Training actions impact on the use of technologies in teaching practices

Lucicleide Araújo de Sousa Alves[1]
Catholic University of Brasília, DF, Brazil

Benedito Rodrigues dos Santos
Catholic University of Brasília, DF, Brazil

Lêda Gonçalves de Freitas Gonçalves de Freitas
Catholic University of Brasília, DF, Brazil

Abstract: The study is a systematic review on the impact of training actions on the use of technologies in teaching practices, its main effects, and challenges. The sample is the result of the survey of complete scientific articles indexed in the Scientific Electronic Library Online – (SciELO), published between 2003 and 2016. Seeking to understand communication and its meanings critically, we held a thematic content analysis, according to Bardin (2002). The review pointed to the lack of sufficient results regarding the desired impacts about the use of technologies in teaching practices with pedagogical focus and authorship by teachers and students. Thus, more studies that can meet the needs still in force are necessary, focusing on methods of utilization of technological resources in the network that enhance students' learning and development.

Keywords: teacher training; effects and challenges; digital information and communication technologies; education; psychology.

IMPACTO DAS AÇÕES FORMATIVAS NO USO DE TECNOLOGIAS NAS PRÁTICAS DOCENTES

Resumo: O estudo consiste em uma revisão sistemática sobre o impacto das ações de formação no uso de tecnologias nas práticas docentes, os principais efeitos e os desafios. A amostra é resultante do levantamento de artigos científicos completos indexados na base Scientific Electronic Library Online (SciELO), publicados entre 2003 e 2016. Com o objetivo de compreender a crítica das comunicações e de suas significações, foi realizada uma análise de conteúdo temática pautada nos estudos de Bardin (2002). A revisão apontou carência de efetivos resultados quanto aos impactos desejados em relação ao uso de tecnologias nas práticas docentes com foco pedagógico e com autoria por parte dos professores e estudantes. Assim, são necessários demais estudos que possam suprir as necessidades ainda vigentes, focando em práticas de utilização dos recursos tecnológicos em rede que potencializam a aprendizagem e o desenvolvimento dos estudantes.

Palavras-chave: formação de professores; efeitos e desafios; tecnologias digitais de informação e comunicação; educação; psicologia.

[1] **Mailing address:** Lucicleide Araújo de Sousa Alves: CNB 14 lote 2, ap. 605 – Edifício Porto da Barra – Taguatinga Norte. CEP: 72115145. *E-mail:* lucicleide.ead@gmail.com

IMPACTO DE LAS ACCIONES FORMATIVAS EN EL USO DE TECNOLOGÍAS EN LAS PRÁCTICAS DOCENTES

Resumen: El estudio de una revisión sistemática sobre el impacto de las acciones de formación no el uso de tecnologías en las prácticas docentes. Una muestra de los resultados científicos completos indexados en la base SciELO, publicado entre los años de 2003 y 2016. No hay sentido de buscar la comprensión crítica de las comunicaciones y de sus significaciones, se ha hecho un análisis de contenido temático, segundo Bardin (2002). A revisión de resultados de los resultados de los impactos deseados en relación con el uso de tecnologías en las prácticas docentes con el enfoque pedagógico y la autoría por parte de los profesores y los estudiantes. Así, los estudios que se realizan en el ámbito de las necesidades aún no vigentes, se centran en las prácticas de la utilización de los recursos tecnológicos en la definición de la posibilidad de aprendizaje y el desarrollo de los estudiantes.

Palabras clave: formación de profesores; efectos e desafíos; tecnologías digitales de información y comunicación; educación; psicología.

Introduction

Today's society is driven by the accelerated development of the possibilities offered by digital information and communication technologies (DICTs) and their presence in a wide range of sociability spaces since the 20th century. The explosion of the Internet (World Wide Web) in 1995 provoked and has provoked vertiginous changes in the culture, society, and economy. All spheres of social life have been affected by the network technologies and their transformations, which have revolutionized the relationship and communication among people, as well as production and consumption (Castells, 2001).

Precisely, as far as education is concerned, technologies have also exerted considerable influence. Therefore, governments and secretariats from various countries have mobilized to think of continuing education strategies as a crucial issue and one of the primary cultural mediators to initiate the digital inclusion process of teachers, to the appropriation of digital resources and their use in the classroom, as potential drivers of a new teaching and learning process, and not merely as reproducers of existing practices.

The training proposals presented at the federal, municipal and state levels focus on the need to use technologies in educational contexts, beyond the use of techniques per se. They are aimed, above all, at teaching and learning processes intertwined by the digital technological cultural instruments present in the contemporary society, in a perspective more driven towards the high-quality pedagogical aspect (Karsenti, Villeneuve & Raby, 2008; Ricoh & Couto, 2011; Sampaio & Coutinho, 2013, Miranda, 2014, Costa, 2008).

