Open Educational Resources and Maker Culture: Foundations for Building New Knowledge Spaces in Post-Pandemic Higher Education

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This article is an English version of the original work titled "Recursos educacionais abertos e cultura maker: pressupostos para construção de novos espaços de conhecimento na educação superior pós-pandemia". The original article was written in Portuguese and published in the proceedings of the 4th International Conference Media Ecology and Image Studies, Volume 2, pages 1528–1542. It was authored by Renata Pires Quaresma, Marcelo Setsuo Hashimoto, Dorival Campos Rossi, Vânia C. P. Nogueira Valente, and Maria da Graça M. Magnoni. The original proceedings can be accessed here. This version aims to make the research accessible to an international audience, focusing on the impacts of the COVID-19 pandemic on higher education and exploring innovative approaches to building collaborative and resilient educational systems.

Open Educational Resources and Maker Culture: Foundations for Building New Knowledge Spaces in Post-Pandemic Higher Education

The 21st century will undoubtedly be marked by the significant impacts of the COVID-19 pandemic across various sectors of society. One of the most strongly affected sectors was education, as the pandemic interrupted in-person activities for more than 1.5 billion students worldwide (United Nations Educational, Scientific, and Cultural Organization [UNESCO], 2020a).

The urgent need for social distancing caused schools and universities to close, requiring educational activities to be rapidly adapted to continue in an online environment, "transferring and transposing methodologies and pedagogical practices typical of physical learning environments into what has been termed emergency remote teaching" (Moreira et al., 2020, p. 352).

The challenges imposed on education by the health crisis were numerous. In addition to the negative impacts on the physical and mental health of students and teachers, pre-existing inequalities were exacerbated. The crisis context demanded new competencies and, above all, collaboration from both educators and students. Over months, knowledge and learning spaces were modified, built, and rebuilt almost simultaneously, with teaching materials and methods being exhaustively tested and adapted to the new reality. Not all educators possessed the same skills or knowledge of digital tools for education, making the transition to remote teaching even more challenging in an already demanding scenario. The crisis further highlighted the need for forward-looking pedagogical management capable of addressing inequalities, ensuring learning opportunities for all, and building resilient educational systems prepared to prevent and respond to emergencies.

> Without making education a pillar of recovery plans alongside health, jobs, and climate, societies will deepen rather than reverse the growth of inequality, poverty, and social division [...]. Building resilience must become a central part of planning and managing education systems, ensuring they can prevent, prepare for, and respond to the global COVID-19 pandemic and any future crises (Giannini, 2021, p. 5).

Thinking about the future of post-pandemic education means, among other aspects, considering mechanisms and strategies for creating new educational scenarios that

incorporate collaboration skills and digital competencies to build innovative, inclusive, and, above all, resilient educational systems. Such systems must be better equipped to respond to crises and adapted to new demands. This article aims to contribute to this discussion by reflecting on the possibilities for constructing new knowledge dissemination spaces through collaborative learning and the principles of "learning to do" and "learning by doing" as pillars for a more innovative, democratic, and crisis-resistant education.

Reflections of the Pandemic on Higher Education

In March 2020, cases of COVID-19, the disease caused by the "new coronavirus" (SARS-CoV-2), were being reported in several countries worldwide. The worsening global health situation led the World Health Organization to declare COVID-19 a pandemic on March 11, 2020 (United Nations, March 11, 2020).

At the time of the pandemic's declaration, there was great uncertainty about its duration and how the suspension of educational activities—imposed by social distancing measures—would impact education systems. As the health crisis deepened, educational institutions had no choice but to adapt learning spaces so that educational activities could continue, now heavily mediated by digital technologies.

> The suspension of in-person classes in public and private universities led to the need to develop alternative methods of teaching, such as attempts to adapt and implement digital systems (Gusso et al., 2020, p. 4).

In this context, many higher education institutions adopted Emergency Remote Teaching (ERT), a strategy to ensure the continuity of teaching activities in which educational content is delivered via digital information and communication technologies (ICT). However, it was not only the delivery of educational content that became intensely virtualized during the pandemic. Spaces for discussion and collaboration among faculty, as well as teacher-student interactions, were also affected by social distancing measures and confined to the online environment.

To respond adequately to the educational challenges imposed by the health emergency, teachers found themselves needing to develop new skills, competencies, and attitudes, including digital competencies and a collaborative mindset.

Technology-mediated teaching can enhance and develop new knowledge since digital learning platforms promote interactivity among individuals, allowing each participant to share ideas, knowledge, skills, and attitudes (Carneiro et al., 2020, p. 5).

In the pandemic context, ICTs became essential allies for building new learning scenarios, mediating not only teaching and learning activities but also serving as tools for collaboration and experience-sharing among educators.

