CREATION OF DIGITAL EDUCATIONAL TECHNOLOGIES BY SCHOOL SUBJECTS: A PROCESS OF EMANCIPATION

MARINA BAZZO DE ESPÍNDOLA

Departamento de Metodologia de Ensino, Centro de Ciências da Educação, Universidade Federal de Santa Catarina, Brazil
marina.bazzo.espindola@ufsc.br | https://orcid.org/0000-0003-3039-5528

ROSELY ZEN CERNY

Departamento de Estudos Especializados em Educação, Centro de Ciências da Educação,
Universidade Federal de Santa Catarina, Brazil
rosezencerny@gmail.com | https://orcid.org/0000-0001-7882-8551

JULIA MARIA GERHARDT DA ROCHA

Escola Básica Getúlio Vargas, Secretaria de Educação do Estado de Santa Catarina, Brazil
juliagerhardt.rocha@gmail.com | https://orcid.org/0000-0001-8461-1869

FRANCISCO FERNANDES SOARES NETO

Pós-graduaçao em Educação Científica e Tecnológica, Centro de Ciências da Educação,
Universidade Federal de Santa Catarina, Brazil
ticofisica@gmail.com | https://orcid.org/0000-0001-8699-7769

ABSTRACT

This article analyses whether, and how, the creation of digital technologies by basic education teachers subsidizes the process of critical appropriation of digital technologies towards their professional emancipation. The research is based on materials produced during meetings with teachers from three schools. The content analysis resulted in the emergence of the following categories: 1 - lack of autonomy in relation to educational technologies; 2 - development of a critical perspective of technologies; and 3 - paths for critical integration of technology in the school – which resulted in two subcategories: 3.1 - Critical adaptation of technologies; and 3.2 - Creation of new technologies in alignment with school needs. It becomes clear that the school is a privileged space for the production of educational technologies based on the real needs of its actors, to contribute to overcoming historical challenges and the effective transformation of contemporary education.

KEY WORDS

educational technology; teacher participation; teaching practice; critical thinking; curriculum design.

SISYPHUS

JOURNAL OF EDUCATION

VOLUME 10, ISSUE 01,

2022, PP 07-21

DOI: https://doi.org/10.25749/sis.25417

CRIAÇÃO DE TECNOLOGIAS EDUCACIONAIS DIGITAIS PELOS SUJEITOS DA ESCOLA: UM PROCESSO DE EMANCIPAÇÃO

MARINA BAZZO DE ESPÍNDOLA

Departamento de Metodologia de Ensino, Centro de Ciências da Educação, Universidade Federal de Santa Catarina, Brasil
marina.bazzo.espindola@ufsc.br | https://orcid.org/0000-0003-3039-5528

ROSELY ZEN CERNY

Departamento de Estudos Especializados em Educação, Centro de Ciências da Educação,
Universidade Federal de Santa Catarina, Brasil
rosezencerny@gmail.com | https://orcid.org/0000-0001-7882-8551

JULIA MARIA GERHARDT DA ROCHA

Escola Básica Getúlio Vargas, Secretaria de Educação do Estado de Santa Catarina , Brasil
juliagerhardt.rocha@gmail.com | https://orcid.org/0000-0001-8461-1869

FRANCISCO FERNANDES SOARES NETO

Pós-graduaçao em Educação Científica e Tecnológica, Centro de Ciências da Educação,
Universidade Federal de Santa Catarina, Brasil
ticofisica@gmail.com | https://orcid.org/0000-0001-8699-7769

RESUMO

Este artigo analisa se, e como, a criação e o desenvolvimento de tecnologias digitais por professores da educação básica subsidiam o processo de apropriação crítica das tecnologias no sentido de sua emancipação como docente. A pesquisa parte de materiais produzidos em encontros com professores de três escolas públicas. A análise de conteúdo resultou na emersão das categorias: 1 - falta de autonomia em relação às tecnologias 2 - desenvolvimento de uma perspectiva crítica de tecnologias; e 3 - caminhos para integração crítica de tecnologia na escola – que resultaram em duas subcategorias: 3.1 - Adaptação crítica de tecnologias; e, 3.2 - Criação de novas tecnologias a partir do currículo da escola. Evidencia-se que a escola se mostra como um espaço privilegiado para a produção de tecnologias educacionais que partam das necessidades reais dos seus sujeitos, para contribuir com a superação dos desafios históricos e a transformação efetiva da educação contemporânea.

PALAVRAS-CHAVE

tecnologia educacional; participação dos professores; prática docente; pensamento crítico; design de currículo.