In this sense, due to the relevance of the discussion on this subject, which is so present in everyday life and in the dynamics of the educational relationship involving educators and students, the present study, entitled "Impact of training actions on the use of technologies in teaching practices" focuses on the effects of technology use in

teaching practices and the main challenges faced by teachers working in public schools who participated in the training courses implemented at the time in some countries, specifically emphasizing the Brazilian scenario of the public education network. The aim was to analyze scientific articles through a systematic review of research on the effects of training actions and their main challenges for the use of digital information and communication technologies in teaching practices.

Technology, in its original and etymological meaning, is formed by two words derived from the Greek: *tekhnè* and *logia*. The first means technique, art, craft. It comprises practical activities "from the making of laws and the ability to count and measure, through the art of the artisan, the physician or the making of bread, until the plastic or fine arts" (Lemos, 2004: 26). Defined by this author as *poiésis*, production, art, a medium and a productive activity (*poiética*), it translates into a mode of unveiling and the existence of subjectivity through its ability to relate in and with the world. In that sense, it is aimed at describing human know-how. The second word, *logia*, means study.

In addition to the ideas of Lemos (2004), Kenski (2012) and Lévy (2011) define technology as a set of techniques, processes, methods, means, and instruments humans use, involving a lot of research, planning, and creation. It consists in the merger between technique (practice) and science (theory) and its application in the various areas and a wide range of social sectors. In this sense, technology is a comprehensive term, which encompasses the entire human creation, in all ages, its uses, and applications.

It is relevant to say that technology is not something new, but as old as man himself, the product of society and culture. Technologies have always been and will be part of the development of humanity. Since prehistorian times until the present day, many have been its contributions to the advancement of science and development, including the contemporary culture, which, according to Castells (2001), moves from the Gutemberg Galaxy to the Internet Galaxy.

This evolutionary process of humanity, permeated by experiences in different stages and cycles of life, by our antecedents, was fundamental for us facing such sophisticated technologies today. And it only reinforces Kenski's assertion (2012, 21), when he says that "man transits culturally mediated by the technologies that are contemporary to him. They transform his way of thinking, feeling, acting."
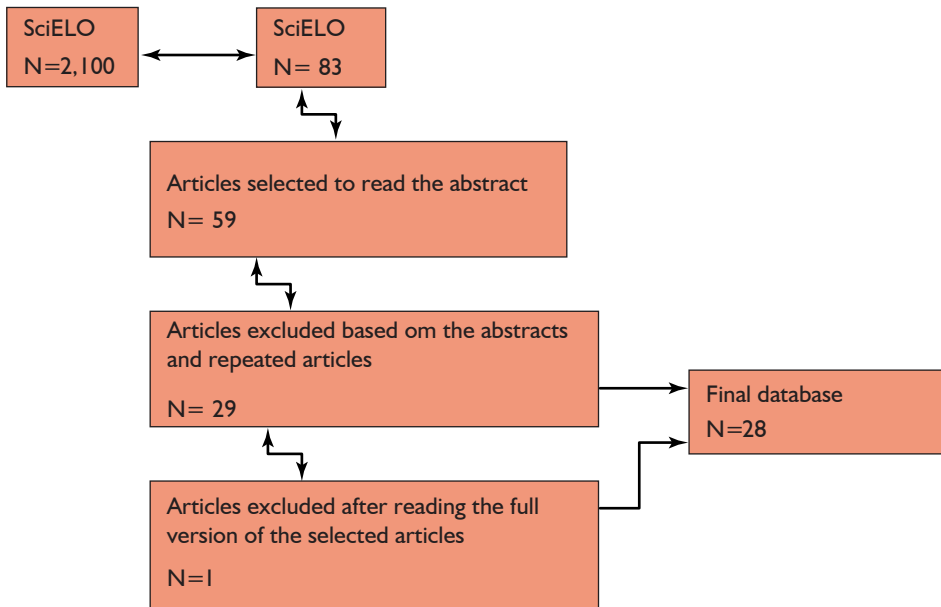
As inter- and intramental cultural mediators, technologies present themselves as other possibilities for subjects in education to have access to information. Turning them into meaningful knowledge and permitting their constant development, entering the spaces conceived in cyberspace (Levy, 2011) for interactive communication with others, in their broad range of levels of reality, beyond the physical presence, is one of the significant challenges today (Cooll, Mauri & Onrubia, 2010). Today's digital culture, characterized by dynamism, fluidity, and interactivity, has demanded from all of us, subjects, a more effective interactive participation in the resolution of any

problem – whether at home, at work or in social life, in school. And the apprehension of knowledge and skills – albeit minimally – of technological devices for their safer, critical and reflexive use, both in personal and social life. Considering that technologies are already part of daily school life, public policies that are aimed at the dissemination of contemporary culture, through training courses in the educational field, focusing on the use of technologies in the teaching and learning processes, need to be focused on and studied, aiming to monitor their effects and the repercussions started in the spaces of continuous training and their effective applicability in teaching and learning processes. As the public resources invested in training are very high (billions of investments), it is essential to know the results these initiatives achieved. The article consists of the following parts: Introduction; Method; Results and discussion; References.

