

The debate of digital technology in the continuing Physical Education teacher education: uses and concepts for teaching and learning

El debate de la tecnología digital en la formación continua del profesorado de Educación Física: usos y conceptos para la enseñanza y el aprendizaje

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Abstract. Teacher education programs have recently incorporated digital technologies into their curricula. However, this does not seem to be sufficient, given all the current education challenges. This lack leads teachers to fill the gaps in other ways, for example, through personal effort, specialization courses, and permanent education. This study aimed to describe and analyze the professional education experience of Physical Education teachers with digital technology concerning the uses and concepts of technology. We used action research as a method by systematically observing continuing education meetings held in 2016, where we problematized concepts such as communication, mediation, narrative, and gamification. We used questionnaires, evaluation documents, and participant observation for data collection, with records in a field notebook to generate information. We identified some intrinsic and extrinsic factors in the mobilization of these teachers with the incorporation of digital technology. Two intrinsic trends and one extrinsic appear as the main factors: 1) the concept of teaching, 2) a belief in digital technology as a possibility to relate to Physical Education, and 3) the pedagogical time for planning.

Keywords: Professional development; Digital Technology; Teacher Education; Communication; Mediation; Narrative; Gamification.

Resumen. Los programas de formación docente han incorporado recientemente las tecnologías digitales en sus planes de estudios. Sin embargo, esto no parece ser suficiente en vista de todos los desafíos actuales en educación. Esta carencia lleva a los docentes a llenar los vacíos de otras formas, por ejemplo, a través del esfuerzo personal, cursos de especialización y educación permanente. Este estudio tuvo como objetivo describir y analizar la experiencia de formación profesional de profesores de Educación Física con tecnología digital, centrándose en los usos y conceptos de tecnología. Se utilizó como método la investigación-acción y se apoyó en la observación sistemática de encuentros de educación continua, realizados en 2016, donde problematizamos conceptos como comunicación, mediación, narrativa y gamificación. Utilizamos cuestionarios, documentos de evaluación y observación participante para la recolección de datos, con registro en un cuaderno de campo para generar información. Identificamos algunos factores intrínsecos y extrínsecos en la movilización de estos docentes con la incorporación de la tecnología digital. Dos tendencias intrínsecas y una extrínseca aparecen como factores principales: 1) el concepto de enseñanza; 2) una creencia en la tecnología digital como posibilidad de relacionarse con la Educación Física; y 3) el tiempo pedagógico para la planificación.

Palabras clave: Desarrollo profesional; Tecnología digital; Formación del profesorado. Comunicación; Mediación; Narrativa; Gamificación.

Introduction

Reflections on teacher education must be connected to professional reality and teachers' thoughts, feelings, and actions (Imberón, 2009; Nóvoa, 2009). We believe that if the contemporary socio-cultural scenario is closely related to digital technologies (Selwyn, 2011) and can modify institutional and social relationships (Castells, 1999; Hjavard, 2014), it is necessary to highlight how this scenario affects Physical Education teachers.

We find different arguments in the literature regarding using technologies in pedagogical practice in Physical Education and Physical Education Teacher Education (PETE). Negative criticisms are anchored in the fear that

digital technologies may trigger intensified surveillance, body control, and body performance (Gard, 2014; Lupton, 2015; Armour, Goodyear & Sandford, 2020; Goodyear, Armour & Wood, 2018) or that generated data can feed into the management policy of the educational process (Williamson, 2015). According to those authors, in both cases, these possibilities even mean questioning the relevance of the teacher's action to the evidence and protocols suggested from the data. From a less drastic point of view, the literature has pointed out the need to think about the reality of using technologies in the teaching process, considering that there is no space for reflection on the role of devices, i.e., their functionalities, without problematizing the pedagogical function in the context of teaching (Watson, 2001). Specifically in Physical Education, there is a perception that it is necessary to

Fecha recepción: 04-05-22. Fecha de aceptación: 02-08-22
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think about a co-evolution between emerging technologies that enter the educational scene with other emerging pedagogical practices that can respond to the cultural demands between learners and learning, teachers and teaching, and knowledge and context (Casey, Goodyear & Armour, 2016). In this sense, it is possible to find some research on how the technology is included in the Physical Education curricula (Araújo, Knijnik, & Ovens, 2021; Araújo et al., 2021a) or even if it is related to other languages in Physical Education curriculum (Oliveira et al., 2021).

Despite the increasing curricular insertion of digital technology into initial teacher education, it does not seem to be sufficient, given all the current education challenges (Fantin & Rivoltella, 2012). This fact does not allow Physical Education teachers to feel confident debating and using digital technology in their classes. In general, they wonder if the technology fits into their own learning philosophy, if they are prepared to invest the time and practice to use it, or how they would use it to enhance learning (Burne, Ovens & Philpot, 2018).

In any case, the literature points out that Physical Education teachers admit that technology not only has the potential to be part of their classes but also to optimize the teaching process (Robinson & Randall, 2017; Tinóco & Araújo, 2020) with other pedagogical arrangements such as cooperative learning (Bodsworth & Goodyear, 2017). However, PETE has slowly adhered to implementing technology in its training programs (Wyant, Jones & Bulger, 2015; Wyant & Baek, 2018), even with explicit experiences suggesting specific theoretical positions to promote such an adoption (Krause & Lynch, 2018; Wyant & Baek, 2018). Indeed, we need to think about what teacher education means in the contemporary world (Imbernón, 2009; Fantin & Rivoltella, 2012).

In this context, it is important to consider technology with three dimensions, namely artifacts and devices, practices, and social arrangements or organization forms (Lievrouw & Livingstone, 2006). Selwyn (2011) adapted these three dimensions to the context of education and technology, defining education technology as a relationship between artifacts and devices, activities, and practices and contexts. In simple terms, it is possible to understand education technology as the practice and context in everyday school.

Casey, Goodyear, and Armour (2017), while exploring 13 narrative texts (written by more than 60 authors in eight countries) related to the use of digital technology in Physical Education teaching, concluded that “the traditional concept of Physical Education remained largely intact, with technology acting to reinforce its practices” (p. 255). We believe in continuing teacher education to

change this reality. In this context, Calderón, Meroño, and MacPhail (2020) warned about a lack of research on the use of digital technology in PETE.

In the recent literature, it is possible to find experiences focused on the specific device uses. Neutzling, Pagnano Richardson, and Sheehy (2018) explored the possibilities of using virtual reality in a PETE program. Marron and Coulter (2018) investigated the potential of integrating iPads into the teaching context to enhance learning in PETE. These two studies are instances of what Díaz Barahona, Molina-García, and Monfort-Pañego (2020) call “technocentric teacher education” and are less centered on critical and pedagogic intentionality.

