CONCEPTIONS OF SCIENCE TEACHERS ABOUT THE USE OF ICT IN TEACHING PRACTICE: CHALLENGES FOR SCIENCE EDUCATION IN BRAZIL

CONCEPCIONES DE PROFESORES EN CIENCIAS ACERCA DEL USO DE LAS TIC EN LA PRÁCTICA DOCENTE: DESAFÍOS PARA LA EDUCACIÓN DE CIENCIAS EN BRASIL

Maria Inês Ribas Rodrigues
(Universidade Federal do ABC, Brasil)
mariainesribas@gmail.com

Ludmylla Ribeiro dos Santos
(Universidade Federal do Vale do São Francisco, Brasil)
ludmylla.santos@univasf.edu.br

ABSTRACT

This qualitative study was carried out in two public schools located in the city of São Paulo, SP, Brazil, and involved two primary school science teachers (one from each school). Its objective was to discuss the relevance of continuing education of Science teachers with the emphasis on the use of ICT (Information and Communication Technologies) in their teaching practice, the challenges faced by the insertion of these technological resources in the school environment, and improvements in school facilities. These aspects guide the need for training that prepares the teacher to deal with this type of situation. Data collection was done through the application of two interviews, at different moments of the research. These results were presented at an international event, Enseñanza de las Ciencias 2017, and we were able to observe the difference of realities between the science education in developed countries and noted the relevance of discussing this topic in the context of science teaching in Brazil.

Keywords: Teaching practice; Challenges in Science Education; Information and Communication Technologies.

RESUMEN

Este studio cualitativo se llevó a cabo en dos escuelas públicas localizadas en la ciudad de São Paulo, SP, Brasil, y contó con la participación de dos profesores de las escuelas principales en Ciencias (uno de cada escuela). El objetivo fue discutir la relevancia de la educación continua de los profesores en Ciencias, con énfasis en el uso de las TIC (Tecnologías de la Información y Comunicación) en su práctica docente, los retos en la inserción de esos recursos tecnológicos en el entorno escolar, y el mejoramiento de instalaciones escolares. Estos aspectos guian la necesidad de capacitación que preparará al profesor para lidear con este tipo de situaciones. La recolección de datos fue elavorada por medio de dos entrevistas aplicadas en diferentes momentos de la investigación. Estos resultados fueron presentados en el evento internacional, Enseñanza de las Ciencias 2017, y fue posibe observar las diferentes realidades entre los paises desarrollados, respecto a la

educación científica, y notar la relevancia de discutir este tema en el contexto de la enseñanza de las ciencias en Brasil.

Palavras clave: Prácticas de la enseñanza. Desafíos en Ciencia de la Educación. Tecnologías de la Información y Comunicación

1. Introduction

Many changes have occurred in all fields of society in the last decades, with technological advances, especially in the school context, as far as information is concerned. It was previously permeated only the print media and disseminated in the classroom by teachers, today it can be accessed where, when and how you want to. In just one click you access information from various sources, subjects, and contexts, without any effort. This is thanks to the innovations in Information and Communication Technologies (ICT), which has been increasing and modifying the ways of obtaining information.

It is also important to be aware that students, most of them are represented by a young audience, have greater ease with the use of new technological resources. The technological resources, besides having an attractive character, also fulfill a fad, that pervades the current society. For example, we can mention the case of cell phones, whose models are increasingly modern and functional.

For the facts mentioned above, young people are called digital natives, since they are individuals who were born in the technological age, thus possessing greater abilities to use ICT (Botacim, 2016). Therefore, teachers need to recognize the importance of student performance in learning, so that they can assist him in this process. Therefore, it is necessary to reflect on who this subject really is, so that they can, in fact, play their role in the teaching and learning process (Delizoicov, 2011). However, because teachers were born in a period that preceded the diffusion of ICTs in different contexts, they are considered digital immigrants. Therefore, they have difficulties or some resistance to use such resources in their classrooms (Prensky, 2001).

Educational processes and methods are constantly changing. The methods used in the classroom ten years ago are no longer the same ones used today. The flexibility with which information reaches people is enormous. The adepts of technology, are increasingly using mobile devices, and this occurs naturally. Tabletop computers are getting outdated, and they do not supply the need for people to connect from anywhere and anytime.

In this context, the teacher's practice also ends up suffering interferences, since they're faced with new methodological proposals, with a language in which the young people are already more adept and familiar. However, they will only perceive or feel that there is a need to adapt his practice to the insertion of ICT as pedagogical resources based on a reflection of/on their practice. This reflection becomes important because it's not enough just to want to modify or make insertions in the teaching practice, to require that they work with technological devices or whatever the resources. This will yield little positive results. It has to start from the professional the restlessness about their practice, about their methodology and about the resources that are used or not in the classroom.

