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ARTICLE

EDUCATION IN THE KNOWLEDGE SOCIETIES: THE USE OF OPEN EDUCATIONAL RESOURCES FOR THE DEVELOPMENT OF EMANCIPATORY CAPACITIES TO ACT

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ABSTRACT: Aiming to broaden the discussion on the use of Open Educational Resources (OER) and its emancipatory potential, this article deepens the theoretical and philosophical reflection on what OER are and their social implications. The discussion takes place in three stages: i) the relationship of OER with others open-source movements; ii) the association between OER and Paulo Freire's emancipatory education precepts; iii) the projection of these results in Nico Stehr's Theory of Knowledge Societies. Based on this discussion, the article proposes the concept of Emancipatory Capacity to Act, understood as the knowledge and practices that need to be mobilized for the emancipation of individuals or groups. Thus, we intend to contribute to the idea that overcoming social injustices involves the incorporation, especially in education, of OER practices and philosophies, including free culture, open-source technologies, and open science.

Keywords: Open educational resources, Emancipatory education, Knowledge society, Hyperobject, Emancipatory Capacity to Act.

EDUCAÇÃO NAS SOCIEDADES DO CONHECIMENTO: O USO DE RECURSOS EDUCACIONAIS ABERTOS PARA O DESENVOLVIMENTO DE CAPACIDADES DE AÇÃO EMANCIPATÓRIAS

RESUMO: Com o intuito de ampliar as discussões sobre a adoção dos Recursos Educacionais Abertos (REA) e o seu potencial emancipatório, o presente artigo aprofunda a reflexão teórica e filosófica sobre o que são os REA e sobre suas implicações sociais. A discussão é feita em três etapas: i) a relação dos REA com outros movimentos de código aberto; ii) a associação entre REA e os preceitos de uma educação emancipatória de Paulo Freire; iii) a projeção desses resultados na Teoria das Sociedades do

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Conhecimento de Nico Stehr. Como resultado dessa discussão, o artigo propõe o conceito de Capacidade de Ação Emancipatória, entendida como os conhecimentos, saberes e práticas que precisam ser mobilizados para indivíduos, ou grupos, se emanciparem. Assim, deseja-se contribuir para a defesa de que a superação das injustiças sociais passa pela incorporação, em especial na educação, das práticas e filosofias dos REA, incluindo a cultura livre, as tecnologias livres e a ciência aberta.

Palavras-chave: Recursos educacionais abertos, Educação emancipatória, Sociedade do conhecimento, Hiperobjeto, Capacidade de Ação Emancipatória.

EDUCACIÓN EN SOCIEDADES DEL CONOCIMIENTO: EL USO DE RECURSOS EDUCATIVOS ABIERTOS PARA EL DESATROLLO DE CAPACIDADES DE ACCIÓN EMANCIPATORIAS

RESUMEN: Para ampliar las discusiones sobre la adopción de los Recursos Educativos Abiertos (REA) y su potencial emancipatorio, este artículo profundiza la reflexión teórica y filosófica sobre qué son los REA y sus implicaciones sociales. La discusión tiene lugar en tres etapas: 1. la relación de REA con otros movimientos de código abierto; 2. la asociación entre REA y los preceptos de educación emancipadora de Paulo Freire; 3. la proyección de estos resultados en la teoría de las sociedades del conocimiento de Nico Stehr. Como resultado de esta discusión, el artículo propone el concepto de Capacidad de Acción Emancipadora, entendido como el conocimiento, saberes y prácticas que necesita ser movilizado para que los individuos o grupos puedan emanciparse. Por lo tanto, se pretende contribuir a la defensa de que la superación de las injusticias sociales implica la incorporación, especialmente en la educación, de prácticas y filosofías de REA, incluida la cultura libre, las tecnologías libres y la ciencia abierta.

Palabras clave: Recursos educativos abiertos, Educación emancipadora, Sociedad del conocimiento, Hiperobjeto, Capacidad de Acción Emancipadora.

INTRODUCTION

> *They would have us believe that the moral pillar of sharing has more to do with plundering a ship than lighting a candle with another.*
>
> *Alexandre Oliva* (apud Pretto, 2012, p. 102)

The recent COVID-19 pandemic outbreak has caused people around the world to reinvent the way they relate to each other and to themselves. Our high stage of globalization, with intense flow of people traveling between countries, has meant that handshakes in Wuhan, China, have driven thousands of people around the world into isolation (Han, 2020). The calamity situation has led countries to intensify their control systems over citizens, from South Korea to Brazil (Dieb & Gomes, 2020; Kim, 2020; Magenta, 2020), bringing up again discussions regarding the surveillance and privacy system risks, in authoritarian government, such as China, or in governments with weak data protection laws, such as Brazil, and comparing the phenomenon to global warming (Affonso, 2020; Biddle, 2020; Campagnucci, 2020).

The state of constant isolation and of indeterminate duration has provided the growth opportunity of solutions for remote teaching, especially videoconferencing software (Bandeira & Pasti, 2020). Many of these solutions are proprietary, that is, involve technologies, processes, and works that belong, via intellectual property laws, to individuals, companies, or institutions. Their indiscriminated use requires prior authorization from their owners, and by the beginning of 2020, it had already reached 65% of public universities and state education secretariats in Brazil. Compulsorily, they expose students and

workers to questionable surveillance practices and cybercrime (IEA, 2020). Google Suite (GSuite)[4] , for example, a suite of connectivity, collaborative creation, file sharing, and control *software* solutions offered by Google for businesses and Educational Institutions (EI), has been widely adopted by EIs from basic to higher education (Parra et al., 2018).

Despite the scandals about people's mass surveillance in which Google was involved, such as the PRISM program, aimed to use company's data to monitor individuals inside and outside the US (Greenwald & MacAskill, 2013), and participation in military projects, such as *Maven* - which envisioned the company's use of artificial intelligence and machine learning in images analysis obtained with drones (Gibbs, 2018) - EI, public and private, have adopted the GSuite package as a solution to several of their problems, claiming greater efficiency and low cost. By neglecting the consequences of this adoption, they lead students to compulsorily submit to questionable and confusing terms of use, which feed surveillance and control systems, to access their Education right (Parra et al., 2018). The same follows from the use of the services offered by Microsoft[5], also involved in the PRISM project (Greenwald et al., 2013; Greenwald & MacAskill, 2013). Despite questionable security practices, universities, such as the Federal University of Rio Grande do Sul (UFRGS), insist on making agreements that, as denounced by servers, teachers and students[6], obligatorily exchange their data for services.

The problem is not only reduced to espionage alone. The loss of technological and communicational autonomy amplified also by the use of other GAFAM technologies (Google, Amazon, Facebook, Apple, and Microsoft) and proprietary engineering, science, and audiovisual *software* (e.g. Autodesk, Solidworks, SPSS Statistics, and Adobe Photoshop) limits ways of education, communication, expression, thinking, innovating, creating, and even acting (Parra et al., 2018).

In this way, from elementary school to college, the use of proprietary solutions trains students to use only the *design* present in the *interface of* these technologies, unifying the way of thinking and organizing ideas and feeding an individual and collective dependence on these tools. They also promote a logic in which students, teachers, managers, and other professionals are just passive users of what international companies offers them. Without a voice to express their opinion, nor the means to modify the tools, instead of having in digital technologies means to multiply teaching and communication possibilities, they are limited to what their service provider wants. The uncritical adoption also leads to the difficulty of the emergence of national competitors, free or proprietary, thus deepening the social and economic dependence on these companies. Therefore, the innovation of teaching tools, limited to the inclusion of digital technologies in teaching, is not enough for education, in general, to overcome its banking character.

