

# Digital technologies integration in school curriculum: dialogues about challenges and difficulties<sup>1</sup>

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## *Integração de tecnologias digitais ao currículo: diálogos sobre desafios e dificuldades<sup>2</sup>*

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### ABSTRACT

The purpose of this article is to present some results of a research, in which the objective was to investigate processes of integration of digital technologies into the school curriculum, identifying challenges and difficulties that emerge from pedagogical practices in integration processes. The questions that guided the development of the research were: How can digital technologies be integrated into the school curriculum with a view to innovating pedagogical practices and the curriculum? What challenges and difficulties emerge from pedagogical practices in processes of integrating digital technologies into the school curriculum? How can teacher education contribute to processes of integrating digital technologies into the school curriculum? For the development of the research, studies were carried out on integrating digital technologies into the school curriculum, and education of teachers to use digital technologies, linked to the development of actions in schools. In this article, we will discuss the initial processes of integrating digital technology into the curriculum investigated in three public schools:

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one process was started in partnership with teachers from the early years, another in partnership with high school teachers, and a third process was developed in a subject in college level. The processes are characterized as innovative, but the need for continuous teacher training actions and investment in technological infrastructure in schools was evident in order to intensify integration processes in the investigated schools.

*Keywords:* Digital technologies. School spaces. Teacher training. Digital culture.

## RESUMO

O objetivo com este artigo é apresentar alguns resultados de uma pesquisa cujo objetivo foi o de investigar processos de integração de tecnologias digitais ao currículo escolar, identificando desafios e dificuldades que emergem de práticas pedagógicas em processos de integração. As questões que nortearam o desenvolvimento da pesquisa foram: Como tecnologias digitais podem ser integradas ao currículo escolar com vistas a inovar práticas pedagógicas e o currículo? Que desafios e dificuldades emergem de práticas pedagógicas em processos de integração de tecnologias digitais ao currículo escolar? Que ações de formação de professores podem contribuir com processos de integração de tecnologias digitais ao currículo escolar? Para o desenvolvimento da pesquisa foram realizados estudos sobre integração de tecnologias digitais ao currículo escolar, e formação de professores para uso de tecnologias digitais, articulados ao desenvolvimento de ações em escolas. Neste artigo iremos dialogar sobre processos iniciais de integração de tecnologia digital ao currículo investigados em três escolas públicas: um processo foi iniciado em parceria com professoras dos anos iniciais, outro em parceria com professores do Ensino Médio, e um terceiro processo foi desenvolvido em uma disciplina de graduação, no Ensino Superior. Os processos se caracterizam como inovadores, mas ficou evidente a necessidade de ações contínuas de formação de professores, e investimento em infraestrutura tecnológica nas escolas para intensificar processos de integração nas escolas investigadas.

*Palavras-chave:* Tecnologias Digitais. Espaços Escolares. Formação de Professores. Cultura Digital.

## **An initial dialogue on technology integration and the research proposal**

What is observed is that digital technologies are present in different spaces of society. And as stated by Kenski (2003), the use of digital technologies has implied several changes in the ways of living, studying and working, substantially altering the way we perform tasks and the way we think about them. As a result, educational institutions become spaces responsible for education with / for these technologies.

However, for this education in a digital culture to take place in schools, we consider that it becomes necessary, even if not enough, to consider two central aspects: access to a basic digital technology infrastructure (access to the internet network, personal computers, laptops) and/or cell phones, projectors and digital whiteboards, and continuous training processes for teachers and managers to integrate these technologies into the curriculum. These processes are designed to transform school culture, which implies the challenge of overcoming, in many schools, a conception of learning guided by the transmission of information, and of the teacher as the sole holder of systematized knowledge. Another challenge is to change the organization of the school, which for the most part is segmented into studies by subjects, bimesters, classes fixed in the schedule, and single physical space, with study proposals and interaction with only a group of students, separated by classes, grades, without interaction with other students and teachers from the same school, or people from the local and/or global community.

In this context, Cabero-Almenara (2001) already mentioned some difficulties for the integration of digital technologies into the education system, very close to the challenges that we highlight. In his study, this researcher mentioned difficulties related to the presence of digital technologies at school, such as quantity, quality and updating of equipment, maintenance, software adapted to curriculum content and educational needs. Another difficulty pointed out was related to the training of teachers to use this technology, both to understand it as technology, and to relate it to the ideological and political assumptions that they transmit.

Without diminishing the importance of different difficulties pointed out in research for integration, Escontrela Mao and Stojanovic Casas (2004) also considered that one of the difficulties in advancing the integration of digital technologies into the curriculum is related to the dominant school culture within the school, therefore, with the need to rethink the pedagogical proposal of the

school as a whole. In this sense, the authors state that it is not a matter of doing the same in another way, but of changing the learning objectives according to the potential and possibilities of using digital technologies in pedagogical practices.