During this study, professors from São Paulo State University (UNESP) were interviewed through an exploratory survey using a random and voluntary sample (Laville & Dionne, 1999). The interviewed educators answered open-ended questions where they could report their experiences during Emergency Remote Teaching. Among the main findings was an increase in the time dedicated to class preparation and the use of social networks—mainly groups and private messages—as spaces for sharing ideas and materials among teachers. According to Santos et al. (2021, p. 1), "teachers are participating in groups where members propose sharing, collaborating, and cooperating with each other to meet their knowledge needs, thereby contributing to their peers' professional development."

In the pandemic context, there was a rapid expansion of collaborative spaces for educators mediated by ICTs. These collaborative spaces are configured as communities that emerge "when participants, aligned around a common interest, communicate, interact, and construct knowledge, synchronously or asynchronously" (Santos et al., 2021, p. 2). Given the educational challenges faced by the teaching community during the pandemic and the need to build resilient educational systems prepared to respond quickly and effectively to crises, it is timely to consider objective ways to conceive new knowledge spaces, guided primarily by the principles of collaboration, connection, co-creation, and sharing.

OER, Maker Culture, and Post-Pandemic Education

The Maker Culture or Movement emerged from the "do-it-yourself" term with the advent of information technology (Pereira & Arthur, 2020). It expanded in the late 1990s, driven by technological advancements and associated with the idea of making, creating, modifying, and sharing.

Maker culture redefines the English expression 'do-it-yourself' (DIY) into a potentially transformative and engaging activity, sharing projects and knowledge so that other makers, with their integrative skills, can experience collaborative ideas in search of sustainable solutions (Gama, 2018, p. 17).

The COVID-19 pandemic demanded not only that educators master digital and technological tools to deliver educational content but also fostered their capacity to collaborate and learn from one another, working together to find appropriate solutions for the new classroom reality.

The pace of societal advancement, coupled with the need for crisis preparedness, such as during a pandemic, requires individuals to develop autonomy in seeking knowledge, initiative, and collaborative thinking. In this regard, the principles of maker culture hold great potential for guiding actions to strengthen educational systems by creating spaces that encourage the exchange of experiences and information, grounded in initiatives of making and creating, ultimately contributing to the democratization of knowledge.

Similarly, Open Educational Resources (OER) emerge as a proposal for creating educational materials "based on the dilution of authorship, collectivization, collaboration, co-creation, and connection" (Hilu et al., 2015, p. 130). According to UNESCO, OER can be defined as:

…any educational resources (including curriculum maps, course materials, textbooks, streaming videos, multimedia applications, podcasts, and any other materials that have been designed for use in teaching and learning) that are openly available for use by educators and students, without an accompanying need to pay royalties or license fees (Unesco, 2011, p. 5).

Due to their adaptable and distributable nature, these materials serve as a democratic way to access educational content, particularly in emergency situations such as the pandemic. Recognizing this potential, UNESCO launched guidelines in 2020 on open educational practices, emphasizing OER as a useful tool for addressing the challenges of the current and future crises, aiming to "lay the foundations for a systematic integration of best practices to increase the sharing of knowledge for the future of post-COVID-19 learning, with the goal of building inclusive, sustainable, and resilient knowledge societies" (UNESCO, 2020b, para. 3, translated).

The pandemic prompted educational systems to rethink the teaching and learning process, incorporating technology and fostering innovation. The movement initiated during the crisis should continue in the coming years, broadening the debate on the need for a more flexible education system that actively involves educators and students in knowledge construction. Thus, collaborative thinking and "doing together" as a form of building and appropriating knowledge gain ground as alternatives to the standardized and impersonal education of today. This shift aligns with the maker philosophy, which contrasts with the industrial mindset of mass production, where individuals are mere consumers and not part of the creative process.

Likewise, the use of OER proves to be a promising alternative not only for their ease of distribution but also for their flexibility in adaptation, making it possible to meet specific learning needs:

> OERs have the potential to achieve inclusive education aiming to ensure that learners with diverse needs and preferences (such as learners with disabilities) have equal opportunities in accessing learning resources, services and experiences in general (Zhang, Tlili, et al., 2020, as cited in UNESCO, 2020c, p. 5).

Thus, the dissemination and use of OER are also directed at achieving the educational objectives set out in the United Nations' 2030 Agenda, which advocates "ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all" (United Nations [UN], 2015). OER expands the possibilities for producing and disseminating knowledge while offering opportunities for access to educational content tailored to individual needs, making education more democratic and flexible, aligning with the educational challenges of the 21st century.