However, searching to break the proprietary paradigm, movements such as free technologies - which encompass *software*, *hardware* and biological solutions - of open science and open education emerge as alternatives that expand education, science and technologies access and promote collaborative scientific-technological development (Albagli et al., 2014). They also enable culture and knowledge development in a more organic way, less subject to the interests and wills of large corporations and governments and more aligned with communities' interests that produce them or/and are affected by them (Lessig, 2004).

In the Education area, Open Educational Resources (OER) stand out, a movement commonly associated with the provision of freely available teaching materials and low-cost educational robotics. Defended by UNESCO as essential for education democratization and inserted within the open-source movement and in defense of free knowledge, the OER philosophy advocates educational resources that are, by nature, able to be transformed and adapted (UNESCO, 2012). Thus, the decentralization of their creation, associated with the availability of source codes and schematics that compose them, can break the dependence cycle imposed by the use of proprietary technologies. When associated with their philosophical principles, they have the potential to foster the perception that students and teachers can modify the tools and resources and the world around them (Pretto, 2012, 2017).

4 Available at: < https://gsuite.google.com.br/intl/pt-BR>. Accessed on: 16 Apr. 2020.

5 Available at: <https://www.microsoft.com/pt-br>. Accessed Sept. 2020.

6 Reported in the podcast of the Union Section of ANDES-SN at UFRGS, available at: https://open.spotify.com/episode/1RYvkjQ9yEtj6Oy6fMHIsg?si=4JOfvWI-Rwu0TXjpCHFoRw. Accessed in: sep. 2020.

Although the use of OER has been encouraged in many contexts, it is not unusual to see cases in which the use of such resources is performed uncritically, being justified by circumstantial elements, such as its quality or its gratuity, without reflections on this use implications. As argued, the defense of OER is guided by profound ideas that go far beyond technical aspects. It is important for the educational field that the use of these resources be accompanied by reflections on the opening knowledge implications, such as the aforementioned deconstruction of dependency relationships. Therefore, it is also important that new reflections are proposed to ground public policies[7] and/or educational practices aligned with the OER philosophy, promoting criticality to teachers' and institutions' actions.

Thus, a deepening of these reflections can be built by understanding knowledge as a capacity to act and considering it to be the main resource of modern economies, as proposed by Nico Stehr (2018). Although he does not discuss the implications of his theory for specific cases, ignoring different effects of the Knowledge Society in countries with distinct economic and social characteristics, especially the peripheral countries (Freitas et al., 2020), the author presents a sociological model in which social inequalities are shaped - beyond traditional power hierarchies - by the knowledge's set that each individual possesses (Stehr, 2018). Thus, when considering modern societies as Knowledge Societies, it is understood that the widespread adoption of OER has the potential to lower knowledge barriers and strengthen decentralized, yet local and contextual, knowledge production.

Therefore, an education based on OER practices and philosophies has the potential to contribute to an emancipatory, liberating and hopeful education, as advocated by Paulo Freire (1974). In order to contribute to the reflections that underlie the use of OER defense, *this paper aims to expose a reflection on how the use of OER can contribute to the promotion of an emancipatory education in modern societies context, understood as knowledge societies, according to Stehr*. Throughout the paper it will be discussed: i) a broad and deep OER perception, articulated with other open-source movements; ii) the association between OER and the precepts of an emancipatory education, of Paulo Freire; iii) these results' projection in the Theory of Knowledge Societies, of Nico Stehr. As a result of these theories articulation, we propose the concept of *Emancipatory Capacity to Act*, defined as: *the contextual knowledge set necessary for the individual (or group) to autonomously and consciously deconstruct cognitive and material dependencies arising from social injustices*. Thus, we hope to justify why, making an analogy with Oliva's phrase exposed at the beginning of this section, we believe that an education based on open-source philosophy is like lighting candles of knowledge, and not plundering the ships' capital accumulated.

KNOWLEDGE SOCIETY

The Theory of Knowledge Society (TSC), according to Nico Stehr and collaborators perspective, deals with contemporary discussions about the sociological concept of knowledge and its role in modern society (Adolf & Stehr, 2017). In all societies throughout history, knowledge has played an important role in human activities, being essential for social and cultural activities and the social stratification basis. Nowadays, knowledge and information have assumed a prominent economic and social role. Thus, according to the authors, knowledge is presented as the main resource of productive processes, which makes it central to societies' economic development, giving them the name of Knowledge Societies. It is not, therefore, about knowledge democratization strategies, as the UNESCO project "Building Knowledge Societies" (UNESCO, 2013), nor about a relation of superiority between societies, as proposed by World Bank documents [8](Ruser, 2018).

But what differentiates knowledge and information? For the authors, knowledge is the *capacity to act* (Adolf & Stehr, 2017, p. 1). From this understanding, knowledge is what allows, facilitates, makes possible an action of any nature, individual or collective, whether speaking, designing a building, sawing a board, organizing democratically, or planting a seed. It is a capacity, because it does not

7 Such incentive policies, in the education area, go through the creation of material conditions for the implementation of OER, such as the purchase of computers or the appropriate training of teachers and technicians; but also, as pointed out later in the text, by policies in areas such as culture, science and industry, creating a favorable ecosystem for this philosophy (Pretto, 2012).

8 Stehr et al. 's theory does not fit into several of the criticisms usually attributed to theories of knowledge societies, precisely because they present a different approach (Freitas et al., in press).

represent the action itself, nor is it a guarantee of its realization. Other forces influence, enabling or preventing the action's realization: from political and institutional forces to physical limitations or access to resources and tools. Therefore, knowledge, in this interpretation, does not represent a specific kind of knowledge, nor does it reflect an objective truth. It is not necessarily practical, nor scientific, nor does it classify its consequences as positive or negative. Information, on the other hand, is what can be quantified and expressed in form of texts, tables, maps, calendars, graphs, etc., but which, without the use of specific intellectual tools and skills for its interpretation, does not represent a capacity to act (Ibid. 2017).

In distinct non-knowledge societies, access to production means or agricultural production, for example, influenced individuals lives more than knowledge did. In modern societies, by contrast, life chances are shaped primarily by knowledge access (Ibid., 2017).

Although the name is "Knowledge Society", this does not mean that all people have equal knowledge access. The greater knowledge diffusion has made it possible for portions of society to oppose configurations of power and to secure part of their interests. However, the high level of scientific-technological complexity of the systems that structure and organize society makes it difficult for the public to reflect on social and cultural transformations of their own reality (Stehr, 2008). The popularization of Internet access has promoted the illusion that knowledge is equally produced, that it is democratically available, and that all knowledge represents a benefit to society. However, the knowledge development is uneven and depends on various epistemological conditions, social indicators, human ambitions, needs and desires (Adolf & Stehr, 2017).

Knowledge has peculiar characteristics: it is intangible and, therefore, a non-rivalrous asset; it cannot be transferred instantaneously, and its learning is not controllable, since it depends on the intermediation of cognitive abilities that can alter it. Even if unchanged, a knowledge learning does not necessarily embody the cognitive ability to generate it (Stehr, 2018). For these reasons, it is extremely complicated to classify it as private property. Additionally, despite economic pressure for its privatization, its social relevance puts pressure on it to be a common asset (Adolf & Stehr, 2017; Stehr, 2018).