In this context, the challenge of continuing teacher education to integrate digital technologies into the curriculum arises. When discussing teacher training, Almeida and Valente (2011) point out that one of the main difficulties is not the appropriation of technical knowledge about technologies by teachers, but the understanding of different possibilities of using them in their pedagogical practices. And what could we say that, sometimes, they are related to their conceptions of learning, as mentioned earlier.

In this sense, Costa and Felizardo (2012) state that continuing education can constitute a powerful strategy to carry out a careful management of tensions and conflicts related to teachers' beliefs and values, and of supreme importance in the processes of change. In addition, with training actions, it is possible to help teachers deal with the barriers that prevent the effective integration of technologies in their practices, in curricular innovation processes.

As for the challenge and difficulty of access to a basic digital technology infrastructure, there is still a lot to be invested in public schools of Basic Education in Brazil. What we have observed and followed in many schools, is that those that have access to the internet, it provides poor connection, when appropriate, is sometimes obsolete or under maintenance. Allied to this, we observe the ban on the use of cell phones in some schools.

There are federal government programs, and incentives from some municipal education departments, to invest in digital technologies for public schools. From national programs, we can mention programs launched in the last 15 years, such as *PROINFO Integrado*, proposed in 2007, with the main objective of promoting the pedagogical use of technologies in Basic Education schools in public education networks in urban and rural areas. *PROINFO Integrado's* proposal was to invest in school infrastructure, in the creation and expansion of computer labs, with an internet connection, linked to the *Banda Larga* Project (broadband internet), in 2008, also from the government. Most computer rooms date from this period, that is, computers, which are 10 to 13 years old.

In 2007 the government invested in the experimental project "One computer per student", and in 2010, this project became the *Programa Um Computador Por Aluno* (PROUCA, one computer for each student), with the distribution of educational laptops to several schools. These laptops, due to various restrictions and limits of hardware and software, ended up being discarded, even due to the lack of maintenance, in practically all schools that participated in the Program.

Finally, since 2017, the *Programa de Inovação Educação Conectada* (Connected Education Innovation Program) has been in place, which promotes actions so that the school environment is prepared to receive the internet connection, and provide access to digital educational content. The goal is that, by the end of 2020, 80% of urban public schools in Brazil have access to high-speed internet and 40% of rural schools (with satellite coverage). But there are still many schools with no connection or a poor connection.

In addition to these programs, states and the Federal District can purchase the Interactive Computer containing the digital blackboard, with their own resources or from other sources, by adhering to the price registration minute arising from the Auction, carried out by *Fundo Nacional de Desenvolvimento da Educação* (FNDE, National Fund for Education Development).

And, as for Early Childhood Education Centers, in most states, there is no basic technology infrastructure, with internet, tablets, digital whiteboards, for example. As for Higher Education, policies for infrastructure and use of digital technologies in these courses are more focused on offering them in the Distance Education modality or courses called semi-presential. However, since they are mostly adult students, depending on the region, they have cell phones, which makes it possible to think about curricular integration via this technology.

Nevertheless, if the technology infrastructure is necessary to think about processes of integrating digital technologies into the curriculum, it is far from sufficient. What is observed, even in equipped schools, is that there are few actions for the effective integration of digital technologies into the school curriculum, of innovative pedagogical proposals; what is observed is little investment in effective processes of continuing teacher education for this integration. There are specific initiatives, without becoming programs or projects of a state or country, guarding the differences of each state, municipality, school community, school... In this context, some questions mobilize us to continue investigating processes of integration of digital technologies into the curriculum: Why are there still few proposals for integrating digital technologies into the curriculum in Brazilian public schools? What challenges and difficulties move/paralyze these integration processes?

In this context, it is extremely important that the scientific community and each school community continually investigate and discuss the teaching and learning processes, and the possibilities of integrating digital culture into the school curriculum, ways of thinking, acting, and producing knowledge in each school space. These investigations and discussions make it possible to think together about a unique curriculum for each school and community, produced from the practices and knowledge of its principals, teachers, students, and other members of the school and scientific community; a curriculum that

integrates movements/ knowledge from other cultures, digital culture, since the incorporation of linguistic and semiological variables, resulting from digital technology, can alter teaching and learning processes.

Finally, considering the exposed context, we consider it necessary to ask: how can digital technologies be integrated into each school curriculum in order to continuously innovate pedagogical practices and the curriculum? What challenges and difficulties emerge from pedagogical practices in the process of integrating digital technologies into the school curriculum? What teacher training actions can contribute to processes of integrating digital technologies into the school curriculum? These are some questions that guided the research, from which data, in part, we discussed in this article.