From the reflection of their practice (Dewey, 1933; Schön, 1987; Nóvoa, 1992) emerges the importance of continuing training courses focused on the use of ICT, which will provide teachers with the development of new skills, adaptations of existing ones, and greater interaction with their students. However, it should be noted that teachers do not always have easy access to courses for this purpose. Enter questions related to the proposals that are sent to the schools that act through the Teaching Board of which they are a part: how the formations, the objectives, the selection, the duration, etc. are offered. Based on these considerations, the purpose of this article is to discuss aspects and the importance of the continuing education of science teachers regarding the ICT, as well as the challenges faced for the insertion of these technological resources in their teaching practice and improvements in the facilities of the schools. These aspects guide the need for training that prepares the teacher to deal with this type of

situation. This research was *carried out* in two (02) schools of the public education network, located in the city of São Paulo - SP, Brazil, and as subjects one (01) Sciences professor from each one of these institutions.

2. A debate on the continuing education of science teachers regarding the use of ICT in their teaching practice

Regarding the continuing education of teachers, it is essential for the construction of being an education professional. In this sense, continuing education is seen as a process that aims at complementing initial formation, and at the same time "contributing to a reflection on educational changes that are taking place" (Bettega, 2010: 43).

Carvalho and Gil-Pérez (2011) defended the idea that some teachers' needs would only be perceived and make real sense in their practice as professionals because for this to occur during initial formation, it would have an extended duration or extremely superficial approach. Thus, continuous training should not be based simply on the accumulation of knowledge or techniques (Rodrigues, 2001) present in many training courses. It must condition the construction of new knowledge and the reconstruction of those already existing, derived from their experience, and that allows the teacher to reflect on their practice, allowing the creation and/or adaptation of pedagogical strategies and teaching methodologies.

In this sense, the ICTs have been gaining more space in the school context and in the practice of the teacher, for providing more dynamic and interactive classes, and for awakening the attention of the student. ICTs help teachers and students, providing new learning strategies and possibilities to "reflect, interact, invent, stimulate research and learn to learn, to build new knowledge" (Albino & Souza, 2015: 3).

Because of these factors, the use of ICT in the school environment is gaining a great repercussion. There are many authors who work with this, emphasizing mainly that it is not the use of these resources that will cause better performance of the students, but rather the way the teacher will introduce them in their practice. Leite and Ribeiro (2012), for example, believe that the insertion of ICT will only bring positive results if: the teacher has control over the available technologies; The school has a good physical structure and resources; Teachers are updated, through investments made by the government, in the face of technological advances, through training courses aimed at this purpose, among other factors.

Within this context of training for the use of ICT and the impasses found in the classroom, stands out from the Technological Pedagogical Content Knowledge model, better known as TPACK (Koehler & Mishra 2006). Based on Shulmam (1986) proposal, in which knowledge of content and pedagogical knowledge are indispensable in teacher's practice, in addition to this, they integrated as a third priority knowledge the technological knowledge of teachers. The table below exemplifies the knowledge that makes up this model:

Table 1: The knowledge taken as the secondary axes that form TPACK

Technological Knowledge of Content – TCK	Pedagogical Knowledge of Content - PCK	Pedagogical Technological Knowledge - TPK
The TCK is the knowledge that the teacher needs to be able to select the most appropriate technological resources for a given	It is the ability and/or ability that the teacher needs to have to teach a particular content. It resembles the idea of Shulman (1986). It follows "with the representation	It is knowing how and when to use technological resources to make significant contributions to the teaching and learning process. The TPK "is the teacher's

content that he will address in his class. In teaching, teachers need to master content and know how to use the tools to leverage the teaching and learning process (Gonzalez & Lang, 2014).

and formulation of concepts, pedagogical techniques, the knowledge that potentiates a concept to be easy or difficult to learn, prior knowledge of students and theories of epistemology". (Mishra & Koelher, 2006: 6).

ability to recognize certain technological operational tools that approach or not the teaching interests of the group to be worked on" (Gonzalez & Lang 2014: 9).

Within the TPACK aspect, technological knowledge is increasingly indispensable in teaching practice. Therefore, it is not only a matter of using the technologies and simply affirming that their practice is constructive, since technology alone does not assume a pedagogical value, but rather the strategy of how it will be used, also considering the teacher's goals. In this sense, for Koehler and Mishra (2006: 13) they see TPACK as "(...) the basis of good teaching practice with technology and requires an understanding of the representation of concepts using pedagogical techniques that use technologies constructively in order to teach the content".

In this scenario, in the face of the insufficiency in the initial and continuing training courses for teachers, especially those offered to teachers by the teaching system they are working on, a bias - within the continuous training - that is being discussed and adopted by many teachers who are unsettled and dissatisfied with their practice, is self-training. It is understood as a process where the teacher is the main author of their training, looking for other ways to keep up to date and to improve their teaching practice (Perrenoud, 2000; Teixeira, Silva & Lima, 2010). To do so, we will be presenting further considerations on this subject in the following topic.

