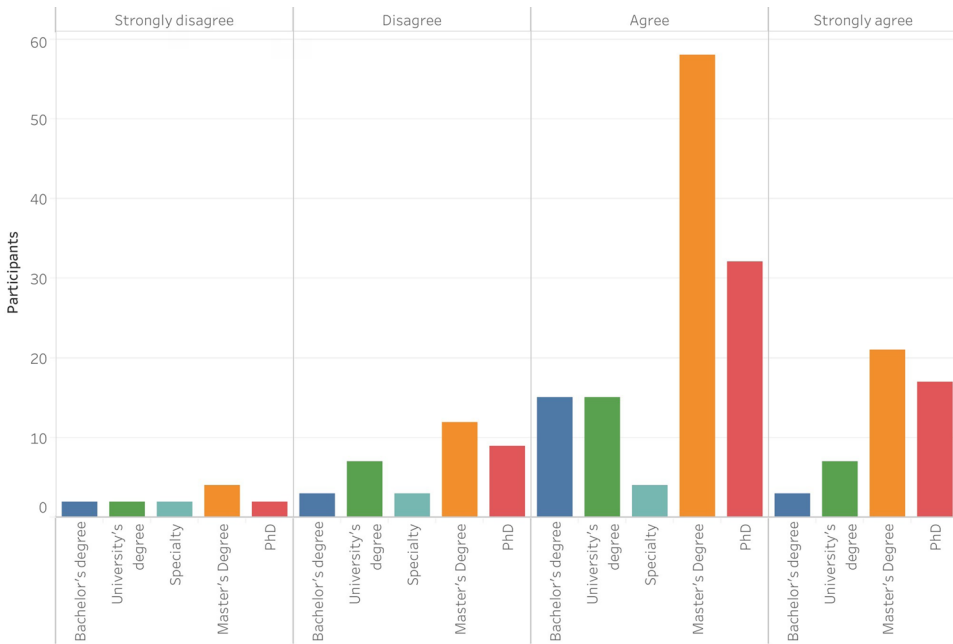


Figure 6. Knowledge of open platforms for inclusion.

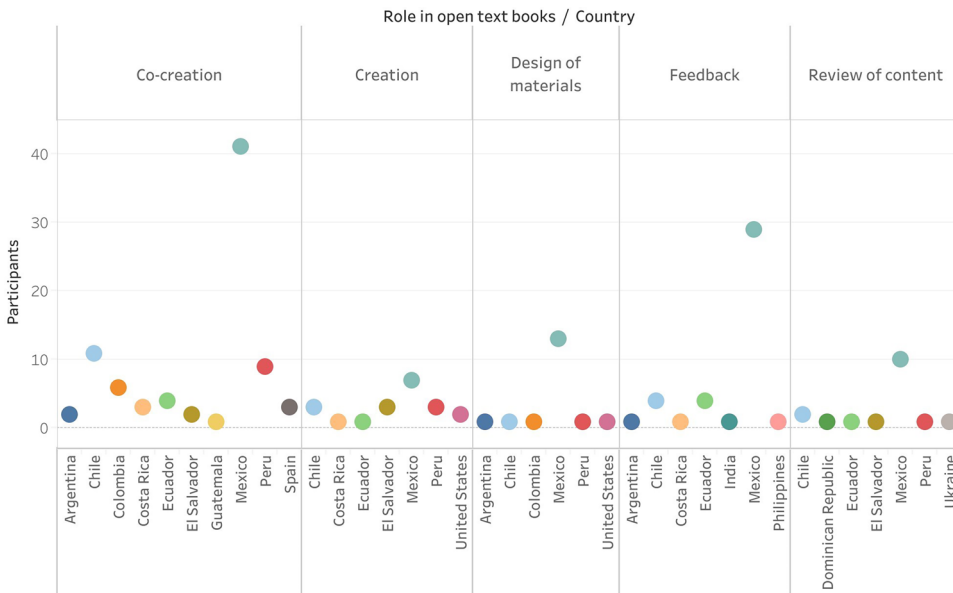


Figure 7. Participation needs of marginalized voices in OER production.

the-art writing, developing applications to place in repositories, providing feedback on OER through pilot tests, and reviewing content for adaptation to their contexts.