According to Adolf and Stehr, knowledge is not by nature a scarce asset, but it can be made scarce in two situations. First, access to incremental knowledge is restricted and is more difficult to obtain than the other knowledge parts. *Incremental knowledge* is a unit of knowledge added to the *overall knowledge* pool. This marginal knowledge unit represents an economic, political, etc. advantage of those who have it over those who do not (Adolf & Stehr, 2017; Stehr, 2018). Incremental knowledge is scarce because, in addition to possibly being protected by intellectual property laws, it is usually poorly materialized in English-language scientific articles and with paid-access, or in restricted-access space such as papers presented at elitist conferences or in patent records.

The second situation in which knowledge can be scarce occurs when the cognitive ability to generate knowledge is restricted (Stehr, 2018). The need for information, to be understood, to be interpreted through individual cognitive abilities means that the more complex the ability required to understand a piece of knowledge is, the greater its scarcity. Therefore, complex knowledge will be scarce even if materials about it, books, videos, etc., are widely distributed, thus hindering knowledge dissemination to those who do not possess specific skills sets, or are tied to the technical work itself, so that they are intrinsically associated with the experts who produce or reproduce these techniques (Adolf & Stehr, 2017).

According to Lessig (2004), knowledge privatization, guaranteed by intellectual property rights, has led to a knowledge and culture emptying into the public[9] domain. The extensive copyright duration, coupled with indiscriminate patenting and "fair use" weakening, strengthens knowledge and culture monopolies, making all resources for creation the rightful property of large industrial and media corporations (Lessig, 2004). As a consequence, the author indicates that science and culture development is subordinated to big industries, the only ones with financial and political power, to buy or circumvent intellectual property rights. Corroborating Stehr's language, intellectual property creates an artificial

9 Intellectual property (IP), divided between copyright and industrial property (patent) are legal mechanisms to guarantee property rights over the creation of works and ideas (artistic, scientific, or technological). Works and inventions that are not under IP are in public domain, thus has no owner. In US law, fair use limits authors and inventors' rights, allowing unauthorized use in special situations (Fundação Getúlio Vargas, 2011).

scarcity of knowledge. It is artificial because it does not represent resources absence, but rather the prevention of knowledge access, or a blockage of the enabled actions. For example, a scientist's team may have access to scientific papers on the effectiveness of a certain drug in fighting a disease, thus overcoming the scarcity of incremental knowledge, and have full capabilities to understand the papers and replicate their studies, but they are legally prevented from conducting research on the subject, or even manufacturing a drug based on it. Therefore, scarcity presents itself as an artificial emptying of possible capacities to act.

In Stehr's analysis, as industrial societies transformed into knowledge societies, theories of social inequality should also be reformulated to encompass the transformations of economic and social reality (Stehr, 2000, 2018). For the author, as there has been an establishment of a citizenship rights and social welfare package, guaranteed to the individual and their collectives, there has been a decrease in direct subordination to their material conditions. For this reason, social inequalities are more related to the knowledge that the individual is able to mobilize, their social competencies, than their occupational position (Stehr, 2000, 2018).

In parallel, modern societies undergo a decentralization process, where they have lost fixed centers of authority and conduct standards exemplary and rigidly limiting (Ibid., 2000, 2018). Thus, what we see is the multiplication of political parties, family patterns, gender structures, scientific disciplines, ethnic groups, communities, cities, social strata, etc. This process causes the formation of malleable structures that, as a result, can reconstruct the rules that shape the patterns (Ibid., 2000, 2018). It is in this context that the social stratification of the individual is no longer based solely on fixed variables, such as the individual's occupational position, education, and income, but is marked by social competencies that it is able to mobilize. As a result, social inequalities in knowledge societies are less visible and obvious, and classes delimitation becomes more diffuse than in industrial societies. Thus, the identification of a "class consciousness" becomes equally diffuse, and it is necessary to investigate cognitive as well as material conditions in order to understand it (Ibid., 2000, 2018).

Social competencies are the knowledge set that gives individuals control over their own lives. In this way, the knowledge that the individual is able to mobilize generates social advantages and disadvantages, direct and indirect, in form of power and authority. Such competencies are those able to protect and insulate individuals and their collectives, in an immediate way, from the swings and demands of the market and coercion; they are the knowledge that makes them less vulnerable. Therefore, they are the ones that shape social classes. Social stratification is also influenced by individuals' material conditions, such as their access to social security, social services, leisure resources, and unequal treatment due to imputed characteristics (such as gender, race, and ethnicity); and its outcomes remain related to old traditional power hierarchies (Ibid., 2000, 2018). However, the flexibility and malleability of new realities have as a consequence an inversion in the relationship between material well-being and knowledge: it is knowledge that comes to command material well-being (Stehr, 2018).

Social competencies enable individuals to have control over their lives, whether by being able to organize themselves financially; by avoiding abusive credit lines; by being able to demand that their rights be respected, by knowing how to resort to public tools to guarantee their rights; or even by knowing how to avoid situations of environmental and health vulnerability, by knowing how to differentiate health organizations technical recommendations from authorities malicious political recommendations. As the main social competencies that carve out social inequality, Stehr (2000, 2018) cites the following five: the *ability to extract advantages* from legal regulations that govern social conduct, as the individual's ability to obtain advantages in the taxes, investments, and schooling field. Similarly, the *facility to organize protection resources* of health patrimony that protect the individual and his family against family, local, or global crises. The *authority to speak*, determined by the individual's competence to express himself, enables, for example, lay people to contest experts and, as a consequence, to dispute "the truth" (Ibid. , 2000, 2018). The *ability to prepare for challenges* is related to the possibility of organizing and protecting oneself beyond what is indicated, or allowed, by experts and the state, including one's ability to circumvent surveillance and enforcement schemes. Finally, the capacity *for avoidance and exclusion* is composed of the ability to construct alternative routes to avoid risky situations, such as exposure to conflict, violence, and health risk situations (Stehr, 2000, 2018).

TSC does not elaborate on the extent to which domination and oppression structures are based on characteristics such as race, ethnicity, gender, physical abilities, and origin influence in social inequalities. The author claims that by avoiding addressing the issues of power and domination and turning instead to the individual's capacity for agency, it was possible to construct a flexible and optimistic theory. As a consequence, however, it ignores how different groups exert power over each other and how the maintenance of this power structures social inequalities and overrides the ability to act. It is therefore crucial, for a more complete analysis, that such factors are considered. Similarly, discussions also need to be elaborated in the Latin American countries' context (Freitas et al., 2020).

Next, we will elaborate on the notion of OER and Freire's pedagogy. After these sections, the vision of TSC will be resumed and articulated to them.

OPEN EDUCATIONAL RESOURCES BEYOND DEFINITIONS

The term "Open Educational Resources" (OER) appeared at the UNESCO's Paris Forum in 2002 (UNESCO, [s.d.]), a meeting that initiated discussions on the subject. In 2012, at the World Open Educational Resources Congress, also held by UNESCO, the Paris Open Educational Resources Declaration was proposed (UNESCO, 2012). In it, it was established that:

> OER are teaching, learning, and research materials in any media, digital or otherwise, that are in public domain or have been released under an open license that allows no-cost access, use, adaptation, and redistribution by others under no or limited restrictions (Ibid, 2012, p. 1).

Like OER, the Open Education movement encompasses, in addition to learning materials, teaching technologies, the sharing of knowledge and practices among educators, and new approaches to assessment, accreditation, and collaborative learning (Baguma et al., 2007). However, the term is also commonly associated with student-centered, flexible, collaboration-oriented educational environments, practices, and resources with freely available resources, even if not always available under permissive licenses (Inamorato dos Santos, 2012). Because it is a term still in dispute, we chose to focus the discussions on OER.