Method

This article resulted from the survey of complete articles indexed in the Scientific Electronic Library Online – SciELO database. In all extractions, we applied the filter containing all indexes. We first used the descriptor "teacher training," totaling 2,100 articles. Subsequently, we performed the search by combining the descriptors "teacher training" and "technologies," resulting in 83 items, of which all abstracts we read after completing all consultations. Then, we selected 59 articles. For the final consultations, we used only the descriptors, one at a time, "use of technologies in the classroom," "teacher training for the use of technology in the classroom," "authorship in teacher training." totaling 20, 2 and 8 articles, respectively. Twenty-nine of the total number of articles selected were excluded after reading the abstracts and as some of them were repeated. Only one was excluded after reading the full article, consolidating the final database with 28 articles. The search strategy is displayed below, in Figure 1.

Figure 1. Search strategies in the SciELO database.


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┌──────────────┐      ┌──────────────┐
│ SciELO       │◄────►│ SciELO       │
│ N=2,100      │      │ N= 83        │
└──────────────┘      └──────────────┘

        ┌─────────────────────────────────────┐
        │ Articles selected to read the abstract│
        │ N= 59                                 │
        └─────────────────────────────────────┘

        ┌─────────────────────────────────────┐       ┌──────────────────┐
        │ Articles excluded based om the abstracts│     │ Final database   │
        │ and repeated articles                 │─────►│ N=28             │
        │ N= 29                                 │       └──────────────────┘
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        ┌─────────────────────────────────────┐
        │ Articles excluded after reading the full│
        │ version of the selected articles      │
        │ N=1                                   │
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Source: The authors.

The following inclusion criteria were defined for the analysis of the abstracts: (a) be an empirical study, (b) have the full text available for reading, (c) fit within the publication period from 2003 to 2016 to cover the studies of the last decade considered as representative of the most recent works, and (d) picture training actions for the use of technologies in teaching practices, their effects, and challenges, focusing on the reality of Brazilian schools. Nevertheless, foreign journals that addressed the theme were not disregarded for the sake of possible comparisons between Brazil and other countries, within a macrosystemic perspective on the use of technologies in teaching practices.

After compiling the articles according to the criteria described above, we read a total of 28 papers and a thematic content analysis was carried out (Bardin, 2002) to seek a critical understanding of communications and their meanings.

The authors of this study served as independent judges in the activities of data extraction, selection, and analysis. An electronic file was created to organize the final sample, which included information about authors, title, keywords, study objective, methodology, the sample used, main results, and conclusions.

Bibliometric indicators

For the total sample, we selected 28 scientific articles published between the years 2003 and 2016. As observed, this is a recent area of research, regarding teacher training focused on the use of technologies in basic education educational contexts, with significant advances in teaching, requiring more research, reflection, and dialogues on this subject regarding its effects on pedagogical practices, but with a focus on learning.

We categorized the surveys according to the institutions in which they were developed to identify the Brazilian states that have privileged such studies, as well as other countries. Most of the articles (72%) are inform Brazilian universities, such as from the states of Rio de Janeiro, Paraná, São Paulo, Bahia, Santa Catarina, Brasília, Mato Grosso, and Mato Grosso do Sul. The remaining 28% are from foreign universities, such as Canada, Portugal, Spain, Australia, and United Kingdom. All higher education institutions (HEI) in Brazil affiliated with the articles surveyed are from the Southeast, South, Central-West, and Northeast. As for the North, we have found no representativeness thus far.

In the article analysis, we emphasized the following aspects: bibliometric indicators, methodological aspects, and main results.

Methodological aspects

Regarding the methodological aspects of the research, we highlight the lack (non-information) of research nature and method clarity in the summary or the corpus of ten of the articles considered; there are cases in which the instrument for the production of the data is presented as the method adopted for the research. Of the 28 articles selected, 27 of the searches socialized through the articles are qualitative nature. We did not find any research that focused solely on the quantitative approach. Only one research was quantitative-qualitative. The most used method in these surveys is the case study (7) followed by methods for exploratory research (3), ethnographic (3), research-teaching (1), and systematic review (6). In eight articles, this information is not precise.