Other marginalized voices are people with disabilities, who can be part of work teams that integrate their family members and special education

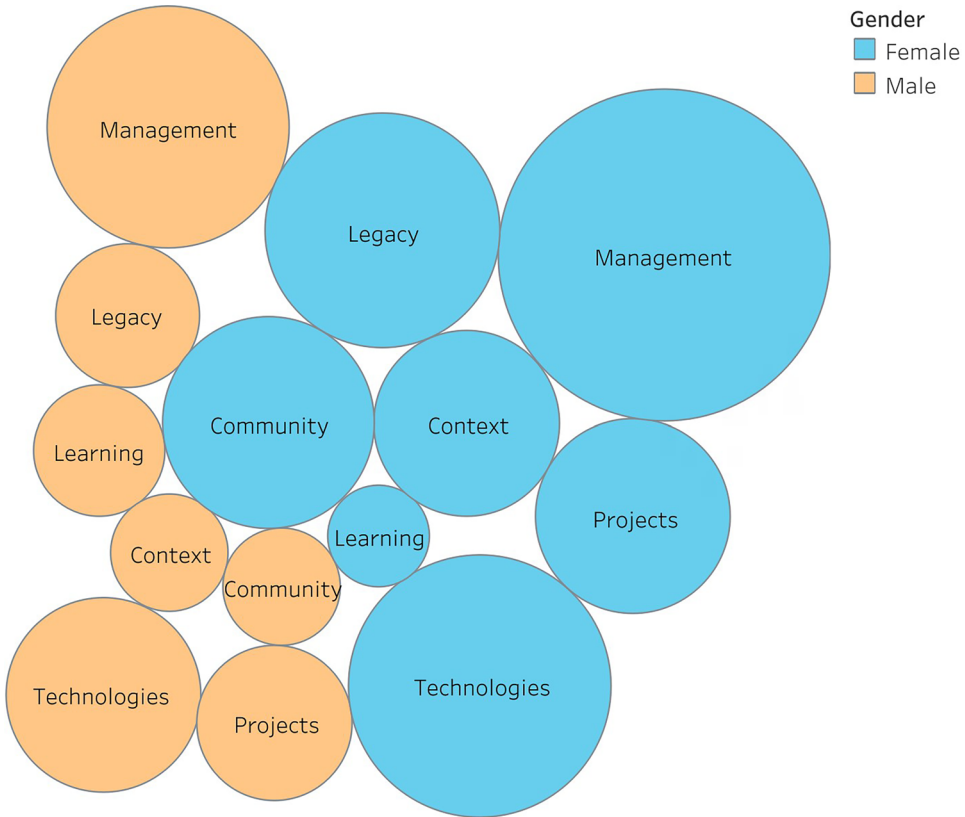


Figure 8. Components of visionary projects for open and inclusive education.

teachers to develop materials that meet their learning needs. One way to generate these inclusive OER is through creative projects using Horizon architecture, whose strategic components for achieving objectives are presented in Figure 8.

Identifying the strategic components of the Horizon architecture can help focus efforts and resources for achieving inclusive open education projects.

Discussion

Digital platforms that host OER must be easily accessible, prioritizing a design that considers the diversity of users. Figure 3 shows that the main challenge for open education related to OER is effective, inclusive, and equitable access to quality resources. Addressing accessibility proactively as part of course design meets the needs of all learners, including marginalized learners (Gronseth, 2018). People with diverse characteristics equally perceive OER access challenges. By improving the design of digital platforms, open education will advance in the right direction toward the democratization of knowledge.

Despite the progress in the production and dissemination of OER, some people are still marginalized in terms of benefits, which is an area of opportunity in open education. [Figure 4](#) shows the challenges that exist to produce inclusive OER. In addition to accessibility, the development of support policies and the creation of sustainability models stand out. A lack of consideration in curricular development affects low-incidence populations; accessible design frameworks can promote the production of inclusive OER (Weber & Skyer, 2022). The need to generate more supportive policies and sustainability models for OER production implies the involvement of people with different profiles, including those who can make implementation decisions.

