

CHALLENGES FOR PRE-SERVICE PHYSICS TEACHER EDUCATION IN A NORTHEASTERN BRAZILIAN STATE IN PANDEMIC TIMES

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Abstract

Pandemic has changed the way education has taken place in Brazil, which has occurred remotely. The classes have been taught in the public network especially through lives or WhatsApp. In this paper, the way in which the training activities of the supervised internship and the Pedagogical Residency in the teaching of Physics in schools took place will be addressed. As a result, the abundant use of new information and communication technologies was verified. Resources and methodologies such as digital platforms, simulators, gamification, among others, were used by pre-service teachers during supervised internship and / or Pedagogical Residency activities. With this, pre-service teachers were able to immerse themselves in the current school reality, better understanding how teaching has occurred in this period and to propose activities that could help to improve the quality of teaching offered in basic education schools and in the recycling of in-service teachers, as well as in the motivation of students, too.

Keywords: *pandemic period, pedagogical residency, physics teaching, supervised internship, teacher education*

Introduction

By the end of 2019, COVID-19 had rapidly spread to China and thus to the rest of the world (Albuquerque et al., 2020). With this, Brazil and the world are continually facing the social, economic, and emotional impacts of the pandemic. In Brazil, federal law no. 13,979 (2020), which provided for measures that could be adopted to deal with the public health emergency of international importance resulting from the coronavirus responsible for the 2019 outbreak, resulted in several other laws, both at the federal, as well as state and municipal levels.

Brazil is a country of continental dimension, composed of 27 Federative Units (FU), popularly known as states. There is a very large disparity between these UFs. Piauí, one of the Brazilian FUs and whose capital is Teresina, the city where the research was carried out, has a Human Development Index of 0.697 (IPEA, 2019), the third lowest among all Brazilian FUs and similar to that of Vietnam, well below Brazil's HDI, which is 0.778. In this state, in response to law no. 13,979, it can be highlight decree no. 18,884 (2020), which regulated the aforementioned law at the state level and determined the suspension of classes in the state public system and recommended the closure of other schools and Universities in the state, as well as churches, bars, restaurants, stores, etc.



Decree no. 18,901 (2020), determined the suspension of religious, commercial, aesthetic and sports activities in the state of Piauí. Social isolation was decreed with a ban on opening economic activities, closing schools and universities, non-essential commerce, and public leisure areas, among others, with the exception of essential activities, such as cleaning, health, safety, among others. With this, ordinance no. 343 (2020) that proposes replacing face-to-face classes with classes in digital media while the Covid-19 pandemic situation lasts. Through the ordinance, the Ministry of Education decides:

“Art. 1st Authorize, on an exceptional character, the replacement of on-site subjects, in progress, by classes that use information and communication means and technologies, within the limits established by the legislation in force, by a higher education institution that is part of the federal education system, of which deals with art. 2 of Decree n. 9,235, of December 15, 2017 (Ordinance no. 343, 2020, p.01, author's translation)”.

Most of the municipal governments adhered to remote education. Schools have had their classroom activities suspended and many states and cities have adopted the continuity of classes through the remote system. Thus, the new reality abruptly imposed opened up the need to revise the teacher training, in order to make them able to work in a dynamic world that requires professionals capable and adaptable to the new demands. In this way, one of the things that would need to be revised was the supervised internship (SI), in which the future teacher immerses in schools, being, therefore, a very rich moment of learning, which we will deal with in the next section.

Teacher Education, Supervised Internship and Pedagogical Residency

Supervised internship is, according to 1st article of law no. 11,788 (2008, author's translation), “supervised school educational act, developed in the work environment, which aims at preparing students for productive work who are attending regular education [...]”. This law adds in its items the internship is part of the pedagogical project of the course and aims the learning competences proper to the professional activity and the curricular contextualization, aiming at the development of the student for the citizen life and for the work. In SI the pre-service teacher carries out observation and teaching activities.