Results and discussion

The central results of the studies were grouped in two thematic axes: Training actions for technology use in teaching practices and their effects and main challenges.

Training actions for technology use in teaching practices

Different policies, government programs and projects – according to Karsenti, Villeneuve and Raby (2008); Ricoy and Couto (2011); Sampaio and Coutinho (2013);

Miranda (2014); Costa (2008); Baptista (2014); Lucena (2016) – were created and have been implemented for some time, at the federal, municipal, and state levels, aiming at introducing digital information and communication technologies in pedagogical practices. The main focus of these actions is the appropriation by the teaching staff of the technologies and their use, mainly in a pedagogical way, with the objective of achieving changes in methodologies and attitudes in the classroom and making possible significant transformations in teaching and students' learning in the digital age.

Among the policies implemented in several countries, we can mention those of the Ministry of Education of Canada in 2001, which launched "La formation à l'enseignement: lês orientations; vocational qualifications "(Training for teaching: guidelines, vocational skills). This document is an official reference on teacher education (Karsenti, Villeneuve & Raby, 2008).

In Portugal, as of 2007, the process of technological modernization of schools has been a priority. And the initiatives taken to improve the situation of schools came about through the implementation of the Technological Plan for Education (PTE), substantially reinforcing the technological infrastructures of schools and the training of teachers in the fundamental competencies for the use of DICTs in educational contexts (Ricoy & Couto, 2011; Sampaio & Coutinho, 2013).

In Brazil, also in compliance with the social demands arising from trends that the globalized world demands about the pedagogical use of information and communication technologies, the federal government, together with states and municipalities and in partnership with the Ministry of Education, launched the Integrated Proinfo Program. One of its goals is teacher promotion and training with the aim of fostering changes in educational contexts through the insertion and use of DICTs in teaching practices (Miranda, 2014; Zandavalli & Pedrosa, 2014; Martins & Flores, 2015).

In spite of investments in training actions for the use of technologies in pedagogical practices though, in the countries mentioned earlier, the knowledge acquired by the teachers participating in these training processes did not permit the apprehension, internalization, and generalization of knowledge and significant transformations in teaching practice. Nor is it a question of learning and, therefore, the non-use of technological resources is justified by a series of conditioning factors and difficulties.

In Brazil, among the primary evidence found for the non-use of technology in the classroom, we can mention the following: lack of time, difficulty to control students on the internet (classroom management), insufficient training of which they have and the general lack of continuity regarding the use of the technologies in the classroom after the end of training courses, as well as some schools and teachers' resistance (Baptista, 2014, Ricoy & Couto (2011), Javaroni & Zampieri, 2015).

The lack of infrastructure in schools, according to Zandavalli and Pedrosa (2014), is also one of the leading villains in preventing teachers from using technologies in the classroom. In school contexts where there are available infrastructure and technologies

that teachers can learn how to use and effectively use them – as is the case, for example, in Portuguese schools demonstrated by the research carried out by Ricoy & Couto (2011), Sampaio & Coutinho (2013), and in Canadian schools, according to Karsenti, Villeneuve & Raby (2008) –, it is a fact that educators do make use of digital educational resources. The research results show that technologies are still not being used as mediating resources, nor as support for daily education, even though the educational contexts of these countries are favorable to possible changes. The teachers who use these resources in the classroom assure that they have not provided transformations in pedagogical practices since the logic established by the DICTs implies networking; this differs from what is done in and by schools. Resistance to the use of DICTs in educational contexts, according to the researchers, slows the real need for technologies to be part of the educational reality of digital native students, in a conception of education with and for technologies.

Thus, even the countries with the best infrastructure, such as Portugal and Canada, in comparison to Brazil – where infrastructure is one of the critical impediments to the use of technologies – do not present relevant and differential results concerning technologies and their use in pedagogical practice. The research data (Karsenti, Villeneuve, & Raby, 2008; Ricoy & Couto, 2011) show that teachers use technology to plan, communicate, to research information, prepare teaching materials, solve problems, and for their professional improvement.

In this sense, the effect is greater on teaching processes and lesser on learning processes; which, in a certain way, does not consider the objectives of those actions regarding the use of pedagogical technologies and as the primary goal for the potential use of technologies in educational contexts, which also requires a focus on learning, not just teaching. That is, nothing has changed in teachers practice and attitudes.

The studies carried out by Karsenti, Villeneuve, & Raby (2008), Miranda (2014), Javaroni & Zampieri (2015), regarding the use of technologies in the classroom with a pedagogical focus, also reveal that the small proportion of teachers who use them is limited and little innovative.