The possibilities for participation in inclusive education practices are multiple; they can involve both novice and experienced people in open education. [Figure 5](#) shows that participation in inclusive education practices has value regardless of the development of open education competency. In digital environments, inclusive education practices require careful attention to the systematic organization of learning in curriculum, pedagogy, and assessment (Carrim & Bekker, 2022). Working with teams of people with different levels of expertise can benefit inclusive, open education.

Marginalized people should have active roles in the production processes of open platforms and OER (co-creation, creation, design of materials, feedback, and content review) for inclusion, innovation, and increased participation. When students know about open educational platforms, although they cannot master them ([Figure 6](#)), they contribute mainly to the production of OER via co-creation ([Figure 7](#)). At the university level, virtual platforms shape inclusive teaching practices (Perera et al., 2021). Open platforms are key elements for open education. Listening to marginalized voices in their use or production promotes innovative and inclusive educational practices.

The efficient use of technology and adequate human resource management are fundamental to the success of inclusive digital educational projects committed to innovation. The main components of the Horizon architecture that enable visionary, open, and inclusive education projects are project management and the use of technology ([Figure 8](#)). Integrating digital technology in all areas of an organization can improve the functioning of education components and systems (Ramírez-Montoya et al., 2022). Inclusion can contribute positively to developing visionary projects to achieve the SDGs.

Conclusion

In the context of complexity, inclusive digital education with open platforms can shed light on a better future of education for all. This study focused on the question: What challenges lie ahead in the future of education, allowing open platforms to facilitate an inclusive digital education that considers special educational, contextual, and diverse learning needs? The results report (a) the challenges of open platforms for inclusive education, including the availability of technological applications that facilitate the particular learning needs of special needs populations and affordances of specific software and hardware, (b) current open practices for inclusion, including design principles (i.e., deaf pedagogic design principles) that address specific learning needs beyond the principles in Universal Design for Learning, (c) production of open resources for inclusion in collaboration with those who are direct users of the resources, (d) processes necessary for the production of open platforms, including the identification of technology, training needs, funding availability, and human capital, and (e) institutional requirements for inclusive digital education, including the infrastructures required to facilitate and maintain open platforms. The findings have also made visible the need for intersectional approaches that consider gender, and this could be extended to race, age, ethnicity. Gender equality and disability have been barriers to accessibility. However, the awareness of open platforms and open educational practices across the countries represented is encouraging.

These results have implications for educational practice to move beyond the principles of universality to identify and support specific, community-based systems, actions, and resources to develop appropriate open and inclusive education resources. At the same time, we need to recognize the available networks that aim to address universal needs. It requires a complex, open architecture to support local and specific communities. Co-creation of open textbooks and other OER is also crucial. Co-creation with colleagues, especially students, can make content more accessible, relevant, and local. Co-creation also brings in voices unrepresented or misrepresented in the past. Open education affords collaboration and co-creation and plays a role in addressing social injustices.

Implications for educational research include curriculum development, preparation and assessment of training resources, evaluation of technological applications and design practices, and research on online pedagogical approaches incorporating multimodality, language learning, specific learning needs, and cultural resources. These signify rethinking existing approaches to teaching and learning and may disrupt traditional power hierarchies in higher education involving educators (due to new forms of

collaboration) and teachers and students (due to co-creation and respect for student expertise).

This study was limited to the participation of people interested in inclusion and open education, with other populations yet to be explored; hence future studies should broaden this analysis to identify insights into open and inclusive quality education for all. Also, the exploration and development of open and complex systems that circumvent the barriers, problems, and ideological cul de sacs blocking the learning needs of specific populations would be critical for future studies. Thus, this study invites continuing explorations of possibilities for a better future for education.

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Disclosure statement

No potential conflict of interest was reported by the author(s).

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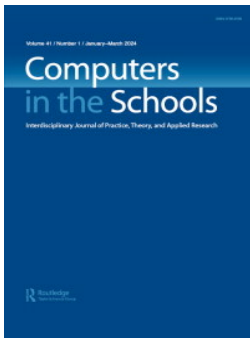
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