Table 1: The knowledge taken as the secondary axes that form TPACK

Technological Knowledge of Content – TCK	Pedagogical Knowledge of Content - PCK	Pedagogical Technological Knowledge - TPK
The TCK is the knowledge that the teacher needs to be able to select the most appropriate technological resources for a given content that he will address in his class. In teaching, teachers need to master content and know how to use the tools to leverage the teaching and learning process (Gonzalez & Lang, 2014).	It is the ability and/or ability that the teacher needs to have to teach a particular content. It resembles the idea of Shulman (1986). It follows "with the representation and formulation of concepts, pedagogical techniques, the knowledge that potentiates a concept to be easy or difficult to learn, prior knowledge of students and theories of epistemology". (Mishra & Koelher, 2006: 6).	It is knowing how and when to use technological resources to make significant contributions to the teaching and learning process. The TPK "is the teacher's ability to recognize certain technological operational tools that approach or not the teaching interests of the group to be worked on" (Gonzalez & Lang 2014: 9).

Within the TPACK aspect, technological knowledge is increasingly indispensable in teaching practice. Therefore, it is not only a matter of using the technologies and simply affirming that their practice is constructive, since technology alone does not assume a pedagogical value, but rather the strategy of how it will be used, also considering the teacher's goals. In this sense, for Koehler and Mishra (2006: 13) they see TPACK as "(...) the basis of good teaching practice with technology and requires an understanding

of the representation of concepts using pedagogical techniques that use technologies constructively in order to teach the content".

With this we see how essential the training of teachers is for the use of ICT, especially for their pedagogical use, opening new possibilities and discussions in the classroom, from the perspective of the students, who are more aware of the technological era. The emphasis of these technological resources on teacher training processes favors a dialogue between current students and a breakdown of extremely traditional practices, thus it is imperative to rethink education and reformulate new teaching formats (Cortella, 2014).

In this scenario, in the face of the insufficiency in the initial and continuing training courses for teachers, especially those offered to teachers by the teaching system they are working on, a bias - within the continuous training - that is being discussed and adopted by many teachers who are unsettled and dissatisfied with their practice, is self-training. It is understood as a process where the teacher is the main author of their training, looking for other ways to keep up to date and to improve their teaching practice (Perrenoud, 2000; Teixeira, Silva & Lima, 2010). To do so, we will be presenting further considerations on this subject in the following topic.

3. Methodology and methods

The present work has a qualitative approach as a research method. This kind of research seeks to interpret people's attributions to a given factor (Chizzotti, 2006), exploring social or individual problems (Creswell, 1997). It focuses on an interpretation of the data attributed by the participating subjects to their actions, in which the researcher submerges themselves in their object of interest.

We chose to use an epistemological, constructivist and interpretative perspective, where knowledge is constructed in the course of the research, and the data to be collected emerge from an existing dependence between the subject and the universe of research. Thus, "knowledge is constructed by human beings when they interact with the world they interpret" (Esteban 2010: 51), that is, it can not be considered a subject isolated from its context since it strongly influences the subject in its conception to see the "world". Therefore, the relation between subject and social context plays an important role in the context of qualitative research.

Universe and research subjects

For the accomplishment of this research, a search of public schools, that had the final years of the Elementary School, like a stage of education was made. Once this was done, the school officials were contacted and an application was made for permission for the investigation to be carried out in schools. Two schools accepted. Then the science teachers (two from each school) were contacted and their proposal was presented to them.

In this way, this research had as context two (2) public schools, here denominated school X and school Y, belonging to the Municipal and State Teaching networks of the city of São Paulo - SP (Brazil), respectively. And two (02) science teachers from the final years of Elementary School, identified as PC1 and PC2, were the target audience, one of each school in the participating schools. In the table below we have a brief profile of these subjects:

Table 2: Teachers profile

	Age	Training	Time working in the field
P1	35	Graduation in Physical and Biological Sciences	10 years
P2	34	Bachelor's Degree in Biological Sciences	5 years

Interviews

The interviews took place in two different moments: in the first moment, they were granted before the interventions (mentioned above), composed of previously structured questions, some of them closed and others opened; and the second moment occurred after the end of the intervention period, with questions also previously structured and open.

Table 3: Purpose of each of the interviews

	Purpose of the interviews
1st interview	1: Analyze their conceptions about the use of ICT in education, highlighting their difficulties in relation to the use of these technological devices, as well as the positive aspects of their insertion; verify if they receive any training for the use of ICT that meets their needs regarding the skills in handling and elaborating methodologies that cover these technologies, and if so, to investigate how they are offered to these professionals.
2nd interview	2: Check the strengths to be maintained with regard to the use of ICT and intensified, and what are the weaknesses, which in this case need to be reviewed and analyzed to reverse this situation; Highlight the criteria used by teachers to use some resources in their classrooms.

4. Results and discussion

As a result of the procedures used to collect data, this section of the paper is divided into two (02) secondary sections. The first one refers to the data of the interview with the science teachers before the interventions, and the second one addresses the data equivalent to the interview applied after the interventions.