Grounded in education as a right for all, and supported in several other declarations on human, economic, social, and cultural rights, the Paris Declaration, in addition to advocating the adoption of other open-source initiatives, such as Open Science, Open Access, and open-source Software, encourages the broad adoption and promotion of OER, by individuals, institutions, and states, as a direct way to broaden access to information and knowledge and foster collaborative production and sharing practices (UNESCO, 2012, 2013).

In Brazil, OER have been incorporated into state public education policies, as in the case of the states of Paraná, São Paulo, and the Federal District, and federal policies, such as the National Education Plan, and in laws about contracting and licensing works (Sebriam & Gonsales, 2016). In 2016, they were adopted by CAPES as the standard for the Open University System of Brazil (CAPES, 2017). Also noteworthy in the country is the OER Brazil organization, a network of educators and scientists who research and develop OER[10] (Rossini, 2010).

The national discussion expands the frontiers on the subject. For Nelson Pretto (2012), OER cannot be summarized only to teaching materials, should be expanded to other educational technologies, such as free *software* and *hardware,* and should not be limited only to the content free availability. The opening character of OER allows the resources used to be sources for new resources and services, enabling teachers and students to appropriate services and resources, especially of centrally produced digital technologies, and to produce their own cultures and knowledge. Thus, OER are the "emancipatory possibility of each individual, nation, or culture" (Ibid., 2012, p. 106). Moreover, the adoption of OER cannot be summarized to actions focused only on education, it must be a collective movement of public policies that involve culture, media, science, technology, and industry, but also involve teachers and students with their local issues (Pretto, 2012). According to Rossini & Gonzalez (2012), educational resources are common and public assets and OER initiatives aim to "make available and share many parts

10 More information on its official website: http://www.rea.net.br/. Accessed in: sep. 2020.

or units of knowledge, which can be remixed, translated and adapted for educational purposes" (Rossini & Gonzalez, 2012, p. 39).

Pezzi (2015) expands the discussion and presents it from the perspective of Pierre Lévy's cognitive ecology, which argues that the ecological environment in which information, knowledge and representations propagate is constituted from human minds and technical networks for storage, transformation, and transmission of representations, such as a common language, for example. The author points out that the open-source movement[11] emergence and the culture of *online* collaborativity, represented, for example, by the emergence of the *World Wide Web* (WWW) and Wikipedia[12] , inaugurate new and revolutionary cognitive ecological means of storage, transformation and transmission of knowledge and information (Ibid., 2015).

From the dissemination of open-source movements philosophy practices to beyond the *Internet*, Pezzi argues that a newer cognitive ecology can be born, based not only on information technologies, but also on knowledge about the objects themselves. In analogy to hypertexts, the author calls these structures *hyperobjects*, which are an object idealization that connects the contents about the object, the data it produces, the tools, theories and data that underlie it, etc.: they are "*objects to which actions and/or sets of information are added*" (Ibid., 2015, p. 178). While *hyperlinks* allow the individual to browse information about a concept, hyperobjects are a channel for the individual to browse information about the object. Therefore, they are objects that have associated with them some "*hyperlink"* that connects them to the knowledge associated with them - model information, instructions for use, associated theoretical and mathematical models, applications, technical schematics, codes, *firmware,* etc. In this sense, legal technical elements are also needed, such as permissive licenses, that legally allow navigation in these contents, but also accept that they can be used, studied, modified, and distributed (Pezzi, 2015).

Thus, the hyperobject allows the expansion of dissemination and recreation possibilities of itself, as well as the emergence of ramifications that expand its potential applications and forms of use. *Therefore, it is understood that the OER potential is amplified when they are understood as hyperobjects, that is, as resources that have their network of knowledge, tools, practices, and data publicly available to be used and transformed*. For practical purposes, this means maximizing the use of free technologies, open-source practices, and open science in the OER construction and availability.

If OER are textbooks, for example, you should prioritize that the *software* used in their design, the writing process and their storage and availability are free. If the OER is a classroom experiment, for example, one should prioritize that the *hardware* used is open and free, as well as the *software* for designing parts and circuit diagrams, calculation, data collection, and sharing the results. In both examples it can be pointed out that not only the tools used are free, but development practice and these resources use also follow the sharing philosophy. Therefore, good practices in documenting, organizing, and making the content available are important so that, in fact, knowledge can be spread. Likewise, the data produced, as well as articles and derived content, should also be published in open access (Ibid., 2015).

When considering the science dynamic and collaborative aspects, and the importance of knowledge access for education, the scientific and educational hyperobjects present themselves as alternative ideas for scientific and educational practices. A hyperobject can point not only to its manuals and manufacturing guides, but to the whole set of theories, articles, databases, experimental results, didactic practices, or scientific protocols associated with them. By integrating the virtual with the non-virtual, scientific, and educational hyperobjects are a bridge between knowledge and the individual (Ibid., 2015).

For OER to be a hyperobjects, and thus be bridges that connect individuals to knowledge, but also to be tools for them to create new knowledge, *the OER philosophy should incorporate, whenever possible, the philosophies and practices of other open-source movements,* such as those described below. The Free and Open-Source Software and Open and Free Hardware movements, respectively, advocate that all tool code, design, and schematics associated with a technology, as well as its documentation and user guides, should be publicly available under permissive licenses, such that anyone can use, study, modify, manufacture, and

11 The term "*open-source*" refers to all movements and ideas that advocate making works and tools available *online* under open licenses. Examples are the free *software*, open access, and OER movements.

12 Available at: https://pt.wikipedia.org/wiki/Wikipédia. Accessed on: April 16, 2020.

distribute without financial, technological, and social constraints (FSF, n.d.; OSHWA, 2012). While Open Access advocates for making scientific research results widely, freely, and publicly available, the Open Data movement promotes the open publication of public interest data, such as government, geographic, climate, cultural, and scientific research results (Albagli et al., 2014). Also added are the recent biohacking and biofabrication movements, which incorporate the manipulation of fungi, bacteria, and even genomes into hacker and open-source philosophy (Palacios & Jara, 2019).

Starting from the OER understanding as hyperobjects, their adoption can democratize education in several spectrums. In the first instance, making resources freely available online, or providing tutorials for making them, increases access to educational content and tools. The quest to make them available on open networks, such as Wikipedia, and public repositories, i.e., without a login need, facilitates access to specific individuals and groups, and makes virtual control systems surveillance more difficult. The OER transforming possibility allows them to be adapted to different pedagogical perspectives, to be translated or changed to be aligned with certain local, regional, or historical and social context realities (Amiel, 2012; Pretto, 2012). Allowing their distribution and commercialization makes it possible for digital content and material objects to be produced and distributed also to those who do not have Internet access.

Thus, it is understood that the OER use, associated with the philosophy described, enables students and teachers to free themselves from the user role and become transformers, hackers, of their reality, starting with the contribution in Wikipedia pages, until the school space transformation itself. As an example, we can cite the case of a group of high school students from the Application School of UFRGS who, immersed in a free and open hardware development group and involved with technical and philosophical discussions of the social implications of free technologies, built the siren of their own school (Ometto et al., 2018; Pezzi et al., 2017).

The siren, as a device, hardly changed the school's dynamics, but the process that led to its production concentrates greater transformation potential. First, because the students went from their position as school "consumers" to "producers" - in a similar way to when collective gardens are made or when the whole school community is involved in painting the school walls. Second, because, unlike these, it is not a one-time action, but continuous and not restricted. Because it was developed based on open-source practices and culture, this action enables this and other spaces to be transformed, since other students will be able to fix and replicate the project. Thus, the potential transformation propelled by the OER use is about the way students relate to the school space and the fact that the project's growth possibilities are not limited to the action time and place[13].