In this sense, Ricoy & Couto (2011), Sampaio & Coutinho (2013), and Zandavalli & Pedrosa (2014) point out the need for changes in educational policies to improve teachers working conditions and expand in-service training. Consequently, teachers will use the DICTs in a reflexive, critical, and creative way, that is, they will act as cultural mediators between what is necessary to teach and what is significant for the students to learn – and to learn using the technologies.

DICTs, when they are well-used and based on clear and consistent theoretical assumptions, are relevant in the educational field and can provide teachers with new potential tools for their mental organization when it comes to thought and language, as well as advances in consciousness. Thus, they may lead to possible revitalization in educators' pedagogical practice, awakening them to a more critical and reflexive awareness about the importance of their access and use in teaching and learning

processes, with a view to the possible constitution of new areas of meaning, as proposed by González Rey (2010), and the construction of significant knowledge both for the learning subject (the student) and the teaching subject (the teacher).

About teachers' need for continuous training, both at the initial level and in the continuous form, it is one of the main mediating instruments and serves to approach school and culture, as well as to include teachers and apprehend technological resources and technological fluency. It is a recommendation attributed almost unanimously among the researchers in this area (Baptista, 2014; Miranda, 2014; Karsentil, VilleneuveII & Raby, 2008; Costa, 2008; Ricoy & Couto, 2011; Sampaio & Coutinho, 2013; Miranda, 2014; Azevedo, Puggian & Friedmann, 2013; Menezes, 2014; Javaroni & Zampieri, 2015). This need is because most teachers are called "digital immigrants," that is because they were not trained to act in this digital culture, a context which students can no longer imagine themselves outside. Each day, in the classroom, teachers or "digital immigrants" deal with students who no longer have a restriction to access to cultural assets only selected by teachers, as Lucena (2016) asserts.

Currently, there are innumerable possibilities to access knowledge through websites, social networks, databases, as well as the possibility of interaction with people from other countries, to exchange ideas and interests in common themes.

Thus, as teachers are one of the main actors in the school environment, in the mediation of knowledge and in stimulating the student's intellectual and social development, Baptista (2014) underlines that their engagement in training can provide them with greater security for the use of web technological devices, as well as the occurrence of significant changes in their practices.

In this context, a set of studies focuses on the effects of the use of information and communication technologies during teachers' engagement in courses, projects, and training programs. Concerning this subject, there is a division of opinions: some researchers – such as Baptista (2014), Freitas (2010), Menezes (2014), Costa (2008), Ricoy & Couto (2011), Pretto (2008), and Belloni (2003) – assert that training for the use of technologies in pedagogical practice has had a positive effect on teachers' use of resources in the classroom with the students, after having been students and participated effectively in the course development process and even in its evolution. Others argue that training efforts have produced little change in teachers' daily practice (Karsenti, Villeneuve, & Raby, 2008; TIC, 2010).

These researchers, all emphatic about the importance of teacher education, further reinforce the fact that future teachers that receive training in the pedagogical use of digital information and communication technologies will increasingly have the opportunity to use them to plan learning activities, seeking information, preparing teaching materials, solving problems or improving their professional skills. They ensure that by having access to the equipment necessary to familiarize themselves with the essential technological tools, they will master and use them regularly and critically,

prompting them to encourage their students to use them in the development of learning activities.

Training for the use of digital information and communication technologies (DICTs) in teaching practices – from a pedagogical perspective – requires that teachers move beyond the simplistic idea of the technological resources as equipment, focusing on the technique itself. They should target a safer and more conscious appropriation of their practical uses to stimulate students to awaken their potential in the dynamics of teaching and learning, which involves producing and publishing, instead of being just passive consumers of information. By doing so, teachers assume a posture that requires interactive subjects who consider the authors' condition of the active course of knowledge itself. This is the teacher's role: to serve as a mediator, with authorship, based on the elaboration and creation of favorable environments for the occurrence of intersubjective dialogues, through scenarios that awaken in their students the desire to learn how to learn, based on the knowledge about the ways of knowing about one's own knowledge, in order to gain education, for and by the technologies, through critical and reflective thinking. Technologies, in this sense, are understood as symbolic cultural instruments that enable students to become co-authors in the dynamic process of relationships involving teaching and learning. And the "mediation" (Vygotsky, 2007) by the teacher as one of the interaction processes favorable and able to provide students with significant advances in their learning processes, beyond what they already do alone, using the potential possibilities of technological apparatuses for the elaboration of processes of subjectivation pending towards creation. Both the teacher (teachers) and by the learners (the students) must assume this posture.