First interview

As already pointed out, this first interview had the objective of drawing a profile of the participating teachers and highlighting the positive and negative aspects from the perspective of these subjects on the use of ICT in the context of the school in which they work. Thus, after the transcription of the data and

its analysis, we highlight some factors that emerged in the speech of both subjects, and which we list here as categories.

Barriers in the technological insertion in the school: school infrastructure and lack of students' awareness regarding the pedagogical use of these resources

This category arose from the analysis of questions about the difficulties of using ICT in schools in question, as well as the negative aspects of this insertion. Thus, within this context of infrastructure, the question of scheduling is emphasized, which according to teachers, as the schools have few technological resources, it is necessary to make a prior appointment so that one can use the multimedia room, the computer room, or even bring some technological gadgets into the classroom. This is evident in the following statements:

> The problem is that you have to schedule it because here we have a practice, a routine of all - or at least a good part of the teachers using these resources. Therefore, I do not think that there's any difficulty, you just have to keep up to date, you're always looking at what's new, for you to bring into this more interactive environment (P1).

On the other hand, P2 emphasizes "the infrastructure offered by the State" as a whole, from the structural issues of the school to the organizational ones, limits the use of ICTs, although a lot is charged with the teacher, even without the necessary support. In this sense, the teacher in question approaches the matter of continued education, emphasizing that there should be more investments in courses that support the teacher to develop methodologies with the use of ICT.

> For example, here we have a room with only 23-27 computers and a school with forty-five students per room. This room remained two months without being able to be used, because the state contract with the company that generates the system ended, so we could not access this SINGLE room. An alternative would be to have the internet in the classroom, so we could use the students own mobile phones, which the school also doesn't have, because is n't offered by the state. And there's a large majority of students who own mobile phones, but there's no internet available; making it useless for me to bring my computer, since I'm not going to have internet access. There are two video rooms, for the same number of classes and a large number of teachers wanting to use it, so in order to schedule the days that we used it, I had to book it in advance and I couldn't exactly get the days I needed. So when we talk about infrastructure, this is what we are talking about, the state itself charges, but it does not offer (the contribution). The room that is used for video originally was supposed to be a lab, but the state never assembled it (P2).

From the student's perspective, teachers stress that they see technologies as just fun, virtual interaction, but not as a resource that can contribute to their learning. This hinders the work of the teacher and disperses the attention of the students:

> When it comes to mobile, I think the good thing is that you have a very fast, efficient exchange of information, because you allow the student to have several parameters to compare the pieces of information of a class topic, some segments of the story subject, but the age factor gets in the way a bit. High school students have a greater maturity to use this resource, so they know that it's being used in a pedagogical, targeted way. It's easy to work with them, with the mobile phone for research, video editing and making slideshows. However, elementary school students still do not have this sort of insight. They believe that mobile phones are just to send messages, make jokes... This kind of interaction. So you have a little more painful work because you have to orientate them all the time, pay attention until they understand that it's not just a toy. And there's the issue of its use being prohibited in some schools (P1).

> The main negative point is the risk of the students' diversion of attention to situations that are not relevant to teaching (P2).

Teacher P1 focuses her statement on the use of mobile phones in the classroom, making a comparison between high school students and elementary school students. He also quotes the issue related to the prohibition of mobile phones in schools, as stated in Decree n°12,730 dated October 11, 2007. According to Saccol, Shlemmer, and Barbosa (2011), the prohibition of the use of mobile phones in schools comes

from a social convention. This adds up to a negative aspect, since mobile phones, as well as other mobile devices, when used in support of the teaching and learning process, can contribute much more than the computer, for example, since they are more malleable, practical and can be used in formal and non-formal spaces. However, the adoption of mobile technologies in school education systems is still a complex task. This is because TDs propose changes in the educational practices of schools, teachers and even in students' posture.

The issue emphasized by both teachers but mainly by P2 refers to one of the facts that need to be discussed the most when talking about the use of ICT in teaching practice: the deviation of attention of the students, especially when it comes to computers and mobile devices. They disconnect themselves from the classroom and connect in the virtual world.

In this sense, the importance of training that is geared towards the use of technologies, in which the teacher can develop skills and acquire pedagogical knowledge about the technological apparatuses, demonstrating the pedagogical domain of the situation, so that the student can be instigated and realize that their own devices can be a pedagogical tool.

Lack of continued education with an emphasis on the use of ICT in teaching practice

When questioned about having already participated in a continued education course, focusing on the use of ICT in their teaching practice, the two teachers emphasized that they had not participated in any type of training that included the use of these technological devices in their practice. Acquiring technological skills in teaching practice is first and foremost to form a judgment, critical sense, communication procedures and strategies (Perrenoud, 2000). The speech of P1 highlights the charging that teachers receive in relation to the use of ICT, but is restricted to only guidelines, not including courses or workshops that develop the teacher's technological skills linked to pedagogical proposals:

> It is more of a guidance of coordination, which sometimes indicates something, exchanges information between..., but no specific training, coming from the board of education. No, they talk a lot, right? When the teaching board or the education secretary is going to offer a course they say you have to use it all the time, right? But at no point do they give you orientation or workshop for this purpose (P1).