SI is seen by a lot of people as the practical part of the course. Pimenta and Lima (2015) have put SI as a theoretical and practical activity. So being considered, it is interesting that research is developed to optimize this moment. André (2015) has observed that there is a consensus in the educational literature, both in Brazil and abroad, that research is an essential element in the professional training of teachers. Severino (2008) affirms that one learns to research by researching and, during graduation, this research is carried out concretely in the Course Conclusion Monography (CCM) and in the scientific initiations. Rodrigues and Arroio (2018) have argued that the SI period can also be a fertile period to carry out research.

Pimenta and Lima (2015) have commented that SI is intended to approach reality, and the internship is not a practical activity, but a theoretical one, which implements the teaching praxis, which is the activity of transforming reality. The authors (idem) also comment research in the internship is a possibility in the training of the intern as a future teacher.

In addition to the SI there is another possibility for the training of future teachers *in loco* who are taking the second half of undergraduate teacher formation courses, which is the Pedagogical Residency Program (RP). The RP is one of the actions that integrates the National Policy for Teacher Training and aims to induce the improvement of practical training in undergraduate courses, promoting the immersion of the student in the basic education school (CAPES, 2020). As in SI, in the RP the pre-service teachers perform observation and teaching activities.

In a similar way to residencies in the health area, in RP the resident stays for a while in the place of his future performance as a professional, which, in this case, is the school, under the supervision of an effective teacher in the area he studies, the preceptor. However, with the pandemic caused by COVID-19, schools and universities were closed and the training activities that took place during SI and RP were hampered. In the following section, it will be presented how the teaching is offered today in Brazilian schools.

The Teaching Offered Today in Schools

In the state of Piauí, according to a survey carried out by the Piauí State Department of Education - SEDUC / PI (Piauí, 2020a), 88.82% of students enrolled in this network are having access to remote activities in a virtual way or by printed material. Among these students, access is distributed in different ways. As shown in Table 1, the teaching contact ranges from WhatsApp groups, instrumental platforms for organizing class content (Google Classroom), through other means, for example, phone calls, email, etc. 11.18% of students in the state public network of Piauí still had no access to classes at the time of publication of the report (12/07/2020).

Table 1
Options for Remote Education Access in the Public Network of Piauí

Contact Source	WhatsApp Groups	Printed Material	Google Classroom	Others	No access
Percentage (%)	42.40	24.49	12.52	9.41	11.18

Source: (Piauí, 2020a)

Of those students who attend classes, there is a predominance of the use of cell phone applications as a means of access. This shows that a large portion of the population has access to cellular devices and that they can also be used in Education. In view of this, at the end of November 2020, the Government of the State of Piauí made available, according to news on its official page (Piauí, 2020b), more than 180 thousand internet chips to students from the state network, to guarantee access to digital platforms that provide video lessons and activities produced by teachers, such as Canal Educação, Pré-ENEM Seduc and the iSeduc Aluno application.

One of the main consequences of remote education during the pandemic was the change from the school environment to the home environment. Such a change was not expected even by teachers who already adopted online environments in their teaching methodologies. This brought about such a rapid and emergency change, almost

obligatorily. At first, teachers and students had to adapt quickly to the use of digital platforms and new information and communication technologies (NICTs), which despite not being new, always faced challenges for their implementation, such as: the lack of investment in technologies in education; schools do not offer the minimum technological structure of pedagogical support to teachers and students; higher education courses that do not enable professionals to work using new technologies; in addition to the teachers' own resistance to work with these technologies (Soares-Leite & Nascimento-Ribeiro, 2012).

Teachers have become exposed to problems never experienced before (for the vast majority),

“[...] for new problems, new answers, then the emergency to face COVID-19 has required updating and incorporation of new knowledge and technologies on the part of professionals who deal directly with suspects, confirmed cases and those who are in other care fronts. As well, remote work, distance education and telehealth, which were the targets of technical and ethical questions, become the means of maintaining services and attendance, permanent education, and social interaction (Falcão et al., 2020, p. 4, author's translation)”.

In this way, teachers would need to become Youtubers by recording video-lessons and learning how to use video conferencing systems to adapt and develop new methodologies, to think about new ways of evaluating, and especially, to ensure the attention of students (Monteiro et al., 2012).