The research problem was constituted by these questions that emerged from the theoretical and practical field (observed in some educational institutions and pedagogical practices). The purpose of this article is to present some results of this research, whose objective was to investigate processes of integration of digital technologies into the school curriculum, identifying challenges and difficulties that emerge from pedagogical practices in integration processes.

The research has a qualitative approach, in which, according to Bogdan and Biklen (1994, p. 16):

The researcher introduces himself to the world of the people he intends to study, tries to get to know them, make himself known and gain their trust, making a written and systematic record of everything he hears and observes. The material thus collected is complemented with other types of data, such as school records, newspaper articles and photographs.

According to Bogdan and Biklen (1994), in the qualitative approach, data are collected in the context of the participants' natural environment, being analyzed throughout the process. Thus, the researcher attends the study sites, because they are concerned with the context, in understanding the actions developed in his usual environment of occurrence.

In this sense, in this article we discuss some data produced in the process of integrating digital technologies into the curriculum of three educational institutions, which we call schools here. With these processes, data were also produced by two masters and two doctoral researches, under the guidance of one of the authors. The choice of data for these integration processes was carried out with the intention of discussing different integration processes, and the training of teachers linked to them.

The research was developed in continuous and articulated movements, including: studies on the integration of digital technologies in the school curriculum, and teacher training; planning, development and analysis of actions carried out in/for schools, in partnership with master's and doctoral students; data selection and analysis to discuss the problem of integrating digital technologies into the curriculum.

In all the actions developed in schools, the researchers' movement was to integrate the school, the movements of teachers and/or students, to get to know it, to dialogue with its actors, considering the history of the place, of the people - teachers and/or principals, students, their knowledge and culture, their rhythms. A research movement, which we call research-integration (which we will not discuss in this article), in which the researcher integrates with the movements of the research context/scenario, with the movements of the research actors and partners, to together produce data, in the "heat" of the context, based on the knowledge of each partner, that integrated, produce new knowledge, innovative in relation to what was already known by each member.

After presenting the research context and proposal, we will then discuss some conceptual elements, and then discuss some data produced in processes of integrating digital technologies into the curriculum.

## **A dialogue about some conceptual elements: when we talk about integration...**

The research problem presented here is part of the discussion of what is the process of integrating digital technologies into the curriculum, which is not limited to inserting or making them available in the school space. There is a difference between integration and insertion of computers in the teacher's pedagogical practice, according to Bittar (2010, p. 5):

The latter means what has been done in most schools: the computer is put in schools, teachers use it, but without it provoking a different learning from what was done before and, more than that, the computer remains a strange instrument (alien) to the pedagogical practice, being used in unusual situations, extraclass, that will not be evaluated. [...] integrating a software into the pedagogical practice means that it "should must" (sic) be used at different times in the teaching process, whenever necessary and in order to contribute to the student's learning process.

In this sense, Almeida and Prado (2011) state that digital technologies will not be integrated into the curriculum if teachers use them only for activities that can be explored with the use of paper and pencils. In other words, these technologies need to be thought/used in order to enable children, adolescents and adults to create, fantasize, think, conjecture, have fun learning different concepts during classes, integrating digital languages into activities that make up the curriculum in action.

But then, what is the integration of digital technologies in the curriculum? This integration, for us, is a process, a continuous movement of planning and development of classes and actions at school, in which digital language is incorporated, conveyed through different digital technologies (equipment, software, applications), and digital culture movements, to other languages used in the production of knowledge, providing innovative learning experiences at school. This integration is not characterized by just one or a few specific actions by the teacher or the school, but in a continuous learning process of each teacher, the school, in interaction with students, school managers, prescribed curricula, school and scientific communities, different partners (from face-to-face and virtual spaces) online, concepts from different areas, new technologies.

In the integration process, the look is not at digital technology itself, but at each student's learning process, which can be favored by enjoying experiences that incorporate digital language. We can say, when appropriate, that integration is continually happening in the practice of a teacher or school (in the dynamic sense of the process), as it is a continuous movement, not an ending one. It constitutes a process built every day, each practice, with each class of students, in a subject, at school; digital technologies are usually and naturally incorporated into the curriculum in action, without forcing its use, without being artificial, mandatory.

In this sense, each integration process is unique, and it would need to be thought of in each group of teachers, principals, students, school community, continuously, in interaction with other groups, scientific and cultural production, technologies, considering prescribed curricula and proposing new ones. However, we think that it is important to consider the uniqueness of each teacher, student, school, culture, community. And, based on the history of each one and the interaction between them, respecting the time of each one, to initiate technology integration processes to the curriculum. These processes require continuous training of teachers and principals, coordinators of this process in schools.