Some studies in Brazil have reflected on digital technologies in PETE. In corroboration with Souza Junior (2018), we highlight two recurring points from these studies: 1) the investigations primarily focus on the debates about the initial PETE, and 2) the studies carry out diagnostic investigations on the dialogue between digital technology and teacher education. These points are also recognized in other Latin-American contexts (e.g., Bernate, Fonseca, Guataquira & Perilla, 2021).

This study aimed to describe and analyze the professional education experience of Physical Education teachers with digital technology concerning the uses and concepts of technology. Describing and analyzing the experience of the continuation of PETE may reveal some factors in the (de)mobilization to use technology. The understanding of the “use of technology” in this study goes beyond technical use. It rather refers to the “systematic access to media concepts and languages, so that teachers can use conceptual and technical tools to understand and re-signify emerging literacies” (Araújo, Oliveira & Souza Júnior, 2019, p. 142).

The study focuses on what we call “Continuing Education Program for Physical Education Teachers” as a kind of professional development. The City Hall of Natal, an 850,000-inhabitant city in Northeastern Brazil, provides Physical Education teachers in public schools with this professional development program which we work with. We have chosen to investigate our local realities and engaged in a comprehensive dialogue among them. We believe that the in-depth knowledge of the continuing teacher education of local teachers can help re-think professional development models in contrast to the reality of others (Ince et al., 2006).

Context and didactic approach of the investigated experience

The study is based on empirical reality, highlighting the different contributions of the investigated participants

in seeking to understand the human being in their social, political, and cultural relations and their productions and symbolic appreciations. This perspective relied on the dialogical cultural action, understanding that it is possible to elaborate a critical reflection on it through dialogue with the subjects who experience reality and promote a reason for it (Freire, 2015).

Given our goals of action and knowledge, we have used action research as a methodological strategy, supported by resolving collective problems through collaborative and participatory processes among the research participants (Kemmis & MacTaggart, 1988; Thiollent, 2011). We have intentionally selected this method to engage us with reality and cause an improvement in a specific scenario (Pérez-Van-Leenden, 2019; Ramírez-Ramírez, Claudio-Martínez & Ramírez-Arias, 2020), using the reflection process as data to the research.

For this purpose, we elaborated an action plan by going through a cyclic process in a spiral composed of four fundamental moments (see Figure 1): 1) planning actions to improve practice; 2) the dialogical actions of this planning; 3) description of the processes and dialogues developed in the course of the actions; and 4) an evaluation of the experience, which sustains a new cycle based on the new problems (Kemmis & MacTaggart, 1988; Tripp, 2005).

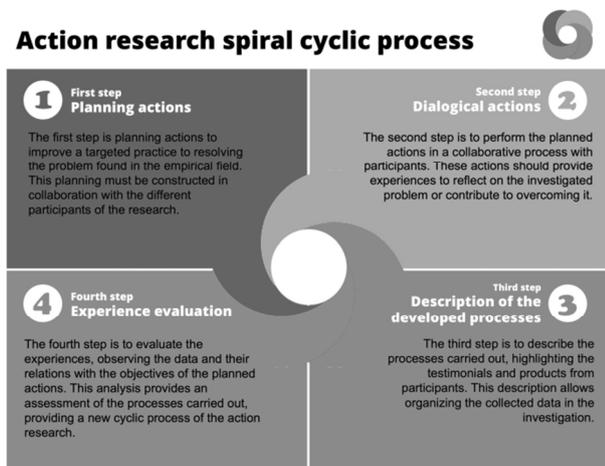


Figure 1. Action research spiral cyclic process

This action research cyclic spiral process guided the entire experience of Continuing Physical Education Teacher Education. In each teacher education meeting, the fundamental moments of action research were used as a guide for interlocution.

Participants’ demographics, formation, and teaching experience

A questionnaire was used as a diagnostic tool for demographics, professional experience, and the use

of technologies. Ninety-three Physical Education teachers from public schools participated in the study, representing 60% of all Physical Education teachers working in the municipal teaching system in Natal (Rodrigues, 2017), but only sixty-two of these teachers (40%) filled out the demographic, formative, professional, and digital consumption characteristics questionnaire (based on the number of participants who attended the first meeting).

The participating Physical Education teachers were 30 female (48.4%) and 32 male (51.6%). Most teachers were between 31 and 45 years old. Most of the teachers graduated in the first decade of the 2000s (66%) and have six to fifteen years of experience in Physical Education teaching (71%). Regarding academic qualification, 8% have a Master’s degree in Physical Education or Education. Figure 2 shows detailed data about participants’ training.

Detailed data about participants’ formation and teaching experience (n=62)

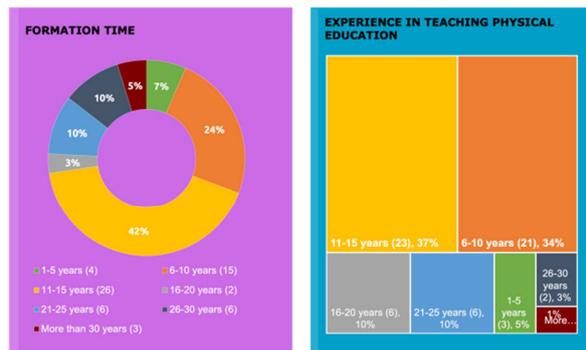


Figure 2. Detailed data about participants’ formation and teaching experience

Most of the participating teachers (74%) had no previous contact with debates about media, communication, or digital technologies in academic formation. These debates were not present in their teacher education curricula (Araújo et al., 2021b; Araújo et al., 2022). In this sense, it is important to present the relationship of these teachers with digital technology in their personal and professional daily lives.

Use of technologies

Most of the participating teachers have daily access to the Internet (77%), mainly through their smartphones and notebooks. All of them have e-mails, and most of them use social networks such as Facebook, WhatsApp, and Youtube on a daily basis (see Figure 3). Other social networks such as Twitter and Instagram are little used. WhatsApp is the teachers’ most used social network.