It's known the year 2020 was atypical, due to the occurrence of the pandemic, teaching underwent several transformations, causing the methodologies adopted within the classrooms to be modified. As a result, teacher training at a higher level to work in basic education had to undergo adaptations, starting from a face-to-face teaching model to an already existing model of Distance Education (DE), but little used by education professionals. This type of distance learning provided a basis for the remote education adopted in the pandemic period, which has brought a new form of interaction between students and knowledge and brought them closer to technologies, that is, it has brought new channels of interaction between teachers and students and, also, a new teaching-learning evaluation process.

Thus, it was clear that part of education professionals was not prepared to take on remote learning, as the vast majority did not know how to use digital platforms or did not have the knowledge to handle them, due to the non-mandatory use in the classroom (Ribeiro Junior et al., 2020). Therefore, this lack of knowledge of many of the digital interfaces is due to the fact that subjects that teach and influence digital use in teaching are not offered in teacher formation courses. Another reason also for being associated with schools, for the most part, do not offer structure for teachers to apply digital teaching:

“A survey launched in early April [2020] by the Innovation Center for Brazilian Education (Cieb) showed the basic education network's difficulty in finding solutions to face the Covid-19 pandemic. At the time of the study, 60% of the counties had no digital strategy to serve students during the period of social distance (Kochhann, 2020, author's translation)”.

According to an interview with the director-president of Cieb Lucia Dellagnelo, “in municipal networks, more than 70% had not used any online tool or methodology with their students. They saw that teachers do not know how to use these tools well” (Kochhann, 2020, author's translation). Corroborating this, in a survey conducted with 52 teachers from different areas of the public and private education network in Piauí and Maranhão (another Brazilian FU, the second with the worst HDI) it was found that “[...] 52% of teachers have knowledge limitations in the use of educational technologies (text editing, internet research, video editing, among others), 27% need help from others, and 22% consider themselves self-sufficient” (Ribeiro Junior et al., 2020, author's translation).

With face-to-face education not possible, the solution was to bet on digital platforms so that teaching would not be stopped. Platforms and applications such as Youtube, Google Classroom, Google Meet, Zoom, WhatsApp, OBS Studio, among others, were essential for teachers to transmit knowledge, trying to minimize the losses of the school year. However, the difficulties become even greater when part of the students do not have access to such platforms, due to the lack of conditions to have good quality internet or devices that can access them.

“Thus, considering the social function of the school in the pre-pandemic and post-pandemic, it is important to understand the use of educational technologies for basic education has potentialized new learning for the teaching staff (mainly), although the focus has been on student, for whom there has been double attention in an attempt to cushion the effects of social isolation and ensure the teaching and learning of students (Ribeiro Junior et al., 2020, author's translation)”.

Pandemic brought about a great transformation in the lives of teachers and students, leaving as legacy the immersion of remote education as the main tool for education networks, both private and public. In the post-pandemic, it is believed hybrid education, part with distance learning and the other face-to-face, will be part of the daily education, as the school will continue to have its role of learning and socialization, however mixed with new technologies.

Given this, the following question came up: how to prepare future Physics teachers to carry out their teaching activities during supervised internship or pedagogical residency in basic education, in Teresina, Piauí during the period of social isolation? It is aimed, specifically, to understand how pre-service Physics teachers will be able to perform SI and RP activities remotely, acting in the way schools are functioning and helping to improve the performance and interest of students in the discipline of Physics in this pandemic period. Below, the methodology used to carry out the research.

Research Methodology

General Background

This study is an exploratory and qualitative research. Exploratory because it seeks to examine and discover a still unknown reality. This method mainly uses qualitative research techniques based on observations and interviews (Selltiz et al., 1987). The data were produced by conversations with the supervising teachers (identifying how

the classes have occurred), proposing new activities and verifying the results of these activities through conversations and / or reports.

According to Liebscher (1998), to learn qualitative methods it is necessary to learn to observe, record and analyze real interactions between people, and between people and systems. This research was carried out with pre-service Physics teachers, who were enrolled in the supervised internship disciplines of teaching physics, or they were participating in the RP program both at the Federal University of Piauí (UFPI), located in Teresina. This research included pre-service Physics teachers at the University and in-service Physics teachers at the secondary schools. The project was only possible with this interaction between the university and the school, so that the implementation of the SI or RP occurred in real schools and with the participation of Physics teachers as partners. All the activities occurred remotely.