Effects of technology use on teaching practices and main challenges

As for the use of technologies in the field of education, there is a significant set of research concerned with their effects on pedagogical practices (Azevedo, Puggian, & Friedmann, 2013; Sampaio & Coutinho, 2013; Costa, 2008; Pretto & Riccio, 2010; Karsenti, Villeneuve, & Raby, 2008, Menezes, 2014, Costa, 2008; Alonso, 2008). These studies demonstrate that the use of technologies in the classroom contributes to overcoming a teacher-centered one-way communication modus, to establishing a more interactive relationship in the development of projects that involve the use of technological resources (for example, WebQuest, Interactive Whiteboard, Cabri, Geogebra). Thus, the increase in student participation has meant more than a simple pedagogical technique, being the result of a change of conception and attitude by the teacher concerning the student-teacher relationship in the classroom, circumscribed at the bottom in a broader spectrum of professional culture change. We could hardly devise this possibility of cultural change could scarcely without the presence of the DICTs.

Many challenges contribute to the non-use of ICTs in teaching and learning processes though, despite teachers' acknowledgement of the benefits they can bring to educational dynamics. Among them, Ricoy & Couto (2011) and Sampaio & Coutinho (2013) cite the following challenges and main inhibiting factors in the use of DICTs in the teaching and learning processes: lack of infrastructure, related to the lack of computers and other support equipment in schools and/or technical support, instability of equipment. There is also the obsolete nature of the equipment, the reduced access to the equipment by the educational community, restricted access to the Internet, insufficient speeds, limited areas, and unstructured and inefficient local area networks.

The DICTs integration into teaching processes focused on learning and the integral development of the subject requires, from the teachers, time to develop technological fluency, the planning and the development with the authorship of pedagogical materials. In this sense, it is necessary to overcome obstacles and the limitations for the effective integration of DICTs in classrooms.

It is important to emphasize that the successful integration of technologies and schools depends to a great extent on what has been done in the field of teacher training, with researchers being unanimous (Ricoy & Couto, 2011) on the importance attributed to training courses for the use of technologies since initial training courses for teaching. This need echoes almost like a call upon teachers who have obtained specific training for the use of technology in education to use the DICTs in the classroom for students' benefit and considering the wealth of digital supplies, selecting the technologies that best fit the context in which they operate and combining them with an innovative methodology.

To do so, teachers need to surpass the simple idea of using the technique for the sake of the technique, of changing the culture of using digital technological resources only to search for works on the internet, prepare slides in PowerPoint, etc. as means only to "teach" – since such practices but reinforce traditional teaching and learning processes more and more, increasingly distancing school from contemporary reality, according to what is proposed by the educational guidelines and the promotion of possible advances in terms of thinking of the current technological resources as auxiliary and teaching support, in order to provoke varied sensorial stimuli that enable students to advance their biopsychosocial development.

The educational guidelines recommend that the use of the computer should enable teachers to create learning environments that privilege the construction of knowledge by the students themselves (Zandavalli & Pedrosa, 2014). This is the direction for a pedagogical work that uses digital information and communication technologies as support and allies for the construction of teaching and learning processes, based on the students' accomplishment and engagement in collaborative work.

In the research carried out by Costa (2008), in this aspect regarding collaborative work, the reflection about the practice and use of the DICTs in the students' education, and later in the education itself was verified, which can significantly contribute to the

professional development of teachers and to generate a new teaching culture that is more focused on the development of critical subjects with autonomy and authorship to assume their knowledge construction processes.

Thus, the collaborative virtual spaces on the Internet emerge as one of the options for teachers to invest in their educational processes through rich and varying experience exchanges among professionals from different knowledge areas, for the sake of a more familiar and diversified used of digital educative resources, through countless courses offered today that are freely available on the web. The constitution of groups in schools to share knowledge, aiming to promote advances in the integration of digital resources into the teaching and learning process, also continues to be an important and necessary way of contact, exchange, construction and reconstruction of meaningful processes with regard to pedagogical practice with authorship and in the group, using technologies as the main allies in this process. In short, based on the systematic review of the literature developed based on the Scielo database, it could be verified that the use of DICTs in the teaching and learning processes of foreign and Brazilian institutions has been the subject of several studies in the area of teacher education. Research in the area involving teacher training and the use of technologies is increasing and promising, indicating ways, evidencing different foci, whose perspective goes beyond the purely technical and instrumental use of DICTs. From this perspective, the research points to the necessity of the didactic-pedagogical dimension in the training processes, in order to favor the teaching agents' critical-reflexive and conscious posture towards the DICTs, with a view to the re-dimensioning of the teaching work, whose target consists of training itself, which is not limited to training for "certification" purposes only, as reinforced by Nóvoa (1999). Also, it could be perceived that there are teachers who integrate, in their pedagogical practices, technological resources, while others do not do so yet, although the contexts are favorable to the possible changes. The research carried out in Canada and Portugal about the DICTs for appropriation by teachers and their safer and more competent consolidation and integration, both in formal and non-formal education spaces demonstrated this. In this sense, the authors almost unanimously agree on the importance attributed to the training courses when it comes to the use of technologies in the area of education, since the absence of this initial training for the pedagogical integration of the DICTs has a later direct impact on their use by future teachers in the classroom in the practice of their profession. But, on the other hand, there are teachers who, by their own will to learn more and better, seek self-education, which goes beyond external impositions to get training.