In this sense, it is understood that OER contribute to autonomy development, from access to knowledge, through practices and techniques, and based on the transformation possibility awareness. In the long term, and on a large scale, it is believed that the diffusion of their use and philosophy will promote technological autonomy. However, we are not talking about a technological individualism, where the self-sufficient individual is able to reproduce every detail of his or her devices; it is a collective knowledge, strengthened in a trust network, in which - just as in scientific communities and in networks of agroecological producers - it is not necessary for each individual to have a broad knowledge domain, but to be inserted in a network that shares knowledge (Padilla, 2017). *Therefore, OER are not reduced to empowering individual technological autonomy, but rather collective autonomies.*

Therefore, the use of OER, in this perspective, enables schools, universities, states, non-governmental organizations, neighborhood communities, social movements, etc., to achieve their autonomy, not that they become self-sufficient, but that, through the people who compose them, they emancipate themselves in specific areas. As an example, we can cite the *Safecast* case: in 2011, after the Fukushima nuclear power plant explosion in Japan, in face of the danger of radiation exposure to which a considerable population part was exposed and the extreme difficulty of the Japanese government in providing updated information on radiation levels in the affected areas, a group of people got together

13 In this example, the action was limited to a physical space and to the possible subjective transformations of those involved, directly and indirectly, in the project; a more profound transformation would be the involvement of these students not only in technical development, but also in critical reflection about the siren purpose, its objective, its meaning, in decision making about time control, etc. Still, given the low level of student action in schools, this project exemplifies the transformative potential of teaching spaces based on free technologies, as they enable more concrete and direct actions.

and assembled a simple Gayger radiation detector (Brown et al., 2016). Because it was open-source and low cost, the equipment soon became widespread and a huge people network spontaneously began to measure radiation along roads and cities and feed the open data storage platform (Brown et al., 2016). By the end, the project made available the radiation level per cubic meter with approximately eight times more measurements than government organizations (Bonner, 2016) and inserting the project into the radiation protection world landscape research (Brown, 2014, 2018). Collectively, the Japanese population portion with access to these tools has become autonomous in deciding which regions to monitor, not being subjugated to private or public institutions, and thus being able to make decisions about their lives with greater scientific foundation.

Researchers in the area (Amiel, 2012; Amiel et al., 2017) point out that for the OER contribution to be amplified and consolidated, it is crucial that its adoption in educational institutions occurs with public and institutional policies support focused on the subject. Pretto (2012) points out that it is necessary to think about OER beyond education, incorporating the open-source philosophy in public policies also in culture, telecommunications, industry, science, and technology.

OER should therefore not be seen as isolated from the rest of society. *They are part of a broad free culture movement that begins by licensing resources with permissive licenses but extends to all society spheres.* They aim to perpetuate cultures and practices that allow knowledge to flow freely across people, groups, and times - and that can be organically modified, transformed, and adapted.

We have so far discussed educational resources type and philosophical reflections on their social implications, but when considering the educational context, what would be the OER pedagogy? Knox (2013) pointed out that OER literature, especially in English language, in basing itself on student self-directed learning, ignores the teacher's important pedagogical role in learning directions. He reminds the OER community that an education solely based on free resources is not free from the education standardization discourse, nor from the standardization of acceptable discourses and behaviors. Therefore, the author reaffirms that the OER use, by itself, is not a guarantee of greater autonomy, and may even reinforce structures of power and domination. Although this is not the Brazilian debate scenario, as exemplified by the discussions raised in one of the main works in the area in the country, the book OER*: collaborative practices and public policies* (Zancanaro & Amiel, 2017), we understand the reflection necessity on pedagogical and educational foundations on which the OER perspective presented in this article is intended to be built. Therefore, the perspective of Paulo Freire's emancipatory education and its reflection in OER will be discussed.

EDUCATION FOR CONSCIENCE AND PAULO FREIRE'S PEDAGOGY

In his works, Freire anchors education to its liberating mission. Education is not centered on the educator, learner, or teaching tools; the most important elements are the relationships between learners and educators and their genuine liberation goal from injustice situations (Freire, 1974; 1996). With intellectual honesty and the "beauty of thinking", the educator dialogues with students, bringing up each one context and building a learning space for all (Freire, 1996). The educator is also the learner because one learns by teaching and teaches by learning. To this end, the teacher must leave his position as a knowledge holder who deposits knowledge in students and discourages authentic thinking, and start exchanging and cultivating knowledge with them, giving protagonism to their historical and social contexts and demystifying absolute truths (Freire, 1996).

In this context, "problematizing education"[14] is an education as a practice of freedom. The individual, by understanding himself as an unfinished human being, situated in the world, also understands that he can - and sometimes must - transform himself and the world. In this relationship, both student and educator understand themselves as makers and remakers of their own realities (Freire, 1974).

In this pedagogy, action and reflection go together. Without the word, education reduced to practice is domestication; without action, education reduced to word is indoctrination. Therefore, the word, content, and action and practice, complement each other in a permanent, restless, inventive, but

[14] Translation for "educação problematizadora".

also in a hopeful teaching, because it brings, with awareness, the emancipation will and the consciousness of its power to create and recreate its reality (Freire, 1974).

Freire (1974) also describes what he called "borderline situations," which serve as barriers that limit people's actions - because they are analyzed from a fatalistic and hopeless perspective, which leads people to the belief that they are insurmountable. As an example, Freire cites underdevelopment, dependence - economic, technological, political, etc. - as a limiting situation to which "third world" countries are subjected. Besides this, each society has its own specific situations.

The generating themes, the basis of Freire's methodology, involve and are involved by these situations. Therefore, identifying them, making them visible, and analyzing them in a critical and hopeful way is part of emancipatory education. From this point of view, people start to recognize that it is possible to overcome them, they realize that limit-situations are not frontiers between being and nothingness, but between being and being more. They are, therefore, essential to people humanization. Without this recognition, it is not possible to overcome these barriers. Oppression situation awareness is crucial for emancipation (Freire, 1974).

By projecting Paulo Freire's emancipatory pedagogy onto OER practice and philosophy, we identify how they can complement each other in autonomies construction. Both discuss the possibility right and importance of remixing reality and its components. *The open and free OER character enables and encourages them to be modified, allowing adaptation to local contexts, and facilitating that the most relevant topics and practices to certain groups are highlighted.* As an example, the material can be translated into local dialect, or consider different individual or group needs. It also encourages teaching to be inventive and to permeate all spaces, beyond the specific content taught.

As discussed, *action and reflection are essential for engaging in one's own emancipation. Therefore, the use of OER must be associated with its philosophy.* If practice is the OER use, reflection is prompted by the incorporation of its philosophy, understood here as that which encompasses open-source philosophy and the ideas underlying hyperobjects. So, while uncritical OER use may not lead individuals to abandon their roles as domesticated users, reflection alone may produce empty activists, disconnected from practical reality.

In this dialogue, adapted OER should not be discarded, but shared, adding to the available OER network. Adaptations that initially aim to solve a local problem. When they are shared, they contribute so that other groups can use them. In this philosophy, there is a commitment that users are also contributors, so that they not only consume OER, but also produce and share them.

The practice with OER use enables the development of diverse technical skills that allow individuals and collectives to make small world changes. For example, one can think of Wikipedia contributions, small corrections to teaching materials, experiments redesign, production of audiovisual material, simple websites construction, changes in the computer operating system. *It also allows large changes to be made*, such as major contributions to Wikipedia, the complete redesign of teaching materials, the development of scientific equipment - such as weather stations and radiation detectors - information technology, communication technology, mobility technology, and even city supply technology.