When talking about innovation, innovative practices, we are guided by the studies of Huberman (1973), who considers innovation an action that takes place with the objective of incorporating a change, which is accepted and used in the space of schools, in the case of this research proposal. When discussing innovation and the use of technologies at school, we still consider,



like Groenwald and Ruiz (2006, p. 5), that “The use of new technologies in education implies a process of pedagogical innovation that justifies the need for this incorporation, and that should lead to an improvement in the teaching and learning process”.

In this sense, students’ motivation needs to be instigated by the proposed activity using a certain technology, and not just by using the technology itself. As Salvat (2000) states, in an integration process, the visible element of the technology is not the technology, but the activity that is being carried out.

When integrating them into the school curriculum, these digital technologies are part of the pedagogical practices, of the learning environments in the school, they are not understood only as resources, equipment, machines, but as digital learning spaces, which in each class and pedagogical practice, are transformed and transform the curriculum into action, in a process that we can call structural coupling. For Maturana and Varela (1995, p. 133-134),

As long as a unit does not enter into a destructive interaction with its environment, we, as observers, will necessarily see between the structure of the environment and the unit a compatibility or commensurability. If such compatibility exists, means and unity act as mutual sources of disturbance and trigger mutual changes of state, in a continuous process that we call structural coupling [...].

The unit in the technology integration process would be the school curriculum, and the medium would be the digital spaces accessed from the technologies. When the authors talk about disturbances, they refer to the interactions that trigger changes in state, which for us would translate into changes in the learning environment constituted in a classroom and /or school, by teachers and students. These changes occur continuously, from changes in the curriculum unit, due to guidelines, curricular guidelines, scientific discoveries, and the coupling itself. And changes occurring in the environment, digital spaces, from the emergence of new technologies, whether new equipment, new functions, new applications, software. Hence, we consider that the integration of digital technologies into the curriculum is a dynamic, continuous process, not a static characteristic of a pedagogical practice, caught in a punctual action.

As a process, we agree with Sanchez (2003), that the integration of digital technologies into the curriculum, to the pedagogical practices of teachers, can occur at three different levels, we prefer to call the technology integration stages to the curriculum, which are: preparation, use, and integration. At the first level

of integration, discussed in Sanchez (2003), that of preparation, the teacher is concerned with knowing the operation of technologies and their administration in the classroom; begins to analyze functionality of computers, projectors, digital whiteboards, applications, software, and possibilities for use in the classroom.

The second level of integration is usage. At this level of integration, the teacher uses technologies in class, but the goal is not to innovate curriculum, learning processes but using technologies. At this level, we could state, based on what Salvat (2000) discusses, that the visible is still the technology, its use, not the activity proposed with the use of technology.

At the third level, named by Sanchez (2003) as integration, the teacher, from the learning objective, plans and proposes activities with technologies; activities are carried out, guided by learning objectives, in digital learning spaces. At this level, technologies are invisible, and what is visible is activity (SALVAT, 2000). Integration stage, in which the use of digital technologies begins to become natural at school. However, we consider that the integration process does not end at the third level, given the complexity of the curriculum, the diversity of technologies, the coupling between curriculum and digital technologies, and the possibilities of proposing activities with the use of technologies that can favor the learning of each student, group.

It is also important to mention the understanding of the curriculum that guides our studies and research:

[...] it is not restricted to the transfer and application of the content prescribed in reference documents to pass on to the student in the context of the classroom. The curriculum develops in the reconstruction of this prescribed content in the processes of representation, attribution of meaning and negotiation of meanings, which occur first when teachers prepare the planning of their disciplines taking into account the concrete characteristics of their work context, the needs and potential of its students, their preferences and the way they carry out their pedagogical work (ALMEIDA; VALENTE, 2011, p. 15).

Given the above citation, it is considered that the integration of digital technologies into the curriculum implies a new curricular organization, which considers new times and learning spaces, new pedagogical practices, with the proposal of a more flexible prescribed curriculum and changes in the classroom space and in the educational institution as a whole.

In this regard, to discuss the integration of digital technologies in the school

curriculum, it is essential to discuss the training of teachers and principals. When considering that each integration process is unique, it is important that the continuous training of teachers and principal happens in an intertwined way with the pedagogical practices experienced in the school, “[...] in the reflection about them, in the identification of the changes occurred, of the difficulties faced and the decisions necessary for these practices to materialize” (ALMEIDA; PRADO, 2011, p. 38-39). In this sense, we investigate processes of integration of digital technologies into the curriculum, integrated with processes of continuing teacher education, as we will see below.