SISYPHUS

JOURNAL OF EDUCATION

VOLUME 10, ISSUE 01,

2022, PP 07-21

DOI: https://doi.org/10.25749/sis.25417

CREACIÓN DE TECNOLOGÍAS EDUCATIVAS DIGITALES POR LOS SUJETOS ESCOLARES: UN PROCESO DE EMANCIPACIÓN

MARINA BAZZO DE ESPÍNDOLA

Departamento de Metodologia de Ensino, Centro de Ciências da Educação, Universidade Federal de Santa Catarina, Brasil
marina.bazzo.espindola@ufsc.br | https://orcid.org/0000-0003-3039-5528

ROSELY ZEN CERNY

Departamento de Estudos Especializados em Educação, Centro de Ciências da Educação,
Universidade Federal de Santa Catarina, Brasil
rosezencerny@gmail.com | https://orcid.org/0000-0001-7882-8551

JULIA MARIA GERHARDT DA ROCHA

Escola Básica Getúlio Vargas, Secretaria de Educação do Estado de Santa Catarina , Brasil
juliagerhardt.rocha@gmail.com | https://orcid.org/0000-0001-8461-1869

FRANCISCO FERNANDES SOARES NETO

Pós-graduaçao em Educação Científica e Tecnológica, Centro de Ciências da Educação,
Universidade Federal de Santa Catarina, Brasil
ticofisica@gmail.com | https://orcid.org/0000-0001-8699-7769

RESUMEN

Este artículo analiza si, y cómo, el desarrollo de tecnologías digitales por maestros de educación básica subsidian la apropiación crítica de las tecnologías y su emancipación como docentes. La investigación utiliza materiales producidos en encuentros con maestros de tres escuelas. El análisis de contenido resultó en la aparición de tres categorías: 1 - falta de autonomía en relación con las tecnologías 2 - desarrollo de una perspectiva crítica de las tecnologías; y 3 - formas para la integración crítica de la tecnología en la escuela – que resultó en dos subcategorías: 3.1 - Adaptación crítica de tecnologías; y, 3.2 - Creación de nuevas tecnologías basadas en el currículo escolar. Es evidente que la escuela se muestra como un espacio privilegiado para la producción de tecnologías educativas que parten de las necesidades reales de sus asignaturas, para contribuir a superar los desafíos históricos y la transformación efectiva de la educación contemporánea.

PALABRAS CLAVE

tecnología educativa; participación docente; práctica docente; pensamiento crítico; diseño de curriculum.

SISYPHUS

JOURNAL OF EDUCATION

VOLUME 10, ISSUE 01,

2022, PP 07-21

DOI: https://doi.org/10.25749/sis.25417

Creation of Digital Educational Technologies by School Subjects: A Process of Emancipation

Marina Bazzo de Espíndola[1], Rosely Zen Cerny, Julia Maria Gerhardt da Rocha, Francisco Fernandes Soares Neto

INTRODUCTION

Digital technologies are at the center of contemporary educational debates and policies (Cerny et al., 2019). There is a biased agenda that diffuses the potential of Information and Communication technologies (ICT) in education as if the results were automatic. This agenda does not take into consideration that one of the biggest challenges in achieving the full pedagogical potential of ICT is the school social contexts and the actors who actually use them on a daily basis. The result that we see is a disconnected speech between what is expected to be achieved (by society) and the reality of the schools (Buckingham, 2010).

ICT have the potential to yield many powerful results. However, their full potential will only be achieved if technology integration in education is aligned with the educational project of each school. For that, the school community should ask: Which education do we believe in? What sort of person do we intend to form? What is the importance of the modern context and culture to the educational project? Which technologies should be offered to the school? And who chooses them? How, why, and for which purposes will this particular school integrate ICT into its processes? Which technologies do we want or need?

In the relationship between education and technology, the school quite often lags behind. Educational technologies are generally conceived by professionals other than the scholar community – teachers, students, managers, etc – who are excluded from this process. On the other hand, they are compelled by governmental and social demands to use those technologies in their classes (Sossai, Mendes, & Pacheco, 2009).

The critical theory of technology (Feenberg, 2015) invites us to reflect on the role of society in the definition of the paths of technological development. In particular, it invites us to unveil the values imprinted on technologies, bringing them to a democratic, collaborative debate, thus fomenting civil participation in the processes of developing and designing ICT (Feenberg, 2015). Understanding technology as a human process and therefore, humanly controlled, the critical perspective of technology instigates us to search for new approaches for the school-technology relationship (Cerny et al., 2019).

From this perspective, one must problematize, question, and deconstruct educational technologies. Most importantly, educational technology must be conceived by the educational spaces and their actors. In this sense, we have implemented collaborative research projects alongside the school, through the perspective of Design-Based Research and Participatory Design. These projects search for the transformation of the developmental models of technology for and with the school, considering educational technology from the perspective of social technology for social inclusion (Dagnino, 2014).

1 Departamento de Metodologia de Ensino, Campus Universitário-Trindade, sala 103, Bloco B, CED, Caixa Postal: 476, Florianópolis – SC, CEP 88040-900.

WHO DECIDES WHICH TECHNOLOGY WILL BE USED IN THE SCHOOL?