Regarding P2, he never participated in any specific training on the use of ICT, stating that "Offered by the State, practically none. Sometimes we'll search for something outside. " This statement directs us to the student's own self-investment and training (Maciel, 2003), which starts from the teachers' concerns about their practice (Perrenoud, 2000; Teixeira, Silva & Lima, 2010).

Second interview

At this stage, we tried to highlight the positive aspects to be maintained regarding the use of ICT considering the implementations that were made, which factors the teachers listed as barriers to the technological insertion and what they take into account when selecting their proposed methodologies to be developed in the classroom. In this way, the data were organized according to the following categories:

Characteristics of students in each classroom as a criterion for the selection of activities involving ICT

When questioned about how to select the methodological proposals to be used in their classes, the teachers emphasized the fact that each classroom has students with different specificities, and that this makes the same activity given in two classes, for example, end up giving positive results in one, and not so much in the other. They then consider the profile of classrooms as a prime factor for the use of a technological resource:

The first thing I notice is the profile of the "class" because as technology is something I like, I'm always analyzing and seeing something, I think 'this fits in that class and this fits better with the other one', so it ends up being something common for me. So, even though sometimes I don't have the instrument with me, I try to adapt it, for example: I see something on my computer that I won't have how to use it here, so I can sometimes cut an image or copy a video, and present at another time. But generally I try to observe the profile of the class, it can't be equal, there are classes that respond better, and some that don't respond as well. (P2).

I think this is kind of intuitive because sometimes you can not use the same activity with the same classes. So for example, if you're going to give them an observation to do, as I did with them earlier in the year, giving them a note about the main vegetable groups in the school garden. One class understood the proposal, photographed -they knew how to use the knowledge of the classroom to recognize the vegetable groups that we were working on. But in the other class, maybe when you try to do the same thing, because of even cultural questions or personal discipline, you have to do some adjustments, but it is something done as the problems appear, it is not something that's planned, you can't think that all students are homogeneous. When you are in the classroom, you can see that practice requires some flexibility (P1).

P1 adds the experience time factor to justify her placement because it makes her aware of the needs and abilities of each class. This question refers to one of the knowledge that constitutes one of the teaching skills: knowledge of experience (Tardif, Lessard & Lahaye 1991), which is produced in the teacher's school daily life (Pimenta, 1999). In the following speech she makes this observation explicit:

So, I've been working here for two years, so I know more or less the profile of that class, so it is possible to infer things like "ah, in this activity, for that group I'm going to have to add a difficulty factor, because they're very smart, very fast. For that one, I'll have to be a bit more malleable. So you pick up the class profile" (P1).

It is also possible to highlight actions that are attributed to TPACK, where technology is used to teach a given content in a constructive way (Koehler & Mishra, 2006). Knowing their students and understanding which activities with use of technological resources will have better development in each class, refer both to the technological Knowledge of content (TCK) and to the Technological Pedagogical Knowledge (TPK), which is the same as selecting the most appropriate resources and knowing how and when to use them (Koehler & Mishra, 2006).

In this approach, P1 mentions that in order to recognize the pedagogical factor of technology, it needs to reinforce the content to be addressed and not receive a greater emphasis on content. Coadunate, therefore, with TPACK, more specifically with the technological knowledge of content and pedagogy.

So we're looking to marry the content, that you're working in the classroom, and then you're looking for a video, an animation, an app, something that matches that, so that, not that it's going to be content, but will strengthen, will facilitate, for that student. But it's always the same research. It's something that you're kind of guiding on your own... go scouring the internet, find an app, then you'll say "oh, this here coincides with what I'm going to explain, what I'm explaining, or else you download a video, and tell us this video gives to use with such series "(P1).

Still in the perspective of the criteria for choosing which activities to use in the classroom, PC4 also talks about the importance of considering the profile of the class of students, "because as technology is something that I like, I am always analyzing and seeing something, I think 'this fits in with that class and this fits better with the other', so it ends up being something of every day for me "(P2). His speech also brings us to the characteristics of the TPK, when it makes a distinction of classes, and realizing that although it is the same activity and with the same resource, the results will be different, or they may be different activities, but they approach with the content that the teacher hopes to address in the classroom.

The P2 with the speech down transcends the question of the criteria, and although not making it so clear, it is possible to characterize its speech as being a TCK. Since he is concerned with selecting the most appropriate resources, especially for the context of his classroom:

So, even though sometimes I do not have the instrument here, I try to adapt, for example: I see something on my computer that will not have as I use it here, I can sometimes make a cut of an image or copy a video,

or something and present at another time. But generally, I try to observe the profile of the room, not to be equal, has room that responds better, has room that did not respond so well (P2).