Social media used by participants (n=62)

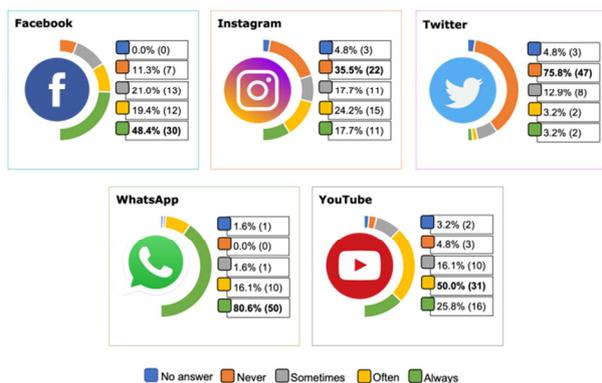


Figure 3. Social media used by participants

This information helped us to understand the centrality of smartphones in the lives of these teachers. Social networks with high usage frequency (“often” or “always”) are associated with mobile devices. In addition to social networks, we have identified the main digital information sources for these teachers. Scientific blogs and magazines are rarely used. On the other hand, online newspapers, magazines, and forum sites are more frequently used.

Other technological devices were investigated for expanding the reflection. We found that TV is a daily device in the lives of these teachers, which does not differ from 77% of the Brazilian population who watch TV every day of the week, as presented by Brazilian Media Research (Brasil, 2016). On the other hand, 79% of the participating teachers never or rarely use video games.

Regarding the school environment, the participating teachers reported that video games, tablets, and cameras are absent in schools. All schools have computers, but not all have access to the Internet. These computers are used by a third of the teachers in their classes. However, DVDs, speakers, and TVs are the devices with the most significant presence in the pedagogical practices of these teachers, which corroborates the data from Fantin’s study (2010) on the use of technologies by teachers in schools.

The Continuing Education Program for Physical Education Teachers

The Continuing Education Program for Physical Education Teachers was launched in 2009 as part of a public policy in Natal. It aims to promote actions to improve the quality of teaching and learning of students in elementary education and the development of educational and pedagogical assessments for different curriculum contents (Natal, 2010).

In 2014, a team of Physical Education teachers was created to organize and promote the meetings of the continuing education program. Since then, the program

has been held annually with themes emerging from the professional reality of Physical Education teachers (Rodrigues, 2017). It is worth mentioning that the participation of Physical Education teachers in this continuing education program is voluntary.

The subject of digital technology emerged from teachers’ concerns highlighted in an evaluation of the continuing education program carried out in 2015. This evaluation enabled the dialogue between the organizing team of the continuing education program with academic researchers¹ to reflect on digital technology. From April to December 2016, seven meetings on digital technology in the context of Physical Education were held. Figure 4 presents detailed information about these meetings.

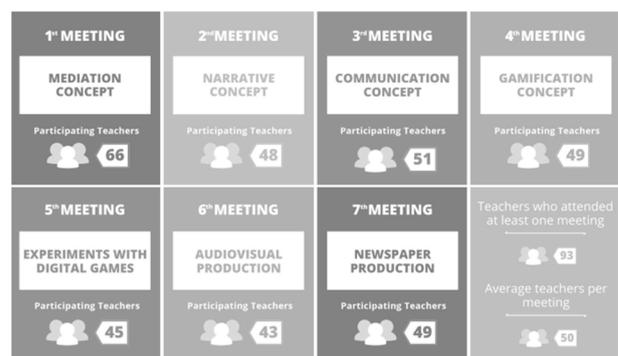


Figure 4. Teacher education meetings

Each meeting had a “generating concept” to guide continuing education (Freire, 2015). It was drawn from an analysis of the different assessments from the previous meeting at each closing of the action research cycle, thus opening a new spiral process. The first “generating concept” was developed based on the evaluation of the continuing education program in 2015 and the teachers’ statements about the students’ lack of interest in participating in their classes, with an alleged justification related to the use of digital technology.

Information sources and analysis

During the meetings, we used three strategies to collect information: 1) the questionnaire used as a diagnostic tool for demographics, professional experience, and the use of technologies; 2) our observation of participants, enabling the elaboration of field notes; and 3) preparation of individual and collective products by participants in the meetings. This resulted in the following products: collective textual syntheses, speeches in audiovisual productions, digital narratives, and testimonials written by teachers. We emphasize that participants have authorized

1. The researchers are from the Physical Education Department of the Federal University of Rio Grande do Norte, Natal, Brazil.

the collection and use of these data by signing a consent form and clarifying the use of their data.

Based on the descriptive analysis, this analytical path allowed the development of two categories of analysis to reflect on the (de)mobilization of participants concerning the use of digital technology (Charlot, 2000): extrinsic and intrinsic factors (Ertmer, 1999; Burne, 2017).

Main results

Research dialogues: concepts in action and other forms

The first Physical Education teacher education meeting took place in April 2016. One of the activities proposed at that meeting was to create a map of meanings about professional performance in Physical Education related to technology. While the teachers narrated their reflections, one of them created keywords using hashtags (#) to highlight the main point presented. The participating teachers acknowledged that digital technologies change school space and time, posing new challenges for pedagogical practices. Among the prominent examples, these teachers alleged that smartphones would cause students to lack interest in participating in their classes.

We also brainstormed ideas based on the following question: how do media and technologies permeate schools, classes, and students? This enabled consolidating the first generating concept: *mediation*. Each teacher responded to this provocation on a piece of cardboard, which was later organized in two circles to connect (using a rope) the different answers, forming a large network of knowledge demonstrating the different interpretations these teachers had during the proposed dynamic.

We highlight here some of these narratives²:

WhatsApp has been a fantastic tool for this communication about sports with kids, about competitions, with weather information [...]. But what I see is just that, on social media and selfies with teenagers [...]. (GGB, 2016)

[...] the difficulty is that we can ... compete, in fact, right; I don't know if competing is the proper term but sharing space with technologies or even integrating them into our classes. So, it's quite a challenge!! (KLGs, 2016)

We obtained ten collective syntheses carried out by teacher groups, which raised the recognition of the presence of technology in schools and its pedagogical potential in school Physical Education. However, some syntheses highlighted the need to consider how this approach can occur, while others warned about the need for a critical understanding of this topic. Gleddie et al. (2017) pointed out that teachers should be encouraged to be critical in

their use of social media, with continuous reflection and awareness of such an impact on students' life.

At the end of this meeting, we proposed producing collective audiovisual recordings on the same question. As a synthesis of the different evaluations of the meeting participants, we reached the concept of narrative as a proposal for dialogue in the subsequent meeting. This concept was established based on the different forms of expression used in the first meeting and the difficulties in creating them. Figure 5 depicts the first action research spiral.