In this sense, the initial and continuing training courses play a fundamental role, that is, to point out ways for teachers to acquire knowledge about web 2.0 tools while resignifying their pedagogical practices in tune with cultural artifacts of the digital and media world that surrounds students. Also, they can act as triggers and mediators to establish a meeting between teacher training, DICTs, and their use in pedagogical

praxis, intending to alleviate the distance between teachers' (digital immigrants) and students' culture (digital natives), increasingly approximating these two realities with possibilities of building another "way" based on the reform of knowledge, which requires the reform of thinking, in accordance with Morin (2008, 2013).

Future teachers and those in the process of continuing education need both desire and willingness to be in a constant state of learning, unlearning and relearning throughout the profession, to make themselves present, in a perspective that allows them to advance in tune with the contemporary reality. It is necessary to monitor their development by appropriating the various forms and possibilities of teaching and learning that lead them to be connected with the emergent technological society in a network and in constant development, so as to enable students to develop even more, using the cultural-technological mediators of his time as support in processes that involve learning in a network.

With the worldwide computer network, educational spaces expand to the exchange of knowledge that emphasizes research, collaboration, and building inter- and transdisciplinary knowledge (Nicolescu, 1999). Despite scientific and technological changes, however, the school remains distant, disconnected from the current culture, and "teaching" as well as resisting to change its ways of teaching and learning. The student is not given the opportunity to say what he would like to learn. The focus on education, when it comes to the use of technology, is still more focused on how to teach and not on how to learn. And there are few learning situations that lead students to learn to think, to doubt, to ask, to research, to produce, to publish – these are essential elements in the daily pedagogical routine of the teacher for the development of autonomy and authorship, with a view to production and co-production together with their students. The reality of most educational institutions remains, unfortunately, that of the reproductive practice, disconnected and still slow in the changes targeted for centuries. Continuing education courses have not achieved the expected effects, with possible perspectives for revitalizing practices in the classroom, supported by technologies.

It is no longer possible for the school to teach absolute truths in a world today permeated by so many uncertainties. The school's role today is much more about helping students think critically – making them reflect, beyond simply "liking" the information that comes at all times on the social networks they participate in – instead of filling them with information that does not match their reality, which is sterile in terms of creativity and also far from production and coproduction with authorship.

Today, making or enabling students to access information is no longer enough; teachers need help students critically read this information to know how to use and appropriate it so that they can transform it into meaningful knowledge for their entire lives. By doing so, they will be able to construct their point of view based on their level of perception about the reality they have reached regarding knowledge. Although this view is provisional and therefore temporary, it allows

them to make sense of information that is not yet clear, so that they feel more secure in facing the uncertainties of the networked knowledge society. This is a desired attitude by both the teachers and the students. This is one of the great challenges educational institutions need to face and surpass to be able to train competent citizens who are autonomous, authors and able to overcome the problems of daily and professional life.

And, in this sense, training courses are favorable instruments capable of promoting the spaces necessary for important dialogues among educators, so that they can advance with the (very) necessary and urgent (re)configuration in the teaching and learning processes involving the potential use of technologies.

One of the ways pointed out in research is that, by combining the training for the use of the DICTs in line with the teachers' daily activities about their pedagogical practice, changes can take place in the teaching culture. This encounter allows for a holomovement between theory and practice, as the education processes occur as from the moment in which the teacher comes in contact with the social culture, appropriating the use of the DICTs to communicate socially, to participate in moments of coexistence in a network, as well as for private purposes. It is important to broaden the possibilities of using DICTs beyond their particular utility though, from a more collective perspective, thinking in a critical-reflective way, in interaction with other professionals in the area, in order to find the paths favorable to the incorporation of DICTs into teaching practices, as potential psychological mediators that arouse in teachers and students the desire to be learning throughout life, in a circular and recursive process. In this sense, communities of practice emerge as spaces favorable to these exchanges of experience and professional training, as well as to the self-training that teachers seek without necessarily being involved in courses that only mean certification. Prompted by the words of Morin (2011, 28), it is necessary that we "seek the paths, unlikely paths, it is true but possible, that will allow us to move towards the metamorphosis," because it is this dynamics of a metamorphosis that potentializes the dialogic relations among learning, culture and educational development, revealing, within the processes of teaching and learning, the necessary transformations in the educational scope. The DICTs are therefore used as mediating tools to support access to other innovative ways of doing education in the community, in tune with the demands of the contemporary reality to awaken the power present in each subject, in the educational spaces destined to learn to learn in contact with oneself, with the other and with life.