### **A dialogue on some integration processes...**

In order to discuss about processes of integrating digital technologies into the school curriculum in this article, we chose to discuss some data produced in three schools. One of the integration processes<sup>3</sup> was conducted in partnership with a group of teachers from the early years of elementary school, in a public school located in an urban area (a process that resulted in a master and a doctoral research); a second was started in partnership with a group of high school teachers, in a public school, located in a rural area (process of a master’s research in progress); and a third process was carried out in partnership with a doctoral student, whose doctoral research (LOPES, 2020) was not to discuss an integration process, but whose action was guided by a process of integrating digital technologies into the curriculum of a Mathematics subject, in a higher education course, from a public university. All actions were carried out in the Campo Grande-MS region, as part of a larger survey, coordinated by one of the authors of this article.

The integration process started in partnership with the group of teachers from the early years of elementary school, was constituted from a proposal for continuing education of in-service teachers, whose objective was to establish itself, with the group of teachers and school principals, a process of integrating digital technologies into the school curriculum of the early years. The training

<sup>3</sup> The research developed at this school was funded by Fundect - Foundation for Support to Education, Science and Technology (Fundação de Apoio ao Ensino, Ciência e Tecnologia) of the State of Mato Grosso do Sul.

process was developed in 2017 and 2018, in the school space, and had the participation of five teachers and the most direct action of three researchers in the meetings (including one of the authors). The research and training activities involved other researchers (including the second author), management and pedagogical coordinators, at different times.

The data produced in this research consisted of the researchers' notes, field diaries, and audio recordings of the training meetings between researchers and teachers, during these two years at school. The training actions consisted of meetings every two weeks at school, for planning and evaluating classes; observation and monitoring of classes; monthly collective meetings and workshops to explore the use of some technology, according to the interest of the teachers. In these meetings, activities that could favor the integration of digital technologies into the curriculum were discussed, and, after every meeting, before planning new actions, the classes developed were evaluated. Our dialogue here starts from the record of the teachers' speeches in different meetings.

A challenge pointed out by the teachers in this process, and also observed by us, researchers, was the organization of time for the selection of materials and digital technologies to be used in class, such as games, applications, simulators, videos, and digital technologies. This is because, if we looked for digital materials, consistent with each class, that would provide classes in which students could explore/produce/conjecture when building concepts foreseen in the curricular guidelines of the municipal education network, from the digital language, in different areas of knowledge (Portuguese, Mathematics, Science, History, and Geography).

Another challenge was to guarantee a basic technological structure in each classroom, at school, to put into practice ideas and classes discussed during the meetings. After all, even though our conversations were based on what was feasible at school, with existing technologies, sometimes teachers had difficulty to present the planned classes due to the lack of internet connection, or the fact that an application or game we were going to use in class was not working on time. In addition, the fact that the school only has one digital whiteboard and two projectors to be used by approximately ten to fifteen classes per period, made it difficult to use in classes, at times planned by the teacher.

Some of these difficulties in relation to the infrastructure were solved, during the period that we were in school: some teachers bought their own projector; they negotiated a monthly payment for a wireless network with every group of teachers, in order to have access to the internet in their classrooms; used their cell phones in class and notebooks, sharing with students in some activities. This, in order to have more autonomy, has avoided the dependence on defined times to use the technologies.

The fact that teachers invest in the purchase of technologies to carry out their work is not the best alternative, but another one was not found with the principals, for investment in the purchase of equipment, in more digital environments at school. Gradually, the teachers wished to have the technologies available to use when necessary, because the curriculum in action does not reproduce a lesson plan, it constitutes itself in action; they wanted a new classroom project, a room with a blackboard and desks was no longer enough, there were technologies that could change classroom spaces, ways of learning, teaching, allowing modifications of the school curriculum.

We know that it is not enough to have digital technology in school for it to be integrated into the curriculum, but without it, it is not possible to integrate it! That is, their presence is not enough, but necessary. Hence, the need for public policies for investment in minimum technology infrastructure in the school, namely: access to high-speed internet in all rooms and spaces of the school, projectors and/or digital whiteboards attached to a laptop, in all rooms, with maintenance and replacement project considering the use and lifetime of the technologies. A little more than the minimum would be to have laptops available for each class, quality commercial models (because there is no use working with models of disposable computers in a short time).