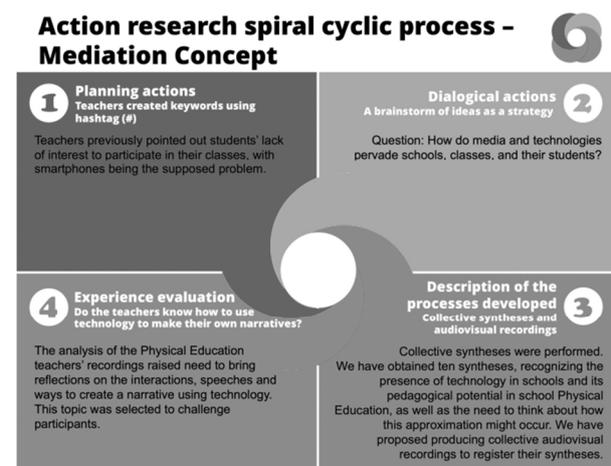


Figure 5. Action research spiral – Mediation concept

In the second cycle of continuing Physical Education teacher education, we proposed to elaborate a reflection and action on sports narratives based on the narrative concept and contextualized by the sports agenda of the 2016 Summer Olympics.

We first evaluated two audiovisual narratives of the Olympic Games that presented the event's history from different perspectives. These two ways of narrating the same sporting event triggered the possibility of reflecting on the construction of different speeches and ways to express the sporting phenomenon. We produced digital narratives from this debate. We proposed creating comics using the "Comic Strip It!" application³, and the teachers collectively constructed 26 digital narratives constructed. In these productions, we could see historical facts related to the Olympic Games, technical descriptions of some Olympic events, training routines for athletes, incorporation of comic elements in productions, and the detachment from the proposed theme, using the context of continuing teacher education to create reflective narratives.

Among the 26 digital narratives, one was highlighted as problematic by our collective assessment. It consisted

2. We use the initials of the teachers' names to ensure their anonymity in testimonials.

3. Available for Android at the Google Play Store: <https://play.google.com/store/apps/details?id=com.roundwoodstudios.comicstripit>

of a single comic strip in which a teacher in initial training (responsible for clarifying the participants' application mechanics) was saying: "Did they understand? Anyway, it is better to smile ..." (see Figure 6).



Figure 6. A comic strip produced in one of the meetings (translation: "Did they understand? Anyway, it is better to smile.")

At that time, it was clear that we acted antagonistically to our initial proposal. As a group of teachers reported, there was no dialogue, but a monologue, a linear teaching stance, or an anti-dialogic posture (Freire, 2015). This learning context was not what the Continuing Education Program for Physical Education Teachers believed, and maybe the focus on the application instructions could have led to an anti-dialogic attitude. The proposal thinks it is essential to "incorporate a dialogical approach to the design of professional development to enable participants to explore and deconstruct their beliefs, values, and experiences" (Meir, 2020, p. 14).

In this context, the concept generated for the next meeting was *communication*. Figure 7 depicts the second action research spiral.

This third action research spiral started with presenting the digital narratives produced in previous meetings, highlighting the production that triggered the newly generated concept. Several activities were then developed problematizing the communication structures, such as the relationship between the sender and the transmitter of the information and the noise caused in these processes.

The experience with some problematic situations was promoted by allowing possibilities for reflection on the communication concept. These activities challenged

Action research spiral cyclic process - Narrative Concept

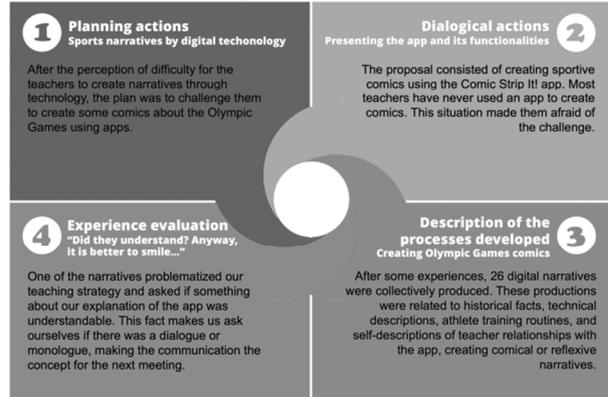


Figure 7. Action research spiral – Narrative concept

teachers to communicate using another language code, such as emoticons and virtual movement (motion sensors) in different games. After the experiments, we collected seven groups of testimonials from the participating teachers. They declared some difficulty in communicating while playing, as they were not allowed to use oral language.

Given this context, we highlight some of these narratives:

I didn't understand the language, I thought it was the fighter who was winning, but I was losing. (MLPB, 2016)⁴

Mimicry and other expressions of information enriched the possibility of thinking about creative didactic actions, linked to the construction of Physical Education knowledge.⁵

During the evaluation of the meeting, we identified that the participants positively mentioned the experiences with digital games (boxing and athletics). This appeals to the ludic experience promoted by digital games, pointing to the next generating concept: *gamification*. Figure 8 depicts the third action research spiral.

Action research spiral cyclic process - Communication Concept

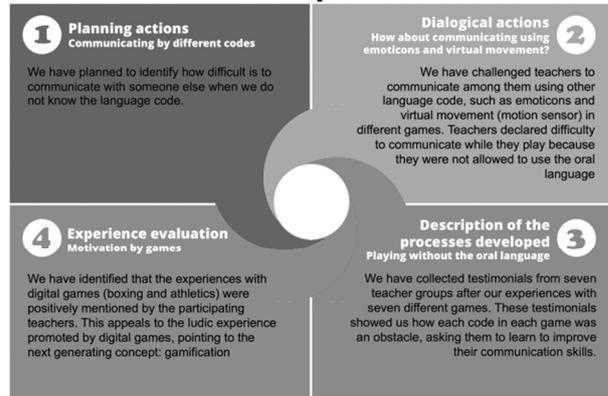


Figure 8. Action research spiral – Communication concept

4. Speech from a participant registered by the researchers in the field notes.

5. Text taken from one of the teachers' written testimonies.

The “Pokémon Go” game⁶ gained attention from the media during the planning of the subsequent meeting. We noticed that many teachers were wary since they did not recognize the pedagogical relevance of the topic.

In the fourth action research spiral, we evaluated two reports from different perspectives (negative and positive) about the digital game to start reflections. After the debates, we created a body experience inspired by the scenario and dynamics of the Pacman classic game, designing our space through a maze made with school chairs.

In addition to the possibility of transposing a digital game into an embedded experience, we have created other games incorporating gamification elements inspired by role-playing games (RPGs) by creating and using cards and characters to acclimate our proposed challenges in class.

While evaluating this meeting, we identified different positive narratives. In a written testimonial, teachers requested “do another training with gamification, augmented reality, virtual reality.” This return points to the possible meanings these teachers dialogued with digital technology through these generating concepts. Figure 9 depicts the fourth action research spiral.