OER and Maker Culture in Building New Knowledge Spaces

Building resilient educational systems capable of overcoming future crises requires learning from past experiences. In the context of the COVID-19 pandemic, the survey conducted with UNESP professors highlighted some challenges they faced as well as potential strategies and possibilities to be explored:

- Professors felt overwhelmed and took longer to prepare classes during Emergency Remote Teaching due to the need to adapt materials for the online format;

- Professors often shared their methods and materials with colleagues, with much of this sharing during the pandemic occurring through social media;

- Professors had little or no knowledge about Open Educational Resources (OER);

- New strategies and pedagogical approaches were needed to maintain student motivation during the extended period of online activities.

As an alternative to overcoming the excessive time spent preparing materials adapted for online teaching, professors could use open educational resources available in national and international repositories (Huang et al., 2020). However, for this to be viable in the context of the health crisis, it would have required prior investment in creating and distributing such materials in specific repositories and establishing their use as a standard practice in teacher training processes.

What lessons can be drawn from this experience? What alternatives could be explored for the future? Overcoming challenges in times of crisis requires innovation. In the context of education, building support networks for educators that encourage collaborative creation with the active participation of various educational stakeholders, combined with policies to incentivize the creation of high-quality open educational resources and promote their sharing, could favor the long-term development of new learning environments. In such environments, knowledge would be constructed collectively, inclusively, democratically, and sustainably. UNESCO, in its 2019 recommendation on Open Educational Resources, states:

> "...the judicious application of OER, in combination with appropriate pedagogical methodologies, well-designed learning objects and the diversity of learning activities, can provide a broader range of innovative pedagogical options to engage both educators and learners to become more active participants in educational processes and creators of content as members of diverse and inclusive knowledge societies. (UNESCO, 2019, para. 7).

Creating communities of educators for sharing information, materials, and pedagogical strategies—through the collective construction of knowledge, even in virtualized forms mediated by digital technologies—proves to be an effective strategy for exploring new possibilities and constructing new learning scenarios through collaboration. Initiatives that promote the democratization of knowledge are necessary for advancing education in response

to the social demands of the 21st century and, above all, during crises, where social inequalities become more evident and restrict access to education.

In 2010, UNESCO, through the report of the International Commission on Education for the 21st Century, highlighted four essential pillars for education: learning to know, learning to do, learning to be, and learning to live together. These pillars strongly connect with the foundations of Maker Culture and the principles for developing OER, emphasizing the ability to "learn to do" and "learn to live together" through collaborative creation and knowledge sharing.

The emergency imposed by the pandemic forced rapid adaptations to minimize the impacts of the health crisis in the educational context. These adaptations revealed potentialities to be explored for constructing the learning spaces of the future. This article proposed a reflection on such possibilities, guided by the principles of collaborative construction and the practice of "making," inherent to both Maker Culture and the foundations of Open Educational Resources (OER).

Based on the study of documents published by UNESCO during the COVID-19 pandemic, as well as prior educational guidelines—especially those concerning the adoption and development of OER—we drew parallels with the reports of higher education professors from UNESP. This effort aimed to explore alternatives for addressing common challenges faced during the health crisis and contributing, in some way, to solving future demands.

It is believed that through collective construction, it is possible to envision a future where educational systems are interconnected, more flexible, and innovative. As a result, these systems will be better equipped to respond swiftly and effectively to crises they may face.

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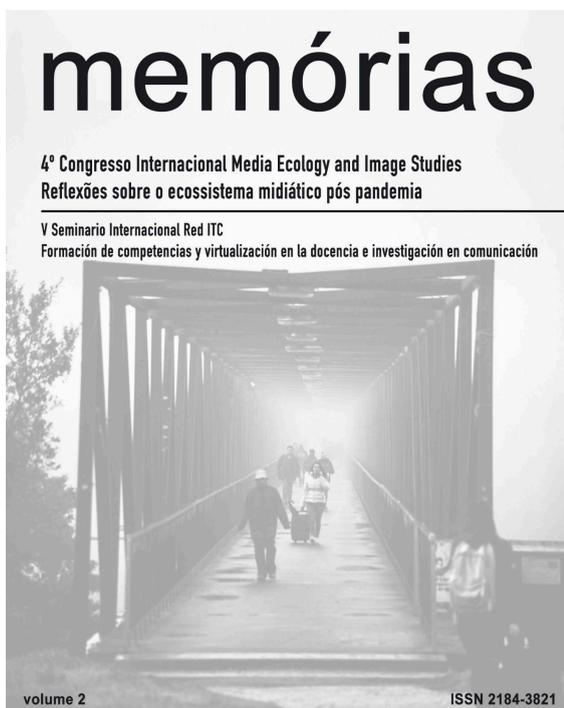
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