In relation to the selection of more specific contents, P2 talks about the language of the resources, that is, the form that the students will dialog and absorb the information. So he believes that when it comes to an audiovisual resource, it must have a less formal language, which according to it, is the most appropriate to be able to work with students these days.

> In relation to specific content, the first thing I have been looking for is language. In the last two months, I was working with them, in the octave series, radiation that involves: energy production, atomic bomb, nuclear accidents, and I spent a couple of days pre-selecting videos that would blend content, a more appropriate language. So I already had a series of videos, used in previous classes that I was not having the goal achieved because it was a more technical language and such. But this year I managed to find some youth channels on YouTube, which dealt with the same issues in their language. So the result was better, something that last year when I went to work I still did not have these videos. So it was the question of language, the content was the same as I got was the video that used a clearer language for them (P2).

We see once again the TCK standing out in the teacher's speech, when seeking resources with a more accessible "language" for the students and that are convenient with the content that intends to approach. Thus, when researching resources that bring satisfactory results to the course of the lesson, the teacher presents a Technological Knowledge of Content (Koehler & Mishra 2006).

Lack of training with the emphasis on use of ICT

In the second interview, once again the lack of continuous training that contributes to a better ability of the teacher with the ICT was highlighted. This factor shows how much the teachers are worried about this absence, and that they need to be in continuous formations to be able to meet the needs found in the classroom. P2 stresses that there should be some form of training for the use of software such as applications and programs. He further emphasizes that what he knows today about the handling and insertion of these resources, he learned by himself, it was an investment that started from himself, and not from the education system, which should provide this type of training to teachers:

> I think I should have some more specific training for the use of applications and programs, since what I know today I learned on my own because it is an area of my interest, but I've never been summoned to have a class or a course on applications, about using the smartphone in the classroom - for example, then I feel like this is missing. Not me, but maybe other teachers because I research it on my own (P2).

P2 seems open to the insertion of technological resources in the classroom. He talks about the use of the mobile device in the classroom, and that there should be training also was the use of this resource. This position of the teacher is quite interesting because the mobile phone is a resource that the great majority of students have. And working with them in partnership with science teaching would enable the student to see their devices in a different way, not just as a device to make and receive calls/messages, access to social networks and play some games.

Still, in the perspective of continued education, P2 says that there are some moments when teachers are called to "meetings", but they address issues totally different from the reality found in the classroom: "*The state sometimes calls for pedagogic meetings, but what is discussed here has nothing to do with reality. So we think it's a waste of time, going there*" (P2). This report emphasizes that there is a lack of motivation on the part of the teacher when being summoned to participate in this type of event since it does not contribute to their professional formation.

P1, highlighting the lack of continuous training, also criticizes the way in which the formative moments occur, or that at least that should be formative, punctuating a lack of logistics:

> The problem of training is, it seems a lack of logistics, you have teachers and coordinators who will take training courses on the boards, but they only address the theoretical part, in those moments of ATPC that are collective moments, they should be multipliers, pass information... 'Look, we had a course in the

boardroom, and this possibility and such was shown'. But no, this is not the case (...). They talk a lot about how you have to foster youthful protagonism - this phrase is beautiful, but how are you going to start encouraging the student to have autonomy if you are pruning those possibilities (P1).

P1 also addresses the fact that few teachers turn to the computer room, and justifies this with the fact that the vast majority do not have any training, and they end up ignoring the range of tools ICT can provide. And because they have settled on the same pedagogical practices or for fear, they end up not researching on their own and the teaching board does not foment restlessness in these professionals - so that it can awaken in them the desire to know new methodologies, at the same time that it does not offer the skills needed for that:

> But here at the school, even those who use the computer room are 3 or 4 teachers, and in our group, there are in all, 40 teachers. So I think it needs a little more training in that sense because the teacher is often unaware. And there are a lot of tools, but some teachers are afraid because they do not search for it and the teaching board does not offer a training course for this (P1).

The use of ICT results in changes in teaching practice

This topic arose from the analysis of questions related to teacher practice and the use of ICT. We wanted to know if teachers saw this relationship as something that would result in changes in their classroom methodology and why. It is important that the teacher perceives that the use of ICT requires a different posture in the classroom, considering that this type of resource "directly interferes with the teacher/student relationship, fostering the need to reflect on the changes, advantages, and disadvantages of ICT in classroom "(Daredo da Cunha & Bizelli, 2016: 287).

In this sense, PC2 talks about a change related to the administration of time in the classroom, since the resources of formerly did not require, for example, that the teacher moved with his students to other environments of the school. This requires planning so that the lesson is not only lost in the assembly of the devices and the behavior of the student. The latter, see ICT much more to the ludic aspect or social networks, than to a pedagogical content. Therefore, the teacher mentions that,

> Ah, you have to change, because you are accustomed to chalk and blackboard, which was the resource we used to have. Regarding time, you have 45 minutes and you have to know how to manage it: you have to work on the student's posture because initially he goes to the computer room thinking he will play, play, or who will be messing with WhatsApp, in the facebook.... So you have to have a yes practice change. You also have to know how to enjoy the time, right? Know how to direct your lesson (P1).