The school, as a social institution, is a reflection of society. It reproduces, in many cases, the inequalities arising from the capitalist economic system. In contrast, we have schools that develop curricula from a transformative perspective. When we integrate technologies into the curriculum, they are adapted to the model being developed at the school, favoring the perception of technology neutrality and "appear now as purely instrumental, as if free from values" (Feenberg, 2015, p. 5).

Historically the work of the teachers is alienated, permeated by social processes that regulate their profession, as mechanisms that control, oppress, and limit their work. In Marx (1983), the concept of alienation involves the worker's relationship with the product of their work, with other work, and with themselves. Abreu and Tibiriçá (2017) understand that, the individual becomes autonomous and able to act in a process of social transformation when he understands the dialectical contradictions of the social context, thinking critically about his human condition.

Silva (2013) adds that in this process of thinking about the human condition, emancipation has to do with one's ability to interact creatively in contingencies, devising explanations to solve problems of our time, from the perspective of our understanding and not because someone simply said that it should be like that. To do so, the author highlights the importance of developing an interpretive view, appropriating the diversity of views and variety of perspectives of social, cultural and political realities.

A critical education focused on emancipation favors spaces for thinking, questioning, problematizing, searching, and proposing autonomously new or re-signified ways to solve contemporary challenges, opening the possibility of innovations intrinsic to the social groups in question.

> Based on what Giroux (1997) and Freire (1979, 1987) propose, we understand critical education as a constant search for connections between educational and cultural practices, the struggle for social and economic justice, for human rights, constant will, and belief in a democratic society, so that critical understandings and liberating practices can be broadened, to seek social and personal transformations of its participants (students, teachers, school community and society in general). Such an attitude implies, amongst other things, a posture aimed at rupturing with the comforting illusions, which carry as an assumption that the ways in which our society and its educational apparatus are currently organized can lead to social justice. (Teitelbaum, 2011, p. 72)

The perspective of social technologies has its origins in the so-called new social movements, in the Science-Technology and Society studies, in Freire's principles of popular education, in participatory research methodologies, in working methods and the socio-technical approach, and in appropriate technologies, among others (Linsingen & Corrêa, 2015).

We understand that the proposal of a critical education must consider digital technologies, because the impacts these technologies have brought to the social context are linked to the expansion of processes and the possibilities of educational experiences beyond traditional educational institutions. Digital technologies also expanded the formative path of the subjects who put themselves in a knowledge network. The possibilities of learning are broadened, as these can take place on multiple platforms, configuring themselves as public spaces for network training through digital technologies, creating enormous challenges for traditional education.

Blikstein (2016) advocates that the integration of digital technologies in schools can be an emancipatory strategy in that it allows new ways of researching, discovering, creating, and expressing itself, where students, in their own voice, can embody their ideas and projects with motivation and commitment. According to the author, the integration of digital technologies is an unprecedented opportunity for the dissemination of Freire's pedagogy in schools, in which emancipation is the greater purpose.

For this, the school needs to overcome the unconscious use of digital technologies, which brings with it a hidden curriculum, the formation of uncritical consumers of technology (Blikstein, 2016), therefore alienated from their intentions and intertwined values. But how can we think of an emancipatory educational process if the school itself does not appropriate the direction of digital technologies in its processes?

From the perspective of technology for emancipation and social transformation, we emphasize the importance of thinking about educational technology as a social technology. According to Abreu and Tibiriçá, social technologies are "products, techniques and/or methodologies, developed in interaction with the community and that represent effective solutions for social transformation" (2017, p. 129). Dagnino, Brandão and Novaes (2004), point out some assumptions of social technologies that seem to us compatible with the critical perspective of educational technology and education for emancipation. For the authors, the process of developing social technologies, based on participation and co-design, necessarily requires a formative process, because "learning and participation are processes that go together: learning implies participation, and involvement and participation implies learning" (Abreu & Tibiriçá, 2017, p. 130). They reinforce that social transformation occurs insofar as there is respect for local identities, where the individual is able to generate knowledge and learn. From the moment they are inserted in a culture and in contact with the world, every individual produces knowledge and learns by this interaction.

The discussion about the technological model of the school gains special importance when we reflect on the fact that, when a model is transposed by technologies conceived from other contexts, it embodies an outside vision, ideas, and values, not always coherent for its implementation in a new space (Busko, 2020).

Although the benefits of teacher involvement in designing educational technology are acknowledged in the literature (Kali, McKenney, & Sagy, 2015), far less is known about different ways of shaping that process and its results, especially focusing on ICT critical integration into the curricula. Costa and Weber (2019) advocate that developing technologies in the educational context constitutes an initial step to explain about both the function of digital culture for the student development and the importance of pedagogical intentions on the teaching process to teachers who develop technologies. Their results show that teachers' involvement in technology development allows us to reflect about how to overcome teaching and learning practice challenges, promoting students' inclusion. Tuhkala (2019) points out that a participative design process encourages teachers and students to be creative with technologies to solve complex problems authentically, thus, taking responsibility in their learning process and creating autonomy regarding knowledge production.