In short, research shows that the investment in training programs aimed at the appropriation of technological resources by the teacher and their integration into the school space is not sufficient for the proper use of DICTs as facilitators of the teaching and learning process. It is necessary that the culture of technology use in the school overarches all the actors in the school context. It requires, therefore, more collective than individual actions, among a wide range of instances – federal, municipal and state -, for the sake of actions in favor of the pedagogical use of technologies, not

focusing on the technology itself, but on how it will be used pedagogically and on the objectives each teacher in the different areas of knowledge targets, in line with the curriculum, for a better quality of student learning.

We reiterate that investments are necessary regarding infrastructure, in the training of teachers for the effective pedagogical use of technologies in educational contexts. The surveys consulted show, however, that this is not a sufficient guarantee to change the course of education. It is necessary to reinvent, create innovative situations based on existing practices, and this requires attitude and change of posture from the teachers, so that there are significant changes in the contexts of the classrooms, both as regards teaching and, mainly, learning.

In a way, the effect of public policies implemented in several countries, including Brazil, regarding the use of technologies in educational contexts, has not impacted the reality and behavior of teachers and students. The expectations of teachers and governments were frustrated, especially those who expected possible reforms and changes in educational contexts, through the training programs implemented, regarding the use of technologies. It should be kept in mind that the purpose of this education is clearly expressed in the documents: train teachers for the pedagogical use of DICTs, aiming to change the educational reality through innovative and interactive practices.

There are intentions in all the actions proposed to achieve these objectives, which is valid. Nevertheless, it is noticeable that there is an abyss between the ideal (modernized schools with teachers qualified for the use of the DICTs), on the one hand, and the real (precarious schools with little change in the teaching and learning processes) on the other.

The use of DICTs in educational contexts, according to research carried out by the Internet Steering Committee in Brazil (TIC, 2010), is far from reality, regarding possible significant transformations in the Brazilian educational scope through education only. The education processes, however, remain one of the fundamental ways for the revitalization of teaching and processes that excel by the quality of learning when analyzed in a context of actions, from a macro to a microsystem and vice-versa, organized in the form of a complex network of interrelations between the part and the whole, the whole and the part. In this sense, the appropriation of the DICTs by teachers and their actual effects on students' learning and development remain one of the enormous challenges educational professionals need to face, in their wide range of knowledge areas.

Conclusion

Through the construction of this systematic review, we could verify and understand that the promotion of significant educational changes in education does not only depend on the installation and presence of technological equipment in schools. It is

urgent to rethink the question of the dimensions of school space and time. The classroom should be understood as a favorable space for teachers and students to carry out, together and in collaboration, diverse and integrating experiences, for the more meaningful appropriation of knowledge for both personal and professional life. It is up to the teacher, playing his role as mediator between scientific knowledge and cultural knowledge, to bring the apprentice closer to his object of knowledge, to mobilize the student, through countless semiotic languages, for a more active, dynamic action committed to building knowledge. This occurs in a dialogical relationship, in which students serve as protagonists under the educators' attentive and careful look.

Taking this position remains a challenge and needs to be a focus of further research, so that studies are not only perpetuated in the management of technological resources, but mainly in the use that teachers make – and the way they do so – of digital information and communication technologies in the educational processes and their impact in the spaces of the classrooms, with a view to the development and the significant transformations in the processes of teaching and, mainly, learning. As regards teachers' use of information and communication technologies, in school contexts, many initiatives have been taken and discussed; nevertheless, gaps remain in the use of technology beyond the technique, especially focused on the pedagogical aspect. In this sense, further studies in this area are needed in order to enable educational professionals to be better prepared to include the technological resource in the teaching and learning processes, with competence and skills to enhance teaching and learning, integrating the culture of school life into contemporary social culture based on the potential use and effective effects of digital information and communication technologies on pedagogical practices, especially with authorship, both by teachers and students. Further research is needed to disseminate studies that emphasize the use of technology by teachers, in the classroom and in training courses, as authors and producers of knowledge through new practices that enhance and focus on students' development and learning.

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