The union of all potentialities discussed composes the fuel for strengthening the hope that reality can be transformed from the individual to the collective. It is also the awareness seed about the world's place of each individual and collective. As an example, the discussions raised by Lessig (2004) about the negative implications of the intellectual property idolatry on social, economic, and cultural development can raise deep reflections about our place in the world and our action on the injustices fed by the patent and copyright market. The intellectual property questioning, the first reflection of open-source philosophy, and knowledge that there are alternatives to the production and development of hegemonic knowledge and technologies, are in themselves seeds for the aforementioned awareness. These reflections can also lead to the perception of how the dominant culture imposes on the common individual the place of user-consumer, limiting his autonomy of creation, action, and reflection. A deepening of this discussion leads to the questioning of how public and federal institutions have worked in favor of lobbies of textbook publishers, scientific journals, educational and engineering software, and corporations and industries, and not in favor of the expansion of popular protagonism in access, production, and distribution of scientific-technological, artistic, and historical knowledge.

It should also be noted that making educational material openly available on the Internet should not mean the elimination of the educator's role. Even with video classes, books, exercise solving, and tutorials on how to use software and hardware, the educator's role is essential for the dialogicity between action and word, between content and practice, between learner and teaching material, regardless of the material's type and support tool. Therefore, it is not proposed that individuals are capable of learning alone, because, as Freire states, "nobody educates anybody, just as nobody educates himself: men educate themselves in communion, mediated by the world" (Freire, 1974, p. 79). Thus, education, being "mediated by the world", is influenced by cultures and tools that mediate this process, as well as by the pedagogy adopted by educators.

Nor does the defense of autonomy indicate that people should act alone in the world, because "self-sufficiency is incompatible with dialogue" (Freire, 1974, p. 95). The goal is not the development of individual, selfish autonomies with a false social disconnection, but to enable groups, sets of more or less connected people, to develop collective, dialogical autonomies, which allow them to act in the world, either by being more aware of their situations or by developing the necessary capacities for action.

While individual actions may resonate around the individual, or to people who are not directly associated with the individual, the OER contribution to emancipatory education is also in the cultivation of collaboration and networks formation of transformative agents - which underlie "collective autonomies". Because they enable more action for more people, they also enable more ways and opportunities for transformation, involving more people and communities.

Changing codes and publishing content are changes in the material world, but they are not enough to overcome borderline situations. It is necessary that these actions are done as borderline acts, that is, with the intention of breaking false barriers of borderline situations. In this way, the isolated OER use is no guarantee of liberation: there must be an awareness of oppression. They contribute, in this sense, when there is recognition of the limiting situations that keep individuals from "being more" and that perpetuate domination. That is why OER-based education must also be critical and problematizing.

Thus, the contribution of this pedagogy to OER goes beyond increasing the number of available materials. It brings to the movement the dialogicity necessary for the production and application of these resources according to life's reality (cultural, economic, etc.) in which students and educators are immersed. By being dialogic, while OER contribute as a tool and content, learners and educators contribute to OER, adding new approaches and views on the same subject and thus diversifying the available OER and enabling the existing ones to be rethought under different epistemologies.

Moreover, OER advocacy is usually based on the democratization of access to knowledge in the hope that this will lead to the democratization of knowledge production and the strengthening of democracy in general (UNESCO, 2013). When thought from Freire's dialogical and liberating perspective, OER, as a social movement, can point their actions beyond access to content, indicating ways to overcome injustices.

So far, we have discussed OER's technical, practical, philosophical, and pedagogical aspects and their social implications. To better understand these impacts, and what they may represent in modern societies, OER, understood as aligned with a Freirean perspective, will be analyzed from the point of view of Stehr's Theory of the Knowledge Society (Freitas et al., 2020).

OVERCOMING INJUSTICE SITUATIONS

By analyzing the inequalities process, and not only their results, we hope to understand which competencies are necessary for an individual to improve its living conditions. From a transformative perspective, which aims to combat social inequalities, it is important to understand these competencies so that direct actions can be designed to prevent the widening of distances between different classes and social groups, as well as to develop propositions capable of overcoming them. Being subject to other forms of oppression and domination, it is not believed that only the expansion of social competencies is enough to achieve social justice. However, it is understood that the expansion of this knowledge instrumentalizes the individual to become less vulnerable and have more control and dominion over their life opportunities.

Emancipatory education, from OER's perspective, in this scenario, is that which develops social competencies that, beyond protection and avoidance, also enable creation and transformation, both in the direction of humanization and liberation. For this reason, it is an education that develops what will be called *emancipatory capacity to act*. This knowledge is emancipatory to the extent that, once internalized and learned by individuals and groups, it can be mobilized so that they can emancipate themselves, that is, free themselves from the limiting situations that restrain and restrict their actions.

While social competencies presented by Stehr shape social classes based on individuals' ability to protect themselves from market fluctuations and avoid situations of vulnerability, emancipatory capacities to act are social competencies that aim to expand individuals' mastery over life opportunities and options. However, they do not eliminate limit-situations, but they collaborate so that limitations generated by subjugation to them can be circumvented, or at least momentarily, locally, overcome. Objectively, emancipatory capabilities to act are defined as the contextual set of knowledge, understood as capabilities to act, necessary for the individual (or group) to deconstruct cognitive and material dependencies resulting autonomously and consciously from social injustices.

They involve the development of one's own ways of creating new knowledge, practices, and technologies, as well as the ability to appropriate hegemonic knowledge, practices, and technologies, especially those associated with modern science and technologies. It is, then, the individual's ability to mobilize knowledge that makes him less dependent on large corporations, institutions, and governments - and makes him less vulnerable to their domination. To be emancipated, therefore, is to be able to solve problems using traditional and hegemonic tools and knowledge, but also to create and perpetuate non-conventional solutions; it is to understand the context in which one lives and be able to make decisions based on it; it is to know how to relate culture, practices, and theories to identify the origin of one's limitations and be able to free oneself from them. Emancipation allows individuals and groups to act on their world, changing it in an active, conscious, and autonomous way, transforming not only their reality, but also their surroundings' reality.

Emancipatory capacities to act are autonomous, but not individualistic. Material resources mobilization, for example, often requires the mediation of others responsible for the extraction or production of these resources. The emancipatory capacity to act gives the individual a greater ability to seek out resources that are abundant in their region, or that need fewer intermediaries, solutions that require as little as possible of energy and computing infrastructures that are beyond their control (because they are the responsibility/domination of international/external groups that do not participate in the same communities as the individual). Thus, this competence includes the ability to emancipate oneself through collective organization. For example, the ability to have management over one's own internet network, or servers, or energy and food production.

Thus, knowledge, being capacities to act, includes all kinds of knowledge and practice, be it science, poetry, technology, or popular knowledge. They can be legal or illegal practices, knowledge formalized in books, collective, such as science, or empirical, from individual experience. They are, however, all kinds of knowledge that, based on the context of each individual or group, allow them to free themselves, together with their community, from an unwanted dependency, injustice, or exploitation, that is, from a limiting situation, moving to a more protected situation with greater control over their life(s).

Emancipatory competence is the ability to survive and create despite scarcity of knowledge, but it is also the basis for abundance of knowledge. By being embodied with OER's philosophies and practices, it expands the capabilities to act available to be learned and developed and minimizes the number of situations where knowledge is scarce. By relying on the use of permissive licenses, denying knowledge privatization, artificial scarcity tends to be eliminated. Even in cases where authorship must be respected, as is prevalent in scientific articles, the content can be accessed, used, modified, and distributed without legal restrictions.