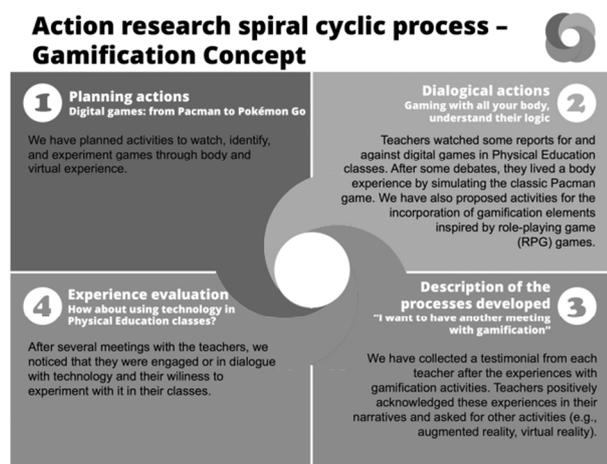


Figure 9. Action research – Gamification concept

The next three meetings were conducted by teachers who had successful experiences with different forms of technology (digital games, audiovisual production, simulation of the publication of a news program on TV, and production of printed newspapers). After these meetings, teachers who participated in the Continuing Education Program for Physical Education Teachers demonstrated a greater sensitivity to using technology. Even though we do not believe in investing in a specific media or particular device to develop this continuing education program, we positively evaluated these last meetings because teachers already

expressed more critical expressions of the experiences based on the concepts we previously worked on.

Results to think new actions

The analysis categories of digital technology activation

From the teachers’ diagnosis and the experienced dialogues, and agreeing with Fantin and Rivoltella (2012), we reached the following considerations: having digital devices available does not imply their pedagogical activation in professional performance contexts. Different authors helped interpret our experience and construct analysis categories to understand this non-activation.

Contributions from Ertmer (1999) regarding the first and second-order barriers to activating technologies in education and the re-significance for the Physical Education context proposed by Burne (2017) introduce the debate on extrinsic and intrinsic factors influencing teachers on implementing digital technologies in their classes. In addition to these references, Charlot’s contributions (2000) on mobilization in the relations between knowledge were significant for elaborating our analysis categories. Extrinsic and intrinsic factors were identified from Physical Education teachers who (de)mobilized digital technology activation in their education process.

Extrinsic factors

The extrinsic factors to teachers were explained at different moments during the experiments as elements that distanced the possibilities of digital technology activation in the pedagogical practices of school Physical Education. This is mainly evidenced in three information sources gathered during the meetings with the teachers: in their discourses given during the meetings, in the performed productions, and from the evaluation sheets held at the end of each session. Three trends were identified in reading these experiences concerning the extrinsic factors that demobilized teachers: 1) infrastructure and devices available in schools; 2) the pedagogical time for planning; and 3) the support of the school’s pedagogical organization.

Infrastructural problems related to the availability of materials and technological devices for pedagogical uses appear in the teachers’ speeches and productions as a demobilizer of digital technology activation in their pedagogical practices. We saw several examples of this problem in the productions carried out during the meetings. This tendency was presented as a demobilizer in the meeting with the narrative concept. In one of the comic book productions, teachers reported liking the experience of producing digital narratives about the Olympic Games and the possibilities of use in their classes. However, they

6. Available online at <https://pokemongolive.com/en/>.

became demobilized by acknowledging the unavailability of digital devices in their schools to develop this activity.

Extrinsic elements also appeared in the teachers' written testimonials in the different meetings. Of 262 written testimonials, 20 announced this tendency, mainly in speeches that point to the distant realities of the schools where they work from the possibilities of digital technology in Physical Education.

The second tendency of extrinsic factors to teachers is related to the pedagogical time for organizing and planning the proposals for conducting this dialogue. This timidly appears in the teachers' speeches, with only one announcement noticed in the written testimonials in the mediation concept meeting. The difficulty is: "Trying to reconcile [these possibilities] in our day-to-day." This comment relates to the distribution of education professionals' pedagogical time. In our analysis, this tendency masks a problem of public education in Brazil. Teachers often are under working conditions with low salaries (that makes them have several other professional bonds), a workload distribution that disregards planning and evaluation as pedagogical activity, and the constant onslaught for revoking granted professional rights.

Nóvoa (2009) considers the school space and time an important training environment. According to Tardif (2002), one of the primary knowledge sources for the teachers' professional activity is the awareness of their own daily teaching experience. However, if these pedagogical spaces and times are inflated, stressful, bureaucratic, etc., the reflection moments about their own performance become unfeasible. In our case, this can augment the demobilization of digital technology.

Finally, the school support and pedagogical organization emerged as another tendency of extrinsic factors to teachers that demobilize activating digital technology in practice. In one of the teachers' testimonials, we noticed the following reference to the possibilities of digital media in school: "Very interesting, however, out of our reality. The principal does not let students use cell phones."

During these meetings, it was evident that teachers used infrastructure elements such as access to the Internet and the availability of digital devices to justify their demobilization to trigger digital technology activation in their pedagogical practices. However, some reflections on the extrinsic factors are relevant here. Fantin and Rivoltella (2012) verified that there is no direct relation between better infrastructure conditions and access to devices in schools with the use of technologies by teachers in their classes.

Along these lines and corroborating Burne (2017) and Li et al. (2015), the problem is not only contained in extrinsic factors to teachers. Having good infrastructure and support of pedagogical managers do not imply mobilization for

activating digital technology in school Physical Education, nor does it seem to be a pedagogical condition for these devices. However, regarding the trend in pedagogical time for planning, we believe that it will be conditioned, but it is not characterized as a determinant for mobilization. The intrinsic factors are evidenced on this path.

Intrinsic factors

Intrinsic factors have also been identified throughout our experiences with the participating teachers through productions, assessments, and especially in their speeches. Our analysis identified the three trends presented by Burne (2017). The first one comprises aspects related to mastering technological and media forms (corresponding to the use of devices), such as consumption and production in the digital language and the approximation with digital technology considering the contexts of use. The second trend is related to the teaching perspectives and concepts. The third one involves the belief concerning digital technology as a possibility in its pedagogical performance.

Our initial diagnosis revealed the low familiarity of participating teachers with some devices, such as videogames, digital whiteboards, camcorders, and tablets. This diagnosis is consistent with the observations, such as the difficulty of technically dealing with producing photos and videos. The lower the teachers' familiarity with the devices, the less their technical creativity in capturing and editing the images. Nonetheless, many teachers have sought to risk and incorporate digital technology in the face of difficulties.