To talk a little more about this integration process, possibilities and challenges, we bring a speech by one of the teachers, conductor of a class of the 1<sup>st</sup> year of Elementary School:

*“The internet worked. It would have two bars (referring to the connection level marking), sometimes it would stop, but better than nothing. Available internet is another life. I was explaining the contributions of the Indians. I was talking about manioc, I talked about the manioc tree. A student asked: -Teacher, how is the manioc tree? [...] They had never seen... [...]. I went there to research (referring to the use of the browser, his laptop and projector installed in the room), and I started showing images [...]. This is good, because we use the internet when doubt arises. How am I going to draw a manioc tree, paint it? If you do not have this feature, it is not real. So I went on researching, they (the students) were asking other things, the class flows...”*

(Year 1 teacher)

This speech shows how the teacher modified her class based on a question from a student, using the internet, because it was accessible in the classroom. This action shows how the teacher, attentive to the students' learning process,

explores a concept based on a dynamics present in digital culture, navigation and search for information, in this case, images on the internet. The technology was present in this class, but invisible in the sense pointed out by Salvat (2000), since the objective of the teacher and students was to identify the characteristics of manioc, not to use an internet browser, to project images.

In addition to observing movements like these in the classroom, we also observe changes in relation to the use of technology room during this integration process. When we started the training action, the teachers who used it were using more to take the students to play, in an action disconnected from the classroom. So, for children, the time in this room was to play, or to perform some activity, without much importance, to be able to play. The challenge for the teachers was to change “this habit”, and to build with the children the idea of classes also in that space, which could be fun. This change in “habit” was revealed in a speech by the regent teacher of a 3<sup>rd</sup> year class, at the end of the first year of the integration process.

*“After a certain time, the children started to understand that they could go to the computer room and do different activities, and that it was not boring, it was a way of learning too, and they started to accept more”.*  
(Year 3 teacher)

Another interesting experience of this teacher involved the use of her cell phone in the classroom, as a natural action, to search for quick information, among other functions based on students’ doubts. She commented that this movement started on a day when one of her students asked a question and she commented that she would check and bring the answer the next day. The student asked: - why doesn’t the teacher “search it on the cell phone” now? At that moment, she realized how natural that technology was for students, and it also had the function of “presenting answers”.

In addition, this is a little about the beginning of an integration process, among so many other movements carried out by the teachers, in different classes. They gradually began to integrate digital technologies into their pedagogical practices, using software, applications, projectors, whiteboards, computers, browsers, videos, cell phones.

As for the integration process initiated in partnership with the group of high school teachers, it was also constituted from an invitation to all high school teachers at the school, to discuss and propose actions for integrating digital technologies into the curriculum prescribed for their subjects. The proposal

constitutes an action of non-formalized continuing education, consisting of planning meetings, partnership in the development of classes with technologies, during 2019. The data were produced from the recording of the planning and evaluation meetings, use of questionnaires to identify profiles, field diaries during observations and partnerships in classes, and records of students and teachers produced in different virtual spaces.

The meetings at this school were held between teachers and the school's pedagogical advisor, one of the researchers, during the teachers' planning hours, with the guidance of a University researcher (one of the authors of this article). In the first semester, questionnaires were applied to identify the profile of the students, three classes, one from each year of high school, from a rural school, with a total of 40 students, aged between 14 and 45 years. A questionnaire was also conducted to find out about the teachers' profile, to talk about the proposal to discuss the use of technologies based on movements of integration into the curriculum and to constitute the group of teachers who would be involved with the actions. Three teachers accepted the challenge, the Portuguese language teacher, the Physics teacher and the Mathematics teacher, who together with the school's pedagogical advisor formed a group to study possibilities of integrating digital technologies into the high school curriculum.

In an initial dialogue with the teachers, the three ones stated that they rarely worked in their classes using digital technology. The math teacher had never used it, had difficulty using technology; the physics teacher had sometimes used slides; and the Portuguese language teacher initially stated that using technology was a lot of work and rarely proposed its use in the classroom, in addition to knowing few resources. But all considered important the use of technologies in class, due to the profile of the students, who, even living in rural areas, used cell phones daily, social networks (of the 34 students who answered the questionnaire, 31 had cell phones, 30 with internet access).

The process started with planning and development of classes in the second semester of 2019. The Portuguese language teacher, due to the content provided in the prescribed curriculum of the three high school classes, for the second semester, started planning actions to explore different textual genres (different classes, different genres), texts that contemplated the students' daily lives (suggestion by one of the students). Below is a statement by the teacher, one month after starting the process, in one of the planning meetings.