Medeiros, Wangenheim and Hauck (2021) discuss that one of the positive aspects of building technology with the subjects of education is to produce knowledge in that process, since it stems from teachers and students' motivation. This process supports their protagonism by leaving the role of technology consumers. Instead it creates the opportunity for building technologic solutions by themselves.

In a study case of participatory design involving teachers, Cober, Tan and Slotta (2015) highlighted the challenge of multidisciplinary work between programmers, designers and teachers. At the same time, they recognize the importance of that kind of work for the production of educational technologies and its integration in school contexts, because it brings together educational theories, context knowledge, collective design prototype and programming solutions.

This paper analyses whether and how the creation and development of digital technologies by basic education teachers, subsidize the process of critical appropriation of technologies and transform their pedagogical practices towards their emancipation as professionals. We also intend to understand whether this process can represent emancipation of the school subjects in face of the educational and digital technologies, which are generally defined by politicians and stakeholders, external to this community and unaware of its real needs and aspirations.

METHODOLOGY

This article is an excerpt from a larger research called "Education in digital culture: the new ways of learning and the integration of ICT in the curriculum". One objective of the bigger research was to create and systematize a model of research, management, and development used in the creation of "MEC Integrated Platform for Digital Educational Resources"[2]. For this we organized four cycles of research and development from 2017 to 2020 (Cerny et al., 2019).

In this paper we analyze the last cycle, held in 2019, where we implemented a Collaborative Learning Initiative (CLI)[3] which was created collectively by a multidisciplinary team and partner schools of the project. The CLI aimed to constitute a learning and development community with the school actors.

As part of this process, the CLI aimed to share experiences and practices that explore, demonstrate and analyze creative possibilities of integrating digital technologies into the school curricula. It was organized in six moments, adding up to 24 hours of activities. The moments were about: 1. Potentialities and Experiences with ICT and Digital Educational Resources; 2. Teaching Planning, Search and Selection of Digital Educational Resources; 3. Development of Didactic Sequences using Digital Educational Resources; 4. Didactic Sequences Implementation – an experience of using Digital Educational Resources with students; 5. Reflection and Evaluation Experience; 6. Creation and Publication of Digital Educational Resources. These moments included reflections, workshops, dynamics of collective construction of features for the MEC platform, and the creation of Digital Educational Resources by school teachers/subjects. The CLI was developed with Basic Education teachers and managers from three public schools located in Florianópolis, southern Brazil. It should also be noted that this initiative was planned combining spaces for reflection and processes for development.

For each moment, we used specific methodological instruments, coupled in a methodological tool called "Diary of Continuous Use"[3] adapted from Preece, Rogers and Sharp (2005) – a methodology of the Designer - that seeks a more dynamic record of the actions and perceptions of research subjects, showing their interactions with the technologies and a view of the whole training process. For each moment we also had a conversation circle to share impressions and to debate about the theme of the day.

At the end of this experience, a structured questionnaire was sent, with closed and open questions about the stages of the CLI. We also organized a final moment of socialization to evaluate the whole process, to present a new feature of the MEC Platform implemented by this group. It was another moment where the participants shared their experiences of digital technologies integration during this process in their schools.

Every meeting was recorded and transcribed. We chose Bardin Content Analysis method (Bardin, 2011) to analyze the data collected.

Each participant is identified with a code composed of numbers and letters. The first letters are "RS" which stand for "South Region" in Portuguese, since these schools are in southern Brazil. Then there's an "E" which is the first letter of "escola", Portuguese for "school", followed by a number. The number 1 stands for Lauro Muller School (RSE1); number two stands for América Dutra School (RSE2); number 4 stands for Dom Jaime School (RSE3); and number 4 decodes Maria Conceição Nunes School (RSE4).

There's also a code for the teachers within each school, so the code is RSE(x) plus the letter "P", standing for "professor" in Portuguese, and a number, which recalls the order of speaking in the Conversation Circles. The first teacher is "P1", the second is "P2" and so on. That means that the whole code for the second teacher to speak at the América Dutra School is, for example: **RSE2P2**.

2 Full disclosure: We must adopt the official nomenclature "Continuous Formation Course Digital Educational Resources (DER) and Pedagogic Practice" following the University regulations for the certification of this collaborative learning initiative as an outreach activity.

3 Diary of Continuous Use was the guiding instrument of the Collaborative Learning proposal, where notes and targeted actions for each moment of the proposal were recorded. The Diary of Continuous Use was personal and nominal.

The analysis organized the participants' speeches into broad categories, of a procedural nature, understanding that the object of study is crossed by a series of contextual and specific demands, but also subject to generalizations.