The difficulties in mastering the digital language sometimes were triggers for mobilizing learning. We identified this perception in one of the teachers' written testimonials: "I hope to enjoy a lot during the course because I have a lot of difficulty and doubts to use some media in the school where I work." There is an acknowledgment of not being able to use digital forms, but this factor does not necessarily imply either mobilization or demobilization (Charlot, 2000).

The second perspective regarding intrinsic factors consists of understanding and conceptions about teaching teachers, which include debates on the role of Physical Education in the school context and representing a model of professional identity, characterized by the teacher-student relationship and structuring of the knowledge of the area. The teachers' speeches on these perspectives laid on the paradigm of "movement as displacement," criticizing any possibility of bodily experience of contemplation or any other way of thinking about the relation between body, movement, and the world. The centrality of these discourses is based on the need for displacement as a possibility of overcoming the sedentary lifestyle or good performance in sports practices. However, the speeches pointing to this

path establish a contradiction and are used as arguments that guide culture as an essential foundation for thinking of the human movement. Problems are raised amid these contradictions, presenting discourses that delegitimize possibilities of experiences that dialogue with the digital forms and seeking approximations to the students' culture.

In a comic book created by the teachers, some teachers reaffirm this reading on the teaching understanding of Physical Education. Two participating teachers established a dialogue in which the first teacher asked: "Do you do any Olympic sport?". In the second frame, the other teacher answers: "Yes, I am playing table tennis...". In the final frame, the first teacher states: "But it doesn't count on the cell phone!" After discussing these narratives with the different participants, we identified a concept of Physical Education centered on movement, without considering the meanings of movement.

This concept of Physical Education implied resistance to the possibilities of dialogues with digital technology. Burne (2017) identified a similar fact in his research: Physical Education teachers who incorporate digital technologies in their pedagogical practices have an approach that centrally places the students in their teaching concept. On the contrary, there is greater resistance when the student is not central. This is the case in our study, in which the centrality is in the displacement and not the student who moves.

The belief in digital technology as a pedagogical possibility in school Physical Education can be allied to these teaching concepts. It is reasonable to think of this tendency from the relations with knowledge, as Charlot (2000) defends. Enchantment plays an important role in mobilizing knowledge-related subjects and satisfying a desire that produces pleasure and gives meaning to the relationships themselves (Charlot, 2005).

In situations these teachers do not believe in the contribution of this dialogue, there will be no mobilization for the relation of knowledge but a demobilization. A single example happened at the gamification meeting due to the "Pokémon Go!" game, in which a teacher was very reactive to the theme. We realized that such a denial came from religious beliefs that created a resistance factor, demobilizing any possible relationship with the proposal.

At the same meeting, a teacher expressed discontent when discussing this digital game. This resistance based on intrinsic factors was put into internal debates by this teacher throughout the session. In its words: "I left with this uneasiness." However, this teacher eventually developed a successful experience from "Pokémon Go!" in the dialogue with traditional games. The difference we observed for such a modification in the relationship with the "Pokémon Go!" game is present in the reflection carried out by this teacher, starting from the uneasiness mobilized by the

education meeting and placing the students as the center of their professional performance. Teaching concept tendencies and beliefs in digital technology as a possibility are intrinsic factors in dialogue regarding (de)mobilizing the teachers for knowledge incorporation.

Therefore, we can see that different extrinsic and intrinsic factors concerning the teachers re-signified the problem of this experience. We emphasize the relevance of the subjective elements of the intrinsic factors as powers of (de)mobilization in the activation of digital technology by Physical Education teachers.

Final remarks

We can consider that this dialogue contributed to teachers' training, facing the problem of using technology and reaching our action objectives, experiencing experiences, and discussing and problematizing some aspects of digital technology in training and professional performance. During the meetings, we identified the consumption and uses of digital technology in both the personal and professional daily lives of these teachers. We also understood the relationships of digital technology in continuing teacher education and the understanding of the processes of incorporating digital technology.

By focusing on incorporating digital technology, we have identified the following main factors for strengthening this mobilization: 1) the concept of teaching; 2) the belief in digital technology as a possibility to relate to Physical Education; and 3) the pedagogical time for planning. These factors are also highlighted by other research. While identifying the perception of school Physical Education teachers concerning using a digital educational resources (DERs) platform, Cavalcante and Araújo (2022) realized that they believe that quickly locating available resources helps them in the planning time. There are also experimental ways to teach Physical Education considering the intersectionality factors of conditions for school Physical Education, such as family and the community (Webster et al., 2021), which are elements that strongly affect our concept of teaching and beliefs on digital technology use.

The most significant contrast of this formative experience regarding existing research is that we did not make only a diagnosis on the use of digital technology with Physical Education teachers (like Lee & Gao, 2020) nor propose a specific experimental teaching way (like Krause & Lynch, 2018). Instead, we built a teacher education experience with Physical Education teachers based on their struggles, beliefs, and pedagogical practice possibilities.

The highlighted factors are problematized as the training proposals provide pedagogical experiences as spaces for reflection and teaching practice times. Focusing

on continuing teacher education in digital devices seems to be a mistake, given that technology is not only about devices but also social practices and the involved context. From our experience, professional development should be collaboratively built so teachers can understand and use digital technology. Considering the recent COVID-19 pandemic situation, when teachers compulsively used digital technology to teach (Silva et al., 2021; Araújo & Ovens, 2022; Leite et al., 2022), improving our way of promoting continuing Physical Education teacher education becomes more important. We hope the next steps after the pandemic draw more attention to how teachers are involved or mobilized to use technology than just offering technology devices to them.

Acknowledgements

«This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil (CAPES) – Finance Code 001».