Sample Selection

In general, in pre-service Physics teacher training courses, there are many dropouts and few finish the course. The supervised internship discipline is allocated at the end of the course and the participants of the RP need to be in the second half of the course to be able to participate in that program. In this research there were all the 20 enrolled students in the SI disciplines who were in teaching activities and 24 students who were involved in RP activities.

All 44 pre-service teachers participating in the research carried out Physics teaching activities in public basic education schools in Teresina, under the supervision of the Physics teachers of the school, in the role of supervising teachers (for the 20 SI students) or preceptors (for the 24 RP students). Both groups were guided by the supervising professor, the author of this text. There were 3 schools that had RP students inserted and 8 schools in which the interns were inserted. The pre-service teachers were asked if they authorize the use of their reports and speeches as a data source for a research and they authorized the use for this.

Instruments and Procedures

The research started through conversations with the supervising teachers and preceptors, in which they reported to the pre-service Physics teachers how the teaching was occurring. Based on this information and after contacting the school's classes, as observers, the pre-service teachers were able to propose new activities to be used in their classes. The verification of the results of these activities took place through conversation circles and / or reports.

The data produced for the writing of this article was obtained through the oral reports of the pre-service teachers and / or the supervising professors and preceptors, which were recorded in a field diary, and through the reading of the reports produced by the pre-service teachers of the activities of the SI and the RP, too.

Data Analysis

Considering these described materials, the corpus analysis was performed, using Bardin's content analysis (2016). The data analysis process itself involves several steps to give meaning to the collected data, which are organized by Bardin in three phases: 1) pre-analysis, when the material is organized with the aim of making it operational; 2) exploration of the material, when the definition of categories and identification of the registration and context units in the documents occurs; and 3) treatment of results, inference and interpretation, when condensation and highlighting of information for analysis occurs, generating moments of intuition, reflective and critical analysis.

Research Results

Based on the responses of the in-service teachers, the preceptors or supervising teachers, activities were proposed to be carried out by residents and interns. It was verified in the three schools that functioned as RP nucleus the classes were taking place through Google Meet, in one school that received trainees the teaching was hybrid (face-to-face and remote, simultaneously, and alternating students), 2 used Google Meet and 5 was working via WhatsApp.

The students at the schools where the pre-service teachers acted were poor and a large part of them did not have access to quality internet or access by computers but used mobile data on smartphones. Because of this, most schools operated via WhatsApp, so that students could follow the activities.

Based on these findings, the proposed activities would be carried out by interns and/or residents and the suggestions were categorized according to the type of resource or activity listed. The categories that emerged after the analysis of the field diary and the reports produced by the interns and residents were: Digital Platforms; Simulators - To Develop; Simulators - To Use; Gamification; and Others.

In the Digital Platforms category, platforms that were being used in schools that had classes via lives (the 3 of the RP and 2 with interns) were mentioned and used these platforms to transmit the classes live. The following platforms were listed: RNP, Zoom and Google Meet. These three platforms were made available for free to use. RNP is a platform developed by the Brazilian government and all students and professors at federal universities who have corporate e-mails can open rooms and use them. This platform was used by only one resident, who opened the room and used it in the classes she taught. The other residents and interns used the platforms with rooms opened by the in-service teachers.

Another category that emerged after analyzing the research corpus was Simulators - To Develop, in which Python, Scratch and Tracker were cited. These simulators are programmed by their users, differently from those will be commented on in the next category. They were only used in classes which occurred with lives through digital platforms. These simulators were used only in 2 schools, with Python and Tracker being used in one of them and Scratch in the other. Both schools were nuclei of the RP.

In the 1st school, the one that used Python and Tracker, the use of these simulators was proposed by residents and in the 2nd school it was the tutor who used it and demonstrated to residents how to do it (this teacher finished his master's degree in Phys-

ics teaching, in which he used this resource). This fact was curious because it demonstrated the two-way street that occurs when the school inserts pre-service teachers in its activities: both the pre-service, in this case, the resident, and the in-service teacher, the preceptor, learn during the interaction.