RESULTS

From the analysis of the collected data, three categories and two subcategories emerged, namely: 1 - lack of autonomy in relation to educational technologies; 2 - development of a critical perspective of technology; 3 - paths for the critical integration of technology in the school. The last category was subdivided into two subcategories 3.1 - Critical adaptation of technologies for integration into the curriculum, and, 3.2 - Creation of new technologies based on the needs of the school curriculum.

LACK OF AUTONOMY IN RELATION TO EDUCATIONAL TECHNOLOGIES

Teachers reported the lack of autonomy to choose which technologies to use in their pedagogical practices. According to these teachers, these technologies are chosen by the management model of the education network to which the school belongs. Most of these technologies come from private companies, through closed instructional packages, or through the provision of commercial online activity management platforms. In addition to teachers being driven to use certain technologies, these kinds of resources still present technical issues in their functioning, contributing to the discourse that it is the teachers who neglect their use. However, the non-functioning ends up being teachers' possibility of resistance, expressed in the speech below.

> We are not free at all, right, because when this google package was presented to us, everybody was forced to migrate to Gmail. I haven't had a password for two years. Thankfully, nothing works there, right, so I am not stopped from anything. But if it worked, I wouldn't go in for 2 years. (RSE4P1)

Teachers show dissatisfaction with this model. They recognize that this process directly influences not only their freedom to use the technology but also their teaching planning and even their pedagogical practice. They highlight that the implemented digital technologies are aimed at the management and control of the teacher's work and other bureaucratic procedures, such as the students' attendance. They do not foresee any contribution to the pedagogical work. "[...] we don't have any freedom. It is all about management, right? Everything we do, we already did, so there is nothing that "improved" our life." (RSE4P1).

The changes that come from management without the participation of teachers result in less adherence, even due to inadequacy to the real needs of this group. We understand that the perspectives that teachers have on technologies generate expectations that guide their practices (Espíndola, Cerny, & Xavier, 2020). The impediment to teachers exercising autonomy may have implications for the development of pedagogical activities, discouraging authorship and creation within the pedagogical perspectives of the teacher and the school.

Teachers and managers show that choices about technologies are made from the outside in, placing the school professionals/subjects as mere users and consumers, with a strong appeal to the process of

commodification of education. At first glance, this reality might signify the rejection of digital technologies in education, since it leaves these actors with no alternatives.

The aforementioned perception opens the possibility for discussions about what may be behind the process of choosing technologies at school. Next, we observe how the discussion about the critical views of technology resonates in the formative process of basic education teachers.

DEVELOPMENT OF A CRITICAL PERSPECTIVE OF TECHNOLOGY

From the movement of unveiling the nature and the contradictions of the digital technologies, teachers begin to understand themselves as active subjects and with possibilities of interfering in the ways of educational technology in their school. When they envision spaces for discussion and questioning what is often naturalized in the school routine, they feel motivated to build their own reflections and practices with the use of digital technologies.

> This research was very interesting because it opens up possibilities … It's made by public institutions for the sake of the public service, public teachers, so, you know? Look up! Zoom in. We have been trained by private groups, from SEBRAE, in the area of technology, with 3d printers. We are doing prototyping and creating prototypes. Okay, but, so what? Are we really acting in citizenship with students or are we only preparing them for the job that needs this workforce? So, this question remains, right? If this technology that is inserted in our school is really serving students, the public, and the school community, if it is really acting on a critical view for the autonomous students, or are we only forming this labor force for ACATE, for other companies [...]. (RSE4P9)

The unveiling of private interests opened space to emphasize the role of the teacher in critically adapting technology, without the interests of specific groups, different from what usually happens in schools. Adapted technology can allow "the recognition and adoption of different learning styles and epistemologies, creating an environment in which students can materialize their ideas and projects with intense personal involvement" (Blikstein, 2016, pp. 840-841).

> As already mentioned, the introduction of digital technologies in schools requires professionals to have an authentic and genuine reflective process. To reach this level of reflective thinking, we have to realize that [...] the teacher must experience situations in which they can analyze their and other teachers' practices; establish relationships between these and the underlying development theories that support them; participate in joint reflections on them; discuss their perspectives with colleagues; and seek new directions. (Almeida & Silva, 2011, p. 43)

Worthy of note, as a result of these discussions, is that the teachers found new possible paths for digital technologies integration into the curricula.

PATHS FOR THE CRITICAL INTEGRATION OF TECHNOLOGY IN THE CURRICULUM

As ways/paths for critical integration of technologies in the curriculum thought by the collective (group/community), we identified two subcategories of analysis: the critical adaptation of technologies for integration into the curriculum and the creation of new technologies from the context of the school.

Critical adaptation of technologies for integration into the curriculum

From the understanding that technology arrives at the school loaded with educative values, with conceptions of contents and methodologies, there was a movement of questioning and transformation of digital technologies into educative tools considering the school context, its needs, and educational projects. This movement induced an authorial pedagogic work, conceived in an empowered and critical way. The mobilization of teachers for pedagogical innovation came from the search for overcoming the challenges of teaching and learning perceived by them. As an example, we bring the report of RSE2P2 where the teacher adapted a DER seeking to overcome learning difficulties of the students, creating new conditions for content visualization, which would not be possible without the use of technology.