*"I became interested in Google Docs (a Gmail account was created for the three classes to access the platform), as it is a tool in which students can build their text types together; with authorship, increasing elements*

*they find useful arising from internet searches. [...] Furthermore, they can access from anywhere and at any time via their cell phones. Another thing that is interesting is that I can simultaneously monitor how the production process is going, and I can access it from anywhere. It will help a lot when evaluating, because I will be more aware of the process and not only of the final product”.*

(Portuguese language teacher)

We can observe the curriculum being experienced as a process, changing ways of producing knowledge, class movements (accessible everywhere), evaluating learning (the teacher also said at other times that she had all the students’ productions in the palm of her hand, anytime, without so many roles; a movement to build a new curriculum, in each new situation, in co-authorship with the students. About the difficulties in the process, the teacher commented:

*“[...] there are days that are not easy, because students come with doubts that I don’t even know how to answer, because the tool is also new for me. But then, we thought together and ended up solving the problem. At first they had a hard time understanding how Google Docs work, but they learned fast. They are excited, it seems that it is natural for them... It doesn’t seem, right?! It is natural”!*

(Portuguese language teacher)

About this initial process, we bring students’ speeches in Portuguese language classes observed: “Wow, I didn’t know that this word was spelled this way. I just realized that through automatic correction.”; “If it was in the classroom, you would write like that and you would lose grade! [laughs]”. In other words, a curriculum in which digital technology was not visible, according to Salvat (2000), as the objective was to know and learn to write texts in different textual genres, to share productions with people, in addition to the class, the school.

In this movement, students and teacher chose to create a space on Facebook, after all, the movement of posting, sharing, enjoying is very common to students, it is part of their culture, which is also digital. They commented: “If it wasn’t for Facebook, our texts would be just between us... [...] others participating together, enjoying and commenting on our productions”, “My aunt commented on my text. This is good for them to see that I’m really studying and not playing like some people say in the family. [laughs among them]”. The productions were published and the students received many returns, including



students from another school where the teacher also worked; a curriculum built on the multiplicity of voices of the actors that constitute it.

The Physics teacher, at the same time, for having the study on thermology in the curriculum of the subject, chose to start a discussion on the construction of home thermometers with the students. At the beginning of the activities, the students suggested the creation of a WhatsApp group, so that they could talk about the construction of the thermometers, and so this was one of the students' learning spaces. They also used the technology room, for example, to search for a thermometer model to be built and that could be used in their homes, in the work they did with their families, in their plantations, cheese production, brown sugar, *rapadura*, molasses. Yes, they aimed to use thermometers and physics knowledge to reorganize some of their daily work actions.

What is observed is that the integration movements were still within the subjects, in the "little boxes", but open, shared boxes, based on social networks, articulated with the lives of these students. But what we observed was a new curriculum being designed in dialogue with the students, due to the favorable predisposition of teachers at that school.

Finally, we will discuss some movements of the proposed integration of digital technologies into the curriculum of a Mathematics subject, in an undergraduate course, at a Public University. In this case, the research and integration process did not start with an invitation to all professors in the course, for example, or from a specific academic semester, it was a movement planned to be carried out with a subject, in which the invitation and challenge was pointed out to the group of students, because the professors of the subject were two researchers (one is the author of this article) interested in investigating the process. The students accepted the challenge, and throughout the second semester of 2017, the subject was developed.

This process of integrating digital technologies into the curriculum shows how the integration process can be linked to a movement that belongs to the school, as well as to the practice of one or more teachers, when we discuss it for higher education courses, especially in which teacher autonomy in proposing methodologies, exploring the contents of the syllabus, is greater, since from a syllabus, in different ways, actions are proposed, based on the pedagogical project of a course. Certainly, the movement would be intense, if it were to integrate digital technologies into the curriculum of the course, or the courses of a Higher Education institution, if many or all teachers adhered to the process, but, just as in schools, this is a challenge!

The technology integration proposal was developed in a Mathematics I subject, in a bimodal education proposal (partly face-to-face and partly distance education), with actions being developed using cell phones (all students had cell

phones). The interaction between the subjects in the virtual space took place in a WhatsApp group and access to didactic materials (produced by the teachers or selected from websites based on the purpose of the classes) on the GeoGebra platform (GeoGebra Platform is a platform on which it is possible to provide various textbooks created using GeoGebra software, dynamic geometry software).

The actions developed with the students constituted a constructionist learning environment for this Mathematics I subject, with the use of cell phones, guided by studies on constructionism carried out by Papert (2008), in which the students are active subjects in the whole process of learning. In face-to-face classes, all with their cell phones, based on a screen mirroring dynamics, the discussions and studies were carried out from the sharing of the students' cell phone screens, in a room projector, in which everyone could produce collectively, reflecting and exchanging productions, until they came up with a proposal that everyone would agree on. In face-to-face classes, students also remained connected to the actions carried out, remotely, in the WhatsApp group and the Geogebra platform.