Simulators - To Use were verified in the reports of both residents and interns and these resources were used both in classes that took place via lives and in those that took place via WhatsApp. The following simulators were mentioned: Ludoteca, Física in Mãos and PhET. These simulators are available ready for use, requiring only the insertion of numerical values or adjustments such as intensity, angulation, etc., according to the theme that was addressed in each one. They were used as an alternative to replace the experimental activity and demonstrated during the lives or proposed as complementary activities for students who had classes via WhatsApp.

Gamification proposal was also used in classes which took place via lives and those took place via WhatsApp. As in the **Simulators - To Develop** category, activities in this category were proposed by both pre-service and in-service teachers. In two of RP schools, the preceptors suggested using this approach and explained to residents how these should occur. In two other schools, but which had interns, the interns who suggested gamified activities. In these two schools, activities took place via WhatsApp.

Among the tools used in the gamification process can be highlighted: Google Forms, kahoot, quizizz, quizlet and mentimeter. Google forms, kahoot, quizizz and quizlet were used to ask questions for teams, with kahoot, quizizz and quizlet showing the team that responded most quickly, being indicated for synchronous activities and Google Forms could also be used in asynchronous activities, in proposals such as, for example, gymkhanas. Mentimeter was used more as a graphic element, indicating the most frequent responses, assisting the teacher in the diagnosis of the class.

Others category encompassed the resources cited by the interns who were working in schools where classes were taught via WhatsApp and which could not be included in the previous categories. The following were mentioned: Youtube, social networks (instagram, TikTok and Facebook) and memes. As students using WhatsApp mostly used mobile data, the resources used by pre-service teachers had to consume the least amount of these, so that students could follow the other classes, too.

Discussion

Results presented above demonstrate some possibilities to conduct remote teaching. The five categories listed (**Digital Platforms**; **Simulators - To Develop**; **Simulators - To Use**; **Gamification**; and **Others**). The activities of Supervised Training and Pedagogical Residence occurred in schools where the students are poor and a large part of them did not have access to quality internet or access by computers but used mobile data on smartphones. The most classes take place via whatsapp.

As there was no concern with teaching for the use of platforms in classes in a period before the pandemic, the pre-service teachers, although they already had remote classes at the university, learned to use the platforms with use in schools. Thus, it was clear that part of education professionals was not prepared to take on remote learning, as the vast majority did not know how to use digital platforms or did not have the knowledge to handle them, due to the non-mandatory use in the classroom (Ribeiro Junior et al., 2020).

It was commented by all pre-service teachers who used these tools that school students did not turn on their cameras and their active participation was limited to about 2 or 3 per class. A fact that deserves to be highlighted is the supervising teachers and the preceptors commented that the students who participated in the remote classes were the same ones who were active in the face-to-face classes. The same was true for classes via WhatsApp.

In the state of Piauí, according to a survey carried out by the Education Department of the State of Piauí - SEDUC/PI (Piauí, 2020a), 88.82% of students enrolled in this public network are having access to remote activities virtually or through printed material. Among these students, access is distributed in different ways. As shown in Table 1, the teaching contact ranges from WhatsApp groups, instrumental platforms for organizing the content of classes (Google Classroom) and even through other means such as, for example, phone calls, email, etc. 11.18% of public-school students in Piauí continued without access to classes at the time of publication of the report (12/07/2020).

Table 1
Options for Remote Learning Access in the Public Network of Piauí

Contact source	WhatsApp groups	Printed Material	Google Class-room	Others	Without access
Percentage (%)	42.40	24.49	12.52	9.41	11.18

Source: (Piauí, 2020a)

However, even teaching via Whatsapp was harmed because, according to a complaint by Souza (2021), in a May 2021 report, many students are still without internet or cell phone/tablet to carry out the activities after more than a year of the pandemic. This fact made remote teaching even more difficult and forced pre-service teachers to think of new proposals for this teaching.

One of these proposals was by use of simulators. It was verifying two different groups of them: Simulators – to Develop and Simulators – to Use. The first group is more laborious to use because it needs programming. Tracker proved to be the simplest of the three (Python and Scratch were the others in this category), because a recorded video is inserted and some data is described so that the movement can be described and quantified (this simulator can be used only in Mechanics, for it serves to describe the movements). Python is widely used in mechanics, but it can be worked in other areas of Physics, too, such as in electromagnetism (Cristiano et al., 2019) and Scratch can be used for other areas of physics, too, and for production games and other purposes. The students really liked the use of these simulators, especially the Tracker, because videos recorded by the residents were used, showing themselves to be an instrument that brings Physics closer to the students' reality, as commented by Sung, Ma, Choi and Hong (2019).