> Second-year students had a lot of problems identifying colors, you know? They didn't identify the colors well. So, I decided to work with ARYE, playing with the colors. They were painting the drawings of ARYE and I would talk to them and ask “what color is this?”, “which color did you use to paint this one?”, you know? And it was very nice/cool [...] I think it was one of the nicest/coolest experiences that I've had in my life. [...] And afterward, when I came back to the classroom, I could really see the results. They came to me saying: “teacher, I already know the colors, this one is red, this one is blue, this one is orange”. (RSE2P2)

In this and many other reports, it was possible to identify a significant increase in pedagogical potential, as a result of the integration of different technologies into the context of the subjects. This process generated new methodological perspectives and encouraged the emancipation of those who experienced it, as pointed out by Silva (2013). A range of new pedagogical possibilities opens up when the use of technology comes from a collective choice.

Creation of new technologies from the school curriculum needs

Another path found by the school collective was the creation of brand new technologies arising from the authentic needs of the school context. The teacher RSE4P9, for example, created a digital magazine collectively with her students, documenting their experiences of a field trip and working on the issue of writing organization, the elaboration of different narratives, and the systematization of the research carried out. They produced a resource with informative and creative potential, which helped the process of monitoring and evaluating students' learning.

> We did a digital magazine that resulted from that field trip. I edited the magazine, the template, with the material of the fourth year. The magazine is ready. If you want, I can share it with you for your appreciation, even give me some feedback, before I publish it. Because I want to publish it too. The context of the work was a project that involved a study trip to Botuverá Cave. Based on this experience, we did a magazine, with written reports of the experiences in this environment, with all the students' testimonials, including a video authored by them. So, it was all inserted in the magazine. (RSE4P9)

Teacher RSE4P1 sought significant technological possibilities for her and the students in the joint construction of knowledge and the growth of autonomy in Freire's perspective, as indicated by Blikstein (2016).

> I work from a Freire perspective, and this year I teach 6 to 10-year-old children. I also appointed myself to work on the pedagogical project of our school. [...] And, every time, when I use technology, I ask myself: "Is this being valid?" Ok, I am using the technology, but so what? What am I getting from it? My work has to be authorial, the child must see him/herself there, I have to improve something with it… And so does the child. So, when I started thinking about what to do … nothing comes out, right? [...] but, I thought, I also have to create something that stays, that is not to be used for one day and it is done. I want this critical work to last for a long time, and maybe from there, we can think and develop other things, right? (RSE4P1)

This teacher thought about the possibility of a continuous and interactive assessment of her students' actions in the development of written exercises in a technological environment. Thus, she set out to create a unique tool, according to her needs and educational conceptions. With that, she contemplated and expanded her pedagogical planning, building spaces for interaction between teachers, students, and learning contents. In addition, it created a space for the development of students' metacognition.

> The tool itself is still under construction, I did it and then sat down with Diego {designer and researcher}, and said "look, there is something missing", he started to understand me [...] he also saw things that I had not seen. It was very cool! What do I think? Try to go beyond the tool. I used to work messily, always filming my students reading because I wanted to see the literacy process, to see them getting there [...]. But I wished it could also be possible to print it in the end, to have this version in the cloud, and to print it for the record. I think that the notebook doesn't tell the story of the student, even if it has the dates, sheet, didactic sequence, it doesn't tell a story. In my perspective of alphabetization/literacy and in the way I work, I value orality, I think [...] But what I wanted, in addition to listening, was to have the records of his actions while writing. And this was very nice/cool because when this boy from the fourth year got there, he wrote, he typed, he kept asking "where do I add the punctuation?", "where do I add the commas?" and I kept showing him on the keyboard and he kept doing it… So, he wrote the way he said it, and then I told him "Ah, now let's review it then". He goes over there and starts reading, "oh, but there was an 'i', but here an 'a' was missing", "is this word correct?" he asked… "the text is yours!!!". By doing so, he raised many hypotheses during the process, which provoked me even more… Beyond what I had expected/projected. (RSE4P1)

The process experienced by this teacher involved the creation of a digital education resource that is not characterized by sporadic use, but a space for monitoring the multiple steps of language construction (written and oral) by the students, valuing feedback, and mediation between the teacher and students.

Teachers evolved to another level of integration of technologies where the construction of more critical notions about the pedagogical act with technologies is noticeable. About this, Borges (2009) points out that "in addition to being a consumer, the subject becomes an author, producer, and disseminator of knowledge, transforming reality and its surroundings, capable of understanding the functioning of the software and technological resources that enable digitalized productions" (Borges, 2009, p. 140).