With the speech of the PC2, it is notorious his concern of guiding the student towards the educational use of the TIC. Since, if the teacher does not know how to conduct the lesson, whose use is some technological apparatus, the students will use them for other purposes, and consequently, they will be dispersed in relation to the lesson.

PC4, when questioned about the need for a change in its practice regarding the use of ICT, he says he needs "a little", justifying that,

> We are accustomed to this environment here in the classroom (which is the four walls, table, chair, book...). And when you change the environment, the simple fact that you do this already requires another approach, be it to work in a reading room, computer room, in the laboratory.... So whether you want it or not, it automatically needs to happen (P2).

With the grafts of the two teachers, however, we have seen that the changes they both point out are not necessarily based on a reflection of their practice, or how exactly this change happens. In this point of view, Daredo da Cunha and Bizelli (2016: 287) consider that "the insertion of ICT in the school environment is also an insertion in the life of teachers, who sometimes do not use them frequently or do not use them as much as his students.

Therefore, the use of ICT in the school context, mainly by teachers, results in a change in the practice of these professionals. Such a change has to start from a reflection involving its practice, with which the teacher can see which actions need to be modified or shaped, in order to fulfill the objectives that he intends to achieve.

It is also important to consider the receptivity of the student in relation to these resources if it provides a dispersion or concentration between them. The teacher needs to be prepared for these two situations. This first occurs mainly when the teacher does not have pedagogical dominion of the technology and ends up using it without any type of didactic-pedagogical planning, diverging from the idea of the TPACK.

5. Final considerations

Through the technological resources available at the school, we seek to aid with contributions to discussions about the insertion of ICT in the school scope, and especially in teaching practice. The implemented activities were, in short, satisfactory, which points to positive results regarding our approach, during the period of data collection. During the interviews, we made room for the teacher to evaluate the implementations, list positive and negative factors, and then suggest strategies that could be made to reverse the unsatisfactory aspects. In this context, they pointed out that when working with students in the computer lab, for example, the ideal would be to have one computer per student, and the presence of the Internet not only in this environment but also in the whole school, with enough power to meet the needs of students and teachers.

Many teachers claim to know the benefits that the use of ICT can provide to their teaching practice, however, this is not a reality in the classroom, meaning that teachers don't always act based on their convictions regarding the insertion of technological resources in the classroom (Belland, 2009; Chen, 2008). According to the results presented here, punctuated from the teachers' statements regarding difficulties in the use of ICT in the school scope, this discrepancy about their conceptions and their practice occurs mainly due to the lack of technological resources in schools, problems linked to the infrastructure of these institutions, as well as the absence of continuous training so that the teacher acquires skills and competencies for the use of these tools.

The research also points out a charge made by the teaching board and school coordinators to teachers for the implementation of ICT in their practice. However, they are not offered continuous training that provides the development of skills that interrelate knowledge of pedagogic and technologic content - TPACK, responsible for the effectiveness of ICT in methodological proposals in teaching. In other words, the use of these technological tools in the school context only occurs positively when the teacher understands and knows its pedagogical functionality intertwined with the content to be approached.

From the foregoing, it is possible to notice that the absence of training aimed at the use of ICT in teacher practice permeates most of the obstacles related to the insertion of these resources in the classroom. School infrastructure, from the lack of resources to the lack of facilities in schools, also appears as an impasse and ends up restricting the teacher's possibilities. And the fact that students do not see ICT as pedagogical resources.

Nevertheless, we believe that the major problem is the first factor: lack of continuous training for the pedagogical use of ICT. This occurs because many schools have several technological resources, from the most traditional to the most advanced, that are left unused due to the lack of teacher preparation. The reason for this to happen is that the concern of the education sectors is focused on providing resources, instead of specialized "manpower". Teachers require assistance to be able to meet the needs that emerge in the classroom. Thus, we emphasize once again the importance of a continuous formation, that enables the teacher to work around this situation.

6. References

Albino, R. D., & Souza, c. A. (2015). "Avaliaçãp do nível de uso das TICs em escolas brasileiras: uma exploração dos dados da pesquisa". *TIC Educação*. Anais do XXXIX Encontro da ANPAD. Belo Horizonte. MG. Brazsil.

Belland, B. R. (2009). "Using the theory of habitus to move beyond the study of barriers to technology integration". *Computers & Education*. 52(2). 353 e 364.

Bettega, M. H. S. (2010). *A educação continuada na era digital* (2a Ed.). Cortez. São Paulo.

Botacim, r. s.; Athayde, s. s. & Souza, m (2016). "As tecnologias da informação e comunicação como instrumento de ensino e a aprendizagem: o precipício entre imigrantes e nativos digitais". In: *XII e VI DOSOL e CILTEC – online*. Anais...p. 1-6. Retrieved from http://evidosol.textolivre.org.