Both Simulators – to Develop and Simulators – to Use were used as an alternative to replace the experimental activity and demonstrated during the lives or proposed as complementary activities for students who had classes via WhatsApp. Very widespread in the teaching of Physics (Neri, Noguez et al., 2018), simulators have been used by

supervising teachers and preceptors since before the pandemic and are used mainly as evidence of theory taught in previous classes.

Gamification proposal was also used in classes which took place via lives and those took place via WhatsApp. Gamification uses, outside the context of games, elements of its design to retain the user's attention, motivate and increase activity (Deterding et al., 2011). Among the elements of games that are used are: clear rules, objectives, rewards, inclusion of error in the process, immediate feedback, intrinsic motivation, abstraction of reality, narrative, competition, levels, cooperation, conflict, voluntariness, etc. (Fardo, 2013). The gamified activities were other way used to encourage students to interact more and motivate them, since students have been quite unmotivated in remote activities (Barbosa, 2020). These activities occurred at two schools where the classes took place via WhatsApp.

The last category, Others, included social networks and memes. The social networks cited by pre-service teachers were: Youtube, instagram, TikTok and Facebook. It was found that students accessed social networks with great frequency, being therefore easy for students to see. Another factor led the trainees to propose these resources was the fact that access to many social networks and Youtube are outside the consumption of the students' internet franchise, which they can access without running the risk of ending it.

Most of the time the pre-service teachers forwarded the links to videos or memes before classes, in order to generate curiosity in the students. Some of them questioned the videos and/or memes in class, but even so, feedback was not as expressive, although greater than without the use of these resources. Memes were funny, according to student comments, allowing pre-service teachers to comment in more depth on the phenomenon addressed, as commented by Baysac (2017).

It is also interesting that different approaches have been proposed for use on WhatsApp. The standard form used by in-service teachers was to send activities before class and, at a specified time, in-service teacher was online to answer questions and normally no students showed up for this purpose. Then, a pre-service suggested that along with the materials sent (slides and text in pdf) a brief explanation, typed in WhatsApp itself was sent. Another intern likewise wanted to send an explanation of the content, but used the format of podcast, with short audio recording on WhatsApp itself and said the students' understanding improved a lot, since they were too lazy to read and had no initiative to question.

Since, according to a survey carried out in January 2021, about 4 million students dropped out of school as a result of the pandemic, with the dropout rate being higher among people from the poorest social strata, such as in classes D and E, in which the dropout is 10.6%, while among class A people it is 6.9% (CNN, 2021). Although it is not possible to quantify it, what it was seen by the investigated schools is this number is much higher, in the range of 30% of dropout students. So, all proposals mentioned in the five categories mentioned above were made with the aim of making the classes more dynamic and achieving greater interaction with students, as well as helping to reduce school dropout rates.

Conclusions and Implications

The internship period and the Pedagogical Residency proved to be a rich learning period for the pre-service teachers. Even though the activities took place remotely, the pre-service teachers were able to use different resources and methodologies, experiencing relevant experiences for their training as future teachers, inserted in the reality of the current context.

The pre-service teachers, both SI and RP, proposed different activities in relation to those offered by in-service teachers and helped to improve the quality of education offered to students from public schools in Teresina. It was found that remote / hybrid teaching has a wide range of possibilities for teaching action, but learning is needed so that NICTs can be widely used.

The supervised internships and the Pedagogical Residency proved to be important so that future pre-service teachers could experience in-depth the contents learned during initial training, this applied in real teaching situations. And, in addition, the pre-service teachers, by proposing varied activities during the RP and / or SI, were able to assist in the recycling / training of in-service teachers and in the motivation of their students.

New research must be carried out in order to provide a higher quality in the actions of Pedagogical Residency and supervised internships, as well as to integrate in an increasingly harmonious way the university and the school, collaborating so that a higher level education is offered in schools.

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