Dagnino (2009) argues that experiences, worldviews, tacit knowledge, and varied languages are the driving force for an effective social technology project. This reinforces the feeling of authorship, authentic need and stimulates participatory action of those who, perhaps, find themselves in a state of exclusion. (Busko, 2020). Teachers and managers, from their reflections and experiences during the CLI, perceived themselves as authors, researchers, and creators. They saw themselves as the main drivers of the process, considering their own ideas and values, articulating theory and practice. In this sense, we observed a process of emancipation of the school and its actors in the relationship between technology and education. "[...] because we did a transposition, a systematization, and created a technology. So sometimes we don't realize it, but it is already a technology that we, as a group, share and create." (RSE4P9).

In this analysis, we were able to understand that the emancipation process of the school for the critical integration of technologies in its pedagogical practices involves: (a) questioning the role assumed by teachers in the ICT integration in the curriculum and in the technology model of the school, (b) the critical analysis of the exogenous proposed artifacts and (c) the search for methodological and practical paths for the implementation of the authorial pedagogical proposals with digital technologies, either through the critical adaptation of the existing technologies or the creation of new and contextualized technologies.

CONSIDERATIONS

This article aimed to analyze whether, and how, the creation and the development of digital technologies by basic education teachers subsidize the process of ICT critical appropriation and transform their pedagogical practices towards their professional emancipation. Also, we tried to understand whether this process can help the emancipation of schools facing the definitions of educational technologies.

We observed that teachers of the participant schools do not feel free to choose the digital technologies that the school incorporates in its practices, and they see themselves even less as co-developers of these technologies. It was also possible to conclude that the teachers challenge the technologies that managers make available, reflecting on the impact of these choices on the daily work and the pedagogical possibilities offered to students.

The proposal of a collaborative process of reflection created a rupture with the traditional models of introducing ICT in these school contexts, encouraging the development of a critical view of technologies. We noticed that the school community felt safe and encouraged to seek new paths and new possibilities, based on the pedagogical needs of their context.

The mobilization of the participant teachers for a pedagogical transformation started with the search for overcoming the challenges faced during their practices and followed two paths: the critical adaptation of digital technologies to the pedagogical needs of their context through the integration of existing technologies and the creation of new ones conceived by the school community. These movements bring different methodological perspectives and encourage autonomy, empowering teachers to make their choices and opening up new possibilities for pedagogical practices. They encourage collective choices and reflections on authorship, opening space for new concepts and technologies, providing the creation of new educational technologies by the teachers themselves. The way we see it, these movements

represent processes of emancipation of the teachers and the school in their relationship with technologies, subverting the traditional, historically adopted model of technology.

The development of a critical perspective of technology in the participants of this research throughout the CLI steps, has opened paths for a critical integration of ICT into the curriculum, driven by authorial pedagogical action. These results suggest that the school could be a privileged space for the production of educational technologies that reflect the real needs of their actors, contributing to overcome historical challenges and to the effective transformation of contemporary education.

AUTHORS CONTRIBUTION

Conceptualization and Methodology: M.B.E., R.Z.C.; Software: F.F.S.N.; Data Curation: J.M.G.R.; Analysis and Writing: M.B.E., R.Z.C., J.M.G.R,, F.F.S.N.; Project Administration: R.Z.C, F.F.S.N.

ACKNOWLEDGMENTS

This study was financed mostly by Secretary of Basic Education (SEB/MEC/Brazil) and in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil (CAPES) - Finance Code 001.

REFERENCES

Abreu, J. C. A., & Tibiriçá, L. V. (2017). Tecnologia Social como Mecanismo de Emancipação Social? Uma Análise Empírica. *Revista Brasileira de Tecnologias Sociais, 4*(2), 135-148. doi: 10.14210/rbts.v4n2.p135-148

Almeida, M. E. B. de, & Silva, M. G. M. da (2011). Currículo, Tecnologia e Cultura Digital: espaços e tempos de Web Currículo. *Revista e-curriculum - São Paulo, 7*(1, Abril). Retrieved from: http://revistas.pucsp.br/index.php/curriculum/article/viewFile/5676/4002

Bardin, L. (2011). *Análise de conteúdo*. (Tradução de Luís Antero Reto, Augusto Pinheiro). São Paulo: Edições 70.

Blikstein, P. (2016). Viagens em Tróia com Freire: a tecnologia como um agente de emancipação. *Educação e Pesquisa, 42*(3, Julho-Setembro), 837-856.

Borges, M. A. F. (2009). *Apropriação das tecnologias de informação e comunicação pelos gestores educacionais*. (Tese de Doutorado em Educação: Currículo). Pontifícia Universidade Católica de São Paulo, São Paulo, Brazil.