The results pointed out in Lopes' research (2020), regarding this process, indicate the innovation in the curriculum experienced in this discipline from: the use of cell phones allowing students to access them, in different places (including face-to-face classes) and at different times, teaching materials of the subject, such as applications, digital books, videos, virtual space resources, simulators; the interaction with these materials, with colleagues and teacher, producing knowledge, by dialoguing, conjecturing, validating hypotheses, producing records with and from digital technologies; video production in distance classes, to present processes or results of mathematical investigations.

In this sense, the recording of the cell phone screen and its sharing with the group constituted a new way of taking mathematics classes, from the WhatsApp group, showing gains in terms of mobility and possibilities of sharing images, texts, files in different formats, videos, gifs, links; and the interaction with the materials made available on the GeoGebra platform, especially the simulators and learning objects, favored the learning of Calculus concepts in other movements, different from the conventional ones.

However, these technologies alone did not favor learning, hence the sense of integrating them into the curriculum of the subject, with clear learning objectives, as the visible should not be the technology, and it was not, but the learning of mathematical concepts, remembering what Salvat (2000) mentioned. In this sense, the teachers' knowledge and the importance of their education became evident, because, according to Lopes (2020), the questioning attitude and the launching of challenges that mobilized students was determinant of several students' learning actions. In addition to this attitude, the proposal of

activities in a constructionist approach, with questions that enabled moments of mathematical investigation with the use of cell phones was also a determinant of other classroom movements; curriculum integrated with digital culture.

What can be concluded with this integration process is that the “classroom space has become a space for dialogue, a space in which students could present their hypotheses, conjectures, explaining formulations and validating hypotheses, when dialoguing with certainties the other” (LOPES, 2020, p. 174); a space for questions, experiments, answers, learning in which technologies are coupled to the curriculum, being truly integrated.

Anyway, it is just one subject, in an undergraduate course, at a Public University, and, with a unique condition, since there were 13 students enrolled. And then we ask ourselves, how to propose this dynamics with groups of 30, 60, and up to 90 students, as we observed in some universities? Or will it be necessary to review the number of students per class, schedules, course curricular matrices, in addition to teacher training, when thinking about integrating digital technologies into the curriculum? There are many reflections to be made when we discuss education, curriculum, digital culture, integration processes.

## **A dialogue about the future...**

In this article, we presented some results of a research, in which the objective was to investigate processes of integration of digital technologies into the school curriculum, identifying challenges and difficulties that emerge from pedagogical practices in integration processes. Thus, we talked about three processes, to point out some possibilities of integrating digital technologies into the school curriculum, with a view to innovating pedagogical practices and the curriculum, and identifying some challenges and difficulties.

In the public schools of Basic Education where the research was developed, we can point out two more central difficulties: the school infrastructure still lacking equipment and high-speed internet access throughout the space; the time available for teachers, due to their routines, sometimes stifled by bureaucratic records, for the preparation of classes, studies and participation in systematic training processes for the use of digital technologies; the time available for trainers and researchers to dedicate themselves to the training processes in the school space.

From these difficulties, some challenges arise: the proposal of investment policies in more digital infrastructures for schools; investment in policies

for initial training, and continuing training for teachers and principals, on a continuous, uninterrupted basis, which make it possible to build with teachers proposals for an innovative curriculum, every day, for their classroom, school. And integrated with digital culture, local and global culture, rethinking the working time of teachers, managers and trainers.

As for training processes in the Basic Education school, what we have observed in our research is that models focused on training-action-reflection actions have been a good choice. The fact that the trainer is in the school space, following the teachers' practices and getting to know their students, the school, in addition to providing more security to the teacher at the beginning of the integration process, provides training, reflection on practice, in practice and after practice in meetings and study groups. The challenge is to think of this training from face-to-face meetings at school and virtual meetings, as part of the teacher's working time at school, in partnership with local trainers (as was the case with the pedagogical advisor at the high school); it also is to think that training needs to involve practical actions in the classroom, as the teachers have experiences with the integration of technologies, they may reflect on possible curricular innovations.

Another challenge is also to think about the initial training of teachers, as undergraduate courses have invested little in differentiated curricula, with the integration of digital technology. These courses, for the most part, are still focused on a teacher-centered curriculum, in classes with analog materials, for schools where cell phone use is prohibited and whose condition is supported by many trainers of these teachers in training. Hence, the challenge of continuing training for trainers and higher education teachers, who, in many cases, are professionals from different areas who work as teachers, and whose training for teaching is precarious.

Anyway, there are many challenges to think about school curricula integrated with digital culture, in processes of integrating digital technologies into curricula. However, the important thing is to continue to carry out actions, seeking partnerships with teachers, administrators, schools, and investigating and sharing results of innovative practices.

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