References

- Araújo, A.C., Oliveira, M.R., & Souza Júnior, A. (2019). Formação de professores de Educação Física e usos de conceitos do campo comunicacional para pensar o ensino [Physical Education teacher education and uses of concepts from the communication field to think about teaching]. *Comunicação & Educação*, 24(1), 141-153. doi:10.11606/issn.2316-9125.v24i1p141-153.
- Araújo, A.C., Silva, J.F., Knijnik, J., & Ovens, A.P. (2021a). Mídia e tecnologia no currículo de Educação Física: um estudo exploratório em diálogo internacional [Media and technology in Physical Education curriculum: an exploratory study in an international dialogue]. *Currículo sem Fronteiras*, 21(3), 1768-1785. doi:10.35786/1645-1384.v21.n3.39.
- Araújo, A.C., Carvalho, M.E.P., Ovens, A.P., & Knijnik, J. (2021b). Competências digitais, currículo e formação docente em Educação Física [Digital competencies, curriculum, and teacher education in Physical Education]. *Revista Brasileira de Ciências do Esporte*, 43, e002521. doi:10.1590/rbce.43.e002521.
- Araújo, A.C., Knijnik, J., & Ovens, A.P. (2021) How does Physical Education and Health respond to the growing influence in media and digital technologies? An analysis of curriculum in Brazil, Australia and New Zealand. *Journal of Curriculum Studies*, 53(4), 563-577. doi:10.1080/00220272.2020.1734664.
- Araújo, A.C., Ovens, A.P., & Knijnik, J. (2022). Developing digital competency in HPETE: a heuristic for and analysis of three programs in the Southern Hemisphere. *Curriculum Studies in Health and Physical Education*, doi:10.1080/25742981.2022.2072229.
- Araújo, A.C., & Ovens, A. (2022). Social distancing and Physical Education teaching: strategies, technologies, and new learning. *Movimento*, 28, e28017. doi:10.22456/1982-8918.122671.
- Armour, K., Goodyear, V.A., & Sandford, R. (2020). The digital age challenge. In A. MacPhail, & H. Lawson (Eds.). *School Physical Education and teacher education: Collaborative redesign for the 21st Century* (pp. 92-102). New York: Routledge.
- Bernate, J., Fonseca, I., Guataquira, A., & Perilla, A. (2021). Competencias digitales en estudiantes de Licenciatura en Educación Física [Digital Competences in Physical Education licenciate students]. *Retos*, 41, 310-318. doi:retos.v0i41.85852.
- Bodsworth, H., & Goodyear, V.A. (2017) Barriers and facilitators to using digital technologies in the Cooperative Learning model in Physical Education. *Physical Education and Sport Pedagogy*, 22(6), 563-579. doi:10.1080/17408989.2017.1294672.
- Brasil, Secretaria Especial de Comunicação Social. (2016). *Pesquisa Brasileira de Mídia 2016: Hábitos de consumo de mídia pela população brasileira* [Brazilian Media Survey 2016: Media consumption habits by the Brazilian population]. Brasília: Secom.
- Burne, G. (2017). *Moving in a virtual world: A self-study of teaching Physical Education with digital technologies* (Master's thesis, University of Auckland, Auckland, New Zealand). Retrieved from <http://hdl.handle.net/2292/34894>.
- Burne, G., Ovens, A., & Philpot, R. (2018). Teaching Physical Education with digital technologies: a self-study of practice. *Revista Brasileira de Educação Física Escolar*, IV(2), 93-108.
- Calderón, A., Meroño, L., & MacPhail, A. (2020). A student-centred digital technology approach: The relationship between intrinsic motivation, learning climate and academic achievement of physical education pre-service teachers. *European Physical Education Review*, 26(1), 241-262. doi:10.1177/1356336X19850852.
- Casey, A., Goodyear, V.A., & Armour, K.M. (2016). Rethinking the relationship between pedagogy, technology and learning in Health and Physical Education. *Sport, Education and Society*, 22(2), 288-304. doi:10.1080/13573322.2016.1226792.
- Casey, A., Goodyear, V.A., & Armour, K.M. (2017). *Digital technologies and learning in Physical Education: pedagogical cases*. London: Routledge.
- Castells, M. (1999). *A sociedade em rede* [The networked society]. São Paulo, Brazil: Paz e Terra.
- Cavalcante, E., & Araújo, A.C. (2022). Digital educational resources in school Physical Education: an exploratory study on the MEC RED platform. *Motriz*, 28, e10220002222. 10.1590/S1980-6574202200002222.
- Charlot, B. (2000). *Da relação com o saber: elementos para uma teoria* [Relationship with knowledge: elements for a theory]. Porto Alegre: Artmed.
- Charlot, B. (2005). *Relação com o saber, formação dos professores e globalização: questões para a educação hoje* [Relationship with knowledge, teacher education, and globalization: issues for education today]. Porto Alegre: Artmed.
- Díaz Barahona, J., Molina-García, J., & Monfort-Pañego, M. (2020). El conocimiento y la intencionalidad didáctica en el uso de TIC del profesorado de educación física [Physical education teachers' knowledge and educational intentionality on the use of ICT] *Retos*, 38, 497-504. doi:10.47197/retos.v38i38.74370.
- Ertmer, P.A. (1999). Addressing first- and second-order barriers to change: strategies for technology integration. *Educational Technology, Research and Development*, 47(4), 47-61. doi:10.1007/BF02299597.
- Fantin, M. (2010). Dos consumos culturais aos usos das mídias e tecnologias na prática docente [From cultural consumption to the use of media and technology in teaching practice]. *Motrivência*, 22(34), 12-24. doi:10.5007/%25x.
- Fantin, M., & Rivoltella, P.C. (2012). *Cultura digital e escola: pesquisa e formação de professores* [Digital culture and school: research and teacher education]. Campinas: Papirus.
- Freire, P. (2015). *Pedagogia do oprimido* [Pedagogy of the oppressed]. Rio de Janeiro: Paz e Terra.
- Gard, M. (2014). eHPE: a history of the future. *Sport, Education and Society*, 19(6), 827-845. doi:10.1080/13573322.2014.938036.