As for the shortage caused by cognitive skills, OER play a crucial role in reducing it. At individual level, the dissemination of tutorials, teaching materials, video lessons, and educational tools on a wide variety of subjects allows more people to develop their skills on their own. Thus, even people who do not have access to formal educational spaces, such as schools and universities, but who do have access

to the Internet, have the possibility to learn several contents that were formally denied to them. The distribution possibility, with or without commercial purposes, also makes it easier for information to reach spaces without Internet access.

From the school point of view, the availability of good quality free content makes it easier for educators to access differentiated educational tools, to adapt them to their reality or reorient them to new purposes, because, in an emancipatory education, when the individual is aware of his injustice situation and engaged in transforming it, OER allow the tool itself, the knowledge itself, to be transformed, remade. In this sense, it is evident how they offer greater freedom to create and build. Teaching that is based on the use of these tools, but that also brings to light philosophies on which they are based, has the potential to strengthen students' perception, their hope, that they are capable of and have the means to transform the world around them.

In this way, OER-based training promotes autonomy, because it makes action possible regardless of any institutional ties. It is common for universities to buy the license to use professional software and release access to enrolled students. Proprietary software such as Adobe Photoshop and AutoCAD exert such a dominance over the market that design and engineering courses, for example, offer courses aimed at their exclusive use. However, when they leave the universities, they lose access to these tools and, because they have only been taught to operate proprietary software, they are compelled to pay expensive licenses for its use, or to obtain it illegally. In contrast, when education is based on free tools, the capacities to act developed by individuals do not lose their strength when they leave educational institutions, because they continue to have access to tools crucial to their profession. Autonomy, then, is not just about knowing how to perform tasks, but also about knowing how to mobilize the knowledge, resources, and networks that enable actions to be taken - both technically and politically.

Thus, as an example, the Baobáxia project has shown how the incorporation of free technologies use and philosophy can allow the construction of new forms of integration, beyond those allowed by proprietary technologies and their owners. The project was developed by, and for, indigenous and *quilombola* communities with unstable internet connections, to serve as a "multimedia repository designed to operate in rural communities with no or little internet" (NPDD/Baobáxia, 2020). It is a fixed or mobile digital infrastructure for these urban or remote communities to share and preserve their memories and cultural creations[15]. The project adopts "as basic principles and work methodology the fundamentals of free software, both in the management of the work teams, and in technological solutions it will use" (NPDD/Baobáxia, 2020).

The large extent of open knowledge on the subject produced and the open-source culture are central elements - in addition to other very important cultural and contextual factors that will not be addressed - so that the solution was produced by people who make use of it and with the involvement of technical members or partners of the community, after all, as announced in the project documentation, "it is not enough to use existing information technologies - we need to shape the development itself so that it meets the demands of society" (NPDD/Baobáxia, 2020). In other words, free technologies, as a culture of technological knowledge production, are important keys that expand forms of social participation, especially in the protagonism of the development of technologies suitable for specific and non-hegemonic needs and interests. In this sense, the emancipatory capabilities to act mobilized favor that scientific knowledge and existing technologies are appropriated for new purposes, or that new knowledge is engendered, creating more emancipated mechanisms of social participation in the collection of data of general interest, of social pressure, or even of construction of solutions for community problems[16].

15 Designed and maintained by the quilombos Rede Mocambos network (more information at http://mocambos.net/), the project also brings with it a renewal in the naming of the internet infrastructure, abandoning the colonial slave pattern and adopting its own words and signs to designate each part of this system. Its name, "Baobáxia", is a mixture of the words "Baobab" and "galaxy". Baobab is the name of a tree that represents, in the Afro-Brazilian culture, the collective memory of a territory, so the network of Macucos is a galaxy and is part of a galaxy of Baobabs. Macucos, the fruits of the Baobab trees, are what are generally called "internet servers," the machines that store the internet's sites and code. More information at https://baobaxia.mocambos.net. Accessed September 2020.

16 The importance of free technologies in this process does not represent an absolution of institutions and governments from their commitment to creating spaces and opportunities for greater popular participation in the formulation of public policies, research agendas, or socio-technical decision making. Nor does it seek to transfer to the shoulders of affected communities

SCIENCE EDUCATION AND ITS EMANCIPATORY ROLE

Modern societies are highly dependent on complex computer systems, internet networks, advanced medical techniques, difficult-to-produce pharmaceuticals, complex power generation systems, etc. This knowledge, derived from advanced science and engineering, makes up the context and history of any individual at different levels, whether they are aware of it or not. In the quest to understand the place of individuals and groups in the world, it is necessary to understand these elements. Usually protected by patents and industrial secrets, when they are not incremental knowledge - materialized only in expensive books and scientific journals with little distribution - they require refined and complex cognitive skills to be interpreted and understood. They are, therefore, scarce.

Thus, understanding the modern world involves, among other things, understanding science and engineering. Whether to emancipate and liberate oneself from limited scientific views, or to appropriate them and liberate oneself from malicious political and religious forces, the teaching of science and technology enables the individual to appropriate knowledge about its world, from biological beings to digital systems, from sociology to neuroscience.

In education, regardless of which knowledge is privileged, they should not be scarce. Still, even if endowed with capacities to act to (re)construct knowledge, technologies, and solutions, if material access to the tools necessary for this action is limited, so is the capacity to emancipate. Therefore, when thinking about emancipatory knowledge, it is understood that the knowledge to be worked on should be as accessible as possible, but also that there should be no impediments to its use and modification. From this reflection emerge naturally the practices of open science and free technologies, which, also used as OER, have in their essence the reduction of barriers for knowledge dissemination and growth. The use of OER also presents a special possibility: it allows teachers and students to appropriate professional technologies and techniques for engineering, science, and audiovisual content production. By learning to use "real" tools, they increase their ability to act upon the world, as they can modify it beyond the digital, extending their power of action into the analog, mechanical, and biological world.

In the following example, we discuss how the conventional practices, contents, and techniques of engineering courses, coupled with awareness of the situation of violence and engagement in one's own emancipation, can be crucial for the injustice reality to be overcomed to some extent.

The Afro Engineering project started in 2015, in Rio de Janeiro, by a then computer engineering student also involved with audiovisual production. Traditional audiovisual equipment is expensive and all black, with the justification of not distracting the actors. Besides the financial difficulty of obtaining them, the dark equipment, driven by black bodies, can easily be mistaken for weapons, and its operators, being mistaken for bandits, are sometimes victims of "accidental" murder[17]. In the quest to avoid violent situations, from the knowledge developed at the university, this student changed technological and aesthetic aspects of his products, making them colorful, printed, and low-cost (Burtet, 2019).

Making a reading of the accounts and discussions presented by Burtet (2019), from this framework, the following interpretations emerge. The project involved technical and practical skills in modeling and 3D printing, mechanics, embedded electronics, and programming, as well as racism awareness. The technical and practical skills allowed him to act in the construction of solutions that direct him towards emancipation, that is, the technical skills were reified as emancipatory action skills, indicating that school and university contents, important for the technical and professional education of

and non-professional scientists and engineers the task of developing solutions to their problems. The goal is, on the contrary, to build autonomous and collaborative alternatives that give protagonism and sovereignty to popular forces so that they are not completely submitted to the control and domination of governments and corporations, and also that they themselves serve as mechanisms of political pressure.