Carvalho, A. M. P., & Gil-Pérez, D. (2011). *Formação de professores de ciências: tendências e inovações*. Cortez. São Paulo.

CreswelL, J.W. (1997). *Five qualitative traditions of inquiry*. Sage Publications. London. 41-72.

Chen, C. (2008). "Why do teachers not practice what they believe regarding technology integration?". *Journal of Educational Research*. 102(1). 65-75.

Chizzotti, A. (2006). *Pesquisa qualitativa em ciências humanas e sociais*. Vozes. Petrópolis.

Darido da Cunha, M. & Bizelli, J. L. (2016). "Caminhos para a TIC em sala de aula sob a perspectiva dos professores". *Revista on line de política e Gestão Educacional*. 20(2). 282-300. Retrieved from <http://dx.doi.org/10.22633/rpge.v20.n2.9458>.

Delizoicov, D.; Angotti, j. a. & Pernambuco, M. M. (2011). *Ensino de Ciências: fundamentos e métodos*. 4. ed. Cortez. São Paulo.

Dewey, J. (1933). *How we think*. Heath. Chicago.

Esteban, M. P. S. (2010). *Pesquisa qualitativa em educação: fundamentos e tradições*. AMGH Editora. Porto Alegre.

González, F. J & Lang, A. M. (2014). "A proposta teórica do conhecimento tecnológico pedagógico de conteúdo e a (sub)utilização das TIC na educação básica". Anais do *Congreso Iberoamericano de Ciencia, Tecnología, Innovación y Educación*, 2014. Buenos Aires. Retrieved from http://www.oei.es/congreso2014/memoricictei/1283.pdf.

Kim, C., Kim, M. K., Lee, C., Spector, J. M., & DeMeester, K. (2013). "Teacher beliefs and technology integration". *Teaching and Teacher Education*. *29*(1). 76–85. https://doi.org/10.1016/j.tate.2012.08.005

Koehler, M. J., & Mishra, P. (2006). "Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge". In *Teachers College Record*. 108(6). Retrieved from https://pdfs.semanticscholar.org/977d/8f707ca1882e093c4ab9cb7ff0515cd944f5.pdf.

Leite, W. S. S., & Ribeiro, C. A. N. (2012). "A inclusão das TICs na educação brasileira: problemas e desafios". *Revista Internacional de Investigación En Educación, Javeriana. Colombia. 5*(10). 173-187.

Moraes, R., & Galiazzi, M. D. (2006). "Análise textual discursiva: processo reconstrutivo de múltiplas faces". *Ciência & Educação*. 12(1). 117-128.

Nóvoa, A. (1992). "Formação de professores e profissão docente". In NÓVOA, A. *Os professores e sua formação*. Dom Quixote. Lisboa.

Patton, M.Q. (1990). *Qualitative evaluation and research methods*. CA. Sage Publications. Newbury Park.

Perrenoud, P. (2000). *Dez novas competências para ensinar*. Artmed. Porto Alegre.

PIMENTA, S. G. (1999). "Formação de professores - saberes da docência e identidade do professor". In PIMENTA, S. G. (Org.). *Saberes pedagógicos e atividade docente*. Cortez. São Paulo.

Prensky, M. (2001). *Digital Natives, Digital Immigrants. On the horizon.* MCB University Press. 9(5). 1-6. Retrieved from https://www.marcprensky.com/writing/Prensky%20-%20Digital%20Natives,%20Digital%20Immigrants%20-%20Part1.pdf

Rodrigues, M. I. R. (2001). *Professores-pesquisadores: Reflexão e a mudança metodológica no ensino da Termodinâmica.* Dissertação de mestrado. Universidade de São Paulo. São Paulo. SP. Brasil.

Saccol, A., Schlemmer, E., & Barbosa, J. (2011). *M-learning e e-learning – novas perspectivas da aprendizagem móvel e ubíqua.* Perarson. São Paulo.

Santos, L.R.; Rodrigues, M.I.R (2017)**.** "Formação continuada de professores de ciências sob a perspectiva das TIC no contexto de duas escolas de São Paulo, Brasil". *Enseñanza de Las Ciencias Revista de Investigación y Experinecias Didácticas*. v. 1. 2143-2148.

Schön, D. A. (1987). *Educating the reflective practitioner: Toward a new design for teaching and learning in the professions*. Jossey Bass. San Francisco.

Shulman, L.S. (1987). "Those Knowledge and teaching: foundations of a new reform". *Harvard Educational Review.* 57 (1).

Tardif, M.; Lessard, C., & Lahaye, L. (1991). *Os professores face ao saber – esboço de uma problemática do saber docente*. Teoria & Educação. Porto Alegre. (4).

Teixeira, F. S.; Silva, M. J. A., & Lima, M. g. (2010). *O desenvolvimento docente na perspectiva da (auto) formação profissional.* Retrieved from http://leg.ufpi.br/subsiteFiles/ppged/arquivos/files/VI.encontro.2010/GT.3/GT_03_09_2010.pdf.