Buckingham, D. (2010). Cultura digital, educação midiática e o lugar da escolarização. *Educação e Realidade, 35*(3), 37-58. Retrieved from: https://seer.ufrgs.br/educacaoerealidade/article/view/13077

Busko, P. S. (2020). Relato de experiência: tecnologias sociais e práticas freireanas aplicadas na educação CTS . *Revista Extensão & Cidadania*, *8*(14), 191-202. doi: 10.22481/recuesb.v8i14.7829

Cerny, R. Z., Espíndola, M. B. de, Ritta, S. B., Vieira, D. F., Amaral, A. L. O. do, & Ladvig, A. (2019). Pesquisa Educativa como espaço formativo e de co-criação nas comunidades escolares: possibilidades metodológicas a partir da Teoria Crítica da Tecnologia e do Design Participativo. Apresentado na *1st International Conference "Education 2019: challenges, trends, commitments" – IREDU*, Barcelona.

Cober, R., Tan, E., Slotta, J. S. H., Hyo-Jeong, S., & Könings, K. D. (2015). Teachers as participatory designers: two case studies with technology-enhanced learning environments. *Instr Sci, 43*(2), 203-228. doi: 10.1007/s11251-014-9339-0

Costa, R. D. A., & Weber, C. G. (2019). Constructos orientativos para o desenvolvimento de tecnologias por professores. *24º Seminário Internacional de educação, tecnologia e sociedade: ensino híbrido – FACCAT*. Online. Retrieved from: https://seer.faccat.br/index.php/redin/article/view/1529https://seer.faccat.br/index.php/redin/article/view/1529

Dagnino, R. (Org.) (2009). *Tecnologia Social: ferramenta para construir outra sociedade*. Retrieved from: http://hdl.handle.net/10625/47974

Dagnino, R. (2014). *Tecnologia Social: contribuições conceituais e metodológicas*. Campina Grande-PB: EDUEPB. doi: 10.7476/9788578793272

Dagnino, R. P., Brandão, F. C., & Novaes, H. T. (2004). Sobre o marco analítico-conceitual da Tecnologia Social. In A. E. Lassance Jr, *Tecnologia Social: uma estratégia para o desenvolvimento* (pp. 15-64). Rio de Janeiro: Fundação Banco do Brasil.

Espíndola, M. B., Cerny, R. Z., & Xavier, R. S. (2020). As perspectivas de tecnologia dos educadores em formação: valores em disputa. *Revista Eletrônica de educação - São Carlos SP*, *14*(jan./dez.). Retrieved from: http://www.reveduc.ufscar.br/index.php/reveduc/article/view/3833

Feenberg, A. (2015). *O que é a Filosofia da Tecnologia?* Conferência pronunciada para os estudantes universitários de Komaba, em junho de 2003, sob o título de "What is Philosophy of Technology?". (Tradução de Agustín Apaza, com revisão de Newton Ramos-de-Oliveira). Retrieved from: https://www.sfu.ca/~andrewf/books/Portug_O_que_e_a_Filosofia_da_Tecnologia.pdf

Kali, Y., McKenney, S., & Sagy, O. (2015). Teachers as designers of technology enhanced learning. *Instructional Science, 43*(2), 173-179.

Linsingen, I. V., & Corrêa, R. F. (2015). Perspectivas educacionais em tecnologias sociais: autoria, inclusão e cidadania sociotécnica. *Oficina do CES, v. u*, 01-27.

Marx, K. (1983). *O capital*. (V. I, tomo 1). São Paulo: Abril Cultural.

Medeiros, G. A. e S., Wangenheim, C. G V., & Hauck, J. C. R. (2021). O protagonismo de estudantes da educação básica a partir do desenvolvimento de aplicativos para smartphone. *Perspectiva, 39*(1, jan./mar), 01-18.

Preece, J., Rogers, Y., & Sharp, H. (2005). *Design de Interação: Além da Interação Humano-Computador*. São Paulo: Bookman.

Silva, L. T. (2013). O Sentido e o Significado de Emancipação. *Revista e-Curriculum, 3*(11, set./dez.), 751-765. Retrieved from: https://revistas.pucsp.br/index.php/curriculum/article/view/8924

Sossai, F. C., Mendes, G. M. L., & Pacheco, J. A. (2009). Currículo e "Novas Tecnologias" em tempos de globalização. *Perspectiva, 27*(1), 19-46.

Teitelbaum, K. (2011). Recuperando a memória coletiva: os passados da educação crítica. In M. W. Apple, W. Au & L. A. Gandin, *Educação crítica: análise internacional* (pp. 349-364). Porto Alegre: Artmed.

Tuhkala, A. (2019). *Participatory Design: An Approach for Involving Teachers as Design Partners*. (JYU DISSERTATIONS 92). University of Jyväskylä, Finland. Retrieved from: https://jyx.jyu.fi/bitstream/handle/123456789/64300/1/978-951-39-7782-5_vaitos14062019.pdf

*

Received: September 07, 2021

Revisions required: October 11, 2021

Accepted: January 24, 2022

Published online: February 28, 2022