17 His fear is based on facts: according to a survey by the Public Security Institute of Rio de Janeiro, 78% of people killed in 2019 in police interventions, in the state of Rio de Janeiro, are black and brown (Rodrigues & Coelho, 2020). Among those killed are people who were not directly involved in the conflict, but who were victims of police racism; examples are 26-year-old Rodrigo Alexandre da Silva Serrano, who was murdered for having his umbrella mistaken for a gun (e.g. Moura, 2018), and 22-year-old João Victor Dias Braga, who was murdered for having his drill mistaken for a revolver (e.g. Notícia Preta, 2019). In both cases the objects held by people were motivation and justification to cover up the racist actions.

students, are not limited to the reproduction of dominant ideology, as they have an important role in the expansion of ways of intervention in the world. They are, therefore, mixed with awareness. By creating a low-cost and safer equipment, the student transformed the reality of the people around him, creating new possibilities of intervention through, for example, cultural production.

The production of knowledge, to be contextual, must start from the understanding of what constitutes the context, that is, what conditions it. The awareness of being conditioned, identified by Burtet (2019), is also a capacity for action and allowed the young man to understand that social, historical, cultural, and biological aspects limit his action. However, being hopeful, he believed he was capable of intervening in the world to change it, building greater autonomy for, in this case, the production of audiovisual content[18] .

Therefore, emancipatory capacities to act have the potential to promote autonomies, to build new possibilities of transforming the world, aiming to overcome injustice situations. Being subjected to other forms of oppression and domination it is not believed that the expansion of social competencies, by themselves, are enough to achieve social justice[19]. However, it is understood that the expansion of this knowledge instrumentalizes the individual to become less vulnerable and have greater control and dominion over their life opportunities, having greater autonomy.

The examples of Afro Engineering and Baobaxias are examples of simultaneous praxis, action, and reflection in technologies production and use. Neither of them is a direct product of an educational space, although they involve skills and knowledge developed in formal educational spaces. In capacities formation for emancipatory action, the dialogicity between the reality of the learners and the contents taught must always seek, itself, to work on raising awareness and overcoming limiting situations. Even though direct and immediate action in the area of science and technology is not always possible, emancipation should not only be cognitive, of developed skills, but also the liberation from fatalism that prevents a look beyond limiting situations.

CONCLUDING REMARKS

With this article, we sought to contribute to the reflections in OER's defense. As discussed, OER contribute to an emancipatory education to the extent that they involve and promote the learning of emancipatory social competencies (knowledge). Their open and free character expands the possibilities of modifications in the world, while their philosophy advocates and encourages that these modifications occur in an active, conscious, and autonomous way. OER can lead individuals (and groups) to develop their own ways of creating new knowledge, practices, and technologies, as well as the ability to appropriate hegemonic knowledge, practices, and technologies.

Being extremely relevant to emancipatory education, the set of capacities to act promoted by OER strengthens the hope and, why not, the certainty that reality, from individual to collective, can be transformed. By promoting emancipatory knowledge, they strengthen the necessary skills for the individual (or group) to deconstruct, autonomously and consciously, undesirable dependencies. In this way, the search for emancipation strengthens, in individuals, social competencies that also protect them, at different levels, from the effects of social inequalities.

Thus, it is possible to attribute a greater contribution in contents and techniques taught liberation, since they have a direct and indirect influence on people's opportunities and ways of life. This does not mean abandoning the transformative, hopeful, curious, and unfinished look. On the contrary, emancipatory capacities to act require such characteristics. In this way, the contents to be taught are not

18 As the student exposes (Burtet, 2019), the motivation for the project was not solely the desire to produce content, but the awareness that there is little content produced about the favela, with little black protagonism, and mostly produced by white people and non-favela residents. The motivation, therefore, stems from the will to emancipate oneself from situations that perpetuate racist and aporophobic structures of oppression. The will to free oneself from these situations is precisely the engagement with one's own emancipation; the engagement is then an action enabled by the awareness of the borderline situations to which one is subjected.

19 The Afro-Engineering project enabled new autonomies but did not make those involved in it emancipated from capitalism or racism. The emancipatory capacities of action mentioned contributed to their emancipation from dependence and subjugation to these systems, in these situations. They constitute another step towards the protagonism of favela residents in the production of audiovisual content about the favela itself.

just a bureaucratic task to be followed, but part of the emancipation process; they are social competencies of protection and avoidance, and of creation and transformation.

OER are resources used for educational purposes that have their knowledge network, tools, practices, and data publicly available to be used and transformed. Although far from the reality in which all OER are hyperobjects, the concept was adopted as a guiding principle. Therefore, it is understood that they are resources that make up the whole range of movements in defense of free knowledge and free culture - such as free technologies (software, hardware, biological, etc.) and open science (from articles and data publication to the use of open scientific protocols, processes, and equipment). Equally, they should extend into all society spheres, with the expectation of perpetuating cultures and practices that allow knowledge to flow freely across people, groups, and times, and that can also be organically modified, transformed, and adapted.

Therefore, since OER are understood as hyperobjects that connect physical and material capacities to intellectual ones, they should not be treated only as tools, disassociated from the open-source philosophy that underlies them. As discussed by Freire, action and reflection are essential for engaging in one's own emancipation. Therefore, working both issues together benefit the capacity, in each individual and collective, to become aware of their place in the world and to engage in their own emancipation.

Furthermore, the OER defense is based on the abundance of knowledge they generate. In line with the intangible knowledge nature, the use of permissive licenses denies its privatization without leaving unassisted the inventors and creators responsible for its composition. Facilitated access to tools, techniques and content also contributes to knowledge flowing between people, thus lowering the barriers caused by cognitive skills and incremental knowledge. Its networking potential strengthens the creation of autonomous communities that collectively can, at different levels, recreate their realities, discarding the idea that autonomy means self-sufficiency.

From the school point of view, the availability of good quality free content gives educators and students the opportunity to access differentiated educational tools and to adapt them to their realities or reorient them to new purposes. Moreover, it contributes to the perception that they are capable and have the means to transform the world around them. Further discussion should be held about what dependencies the school wants to, and should, free itself and its students from, and thereby discover what knowledge can be emancipatory and what autonomous networks can be formed to support its diffusion.

Science and technology teaching in this context is essential for awareness and emancipation in modern societies, as they are highly dependent on complex technological and scientific systems, such as computer systems, drug production, etc. OER enable students, teachers and managers to appropriate technologies and professional techniques of engineering, science, and audiovisual production, to increase their capacity to act on the world, whether artistic, cultural, or scientific.

To understand the impacts of emancipatory capabilities to act in society, the Theory of the Knowledge Society and the main three theory points were based on: understanding knowledge as a capacity for action; the factors that make knowledge a scarce asset; the important influence of a set of knowledge, social competencies, on social inequalities structures. It remains open for discussion, in theory, how much the expansion of social competencies, especially emancipatory ones, can reduce social inequalities and how much they can change their structures. It is also necessary to deepen the theory about the level of influence that factors such as origin, imputed characteristics and occupational position have on the perpetuation of social inequalities and to what extent social competences can contribute to overcoming these inequalities. It is also necessary to consider aspects of the Brazilian economy, culture, and society in the theory, so that concrete actions can be better thought out and proposed (Freitas et al., 2020).

We conclude that the association of OER with emancipatory education, with emancipatory knowledge teaching, seeks to overcome social injustices. As argued by Boaventura de Sousa Santos, global social justice will only be achieved through cognitive justice, which is cultivated by ecologies of knowledges (based on the recognition of the plurality of knowledge and epistemologies), while cognitive injustices are cultivated by the monoculture of knowledges (scientific, cultural, etc.) (Santos, 2007). Thus,

by understanding that education is closer to lighting, burning, and candles in the sharing of knowledge, and not the private and exclusive accumulation of knowledge, the incorporation into education of OER practices and philosophies, including free cultures, free technologies, and open science, is an essential part of an emancipatory education.

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