- Gledie, D., Feith, J., Howe, P.D., Larsson, H., Cale, L., & Casey, A. (2017) Joey: social media as a tool for professional development. In A. Casey, V.A. Goodyear, & K. M. Armour (Eds.). *Digital technologies and learning in Physical Education: pedagogical cases* (pp. 121-136). London: Routledge.
- Goodyear, V.A., Armour, K. M., & Wood, H. (2018). *The impact of social media on young people's health and wellbeing: Evidence, guidelines and actions*. Birmingham, United Kingdom: University of Birmingham.
- Hjarvard, S. (2014). Mediatization: conceptualizing cultural and social change. *MATRIZES*, 8(1), 21-44. doi:10.11606/issn.1982-8160.v8i1p21-44.
- Imbernon, F. (2009). *Formação permanente do professorado: novas tendências* [Ongoing teacher education: new trends]. São Paulo: Cortez.
- Ince, M.L., Goodway, J.D., Ward, P., & Lee, M-A. (2006). The effects of professional development on technological competency and the attitudes urban Physical Education teachers have toward using technology. *Journal of Teaching in Physical Education*, 25(4), 428-440. doi:10.1123/jtpe.25.4.428.
- Lee, J.E., & Gao, Z. (2020). Effects of the iPad and mobile application-integrated physical education on children's physical activity and psychosocial beliefs. *Physical Education and Sport Pedagogy*, 25(6), 567-584, doi:10.1080/17408989.2020.1761953.
- Kemmis, S., & MacTaggart, R. (1988). *Cómo planificar investigación acción* [How to plan action research]. Barcelona: Laertes D.L.
- Krause, J.M., & Lynch, B.M. (2018). Faculty and student perspectives of and experiences with TPACK in PETE. *Curriculum Studies in Health and Physical Education*, 9(1), 58-75. doi:10.1080/25742981.2018.1429146.
- Leite, L.S.G.P., Costa, A.Q., Oliveira, M.R.R., & Araújo, A.C. (2022) Physical Education remote teaching in narrative: on the ruptures and learning in experiences with technology. *Movimento*, 28, e28022. doi:10.22456/1982-8918.122440.
- Lévy, P. (1999). *Cibercultura* [Cyberculture]. São Paulo: Editora 34.
- Li, L., Worch, E., Zhou, Y., & Aguiton, R. (2015). How and why digital generation teachers use technology in the classroom: an explanatory sequential mixed methods study. *International Journal for the Scholarship of Teaching and Learning*, 9(2), 1-9. doi:10.20429/ijstl.2015.090209
- Lievrouw, L.A., & Livingstone, S. (2006). *Introduction to the Updated Student Edition*. In L.A. Lievrouw & S. Livingstone. (Eds.). *Handbook of new media: Social shaping and social consequences of ICTs, Updated Student Edition* (pp. 1-14). London: Sage. doi:10.4135/9781446211304.n1.
- Lupton, D. (2015). Data assemblages, sentient schools and digitised Health and Physical Education (response to Gard). *Sport, Education and Society*, 20(1), 122-132. doi:10.1080/13573322.2014.962496.
- Marron, S., & Coulter, M. (2018). *Experiences of using iPads in Physical Education teacher education*. In Koekoek, J. & Hilvoorde, I. V. (Eds.) *Digital Technology in Physical Education: Global Perspectives* (pp. 242-256). London: Routledge.
- Meir, D. (2022) A qualitative systematic review of critical pedagogy in Physical Education and sport for development: exploring a dialogical and critical future for sport for development pedagogy. *Sport, Education and Society*, 27(3), 300-319, doi:10.1080/13573322.2020.1825934.
- Neutzing, M., Pagnano Richardson, K., & Sheehy, D. (2018). *Harnessing the power of virtual reality simulation in Physical Education teacher education*. In Koekoek, J. & Hilvoorde, I. V. *Digital Technology in Physical Education: Global Perspectives* (pp. 225-241). London: Routledge.
- Nóvoa, A. (2009). Para una formación de profesores construida dentro de la profesión [For a teacher education built within the profession]. *Revista de Educación*, 350, 203-218.
- Oliveira, N.D., Sousa, D.Q.O, Souza Júnior, A.F., Silva, R.M., & Araújo, A.C. (2021). Linguagens e Educação Física na BNCC: uma análise a partir das habilidades prescritas. *Revista Brasileira de Ciências do Esporte*, 43, e004421. doi:10.1590/rbce.43.e004421.
- Pérez-Van-Leenden, M. (2019). La investigación acción en la práctica docente. Un análisis bibliométrico (2003-2017) [Action-research in teacher practice: A bibliometric analysis (2003-2017)]. *Magis, Revista Internacional de Investigación en Educación*, 12 (24), 177-192. doi:10.11144/Javeriana.m12-24.ncev.
- Ramírez-Ramírez, L.N., Claudio-Martínez, C., & Ramírez-Arias, V. (2020). Usabilidad de las TIC en la enseñanza secundaria: Investigación-acción con docentes y estudiantes de México [Usability of TICs in secondary school: Action-research with teachers and students in Mexico]. *Revista Científica Hallazgos21*, 5(1), 85-101.
- Rodrigues, W. (2017). *Formação continuada em Educação Física: um estudo sobre a proposta do município do Natal/RN* [Continuing education in physical education: a study about the proposal of Natal / RN]. (Master's thesis, Universidade Federal do Rio Grande do Norte, Natal, Brazil). Retrieved from <https://repositorio.ufrn.br/handle/123456789/24759>.
- Robinson, D.B., & Randall, L. (2017). Gadgets in the gymnasium: Physical Educators' use of digital technologies. *Canadian Journal of Learning and Technology*, 43(1), 1-21. doi:10.21432/T24C82
- Selwyn, N. (2011). *Education and technology: key issues and debates*. London: Continuum.
- Silva, A.J.F., Silva, C.C., Tinóco R.G., Araújo, A.C., Venâncio, L., Sanchez Neto, L., Freire, E.S., & Conceição, W.L. (2021). Dilemmas, challenges and strategies of Physical Education teachers-researchers to combat Covid-19 (SARS-CoV-2) in Brazil. *Frontiers in Education*, 6, 583952. doi:10.3389/educ.2021.583952.
- Souza Junior, A.F. (2018). *Os docentes de Educação Física na apropriação da cultura digital: encontros com a formação continuada* [Physical Education teachers in the incorporation of digital culture: encounters with continuing education]. (Master's thesis, Universidade Federal do Rio Grande do Norte, Natal, Brazil). Retrieved from <https://repositorio.ufrn.br/handle/123456789/25367>.
- Tardif, M. (2002). *Saberes docentes e formação profissional* [Teaching knowledge and professional education]. (5th ed). Petrópolis: Vozes.
- Thiollent, M. (2011). *Metodologia da pesquisa-ação* [Action research methodology]. São Paulo: Cortez.
- Tinóco R.G., & Araújo A.C. (2020) Concepção crítico-emancipatória e mídia-educação: uma interlocução possível à Educação Física escolar [Critical-emancipatory conception and media-education: a possible dialogue for school Physical Education]. *Revista Brasileira de Ciências do Esporte*, 42, e2068. doi:10.1590/rbce.42.2020.0037
- Tripp, D. (2005). Pesquisa-ação: uma introdução metodológica [Action research: a methodological introduction]. *Educação e Pesquisa*, 31(3), 443-466. doi:10.1590/S1517-97022005000300009
- Watson, D.M. (2001). Pedagogy before technology: Re-thinking the relationship between ICT and teaching. *Education and Information Technologies*, 6(4), 251-266. doi:10.1023/A:1012976702296.
- Webster, C.A., D'Agostino, E., Urtel, M., McMullen, J., Culp, B., Egan Loiacono, C.A., & Killian, C. (2021). Physical Education in the COVID Era: Considerations for online program delivery using the Comprehensive School Physical Activity Program Framework. *Journal of Teaching in Physical Education*, 40(2), 327-336. doi:10.1123/jtpe.2020-0182.
- Williamson, B. (2015). Algorithmic skin: Health-tracking technologies, personal analytics and the biopedagogies of digitized Health and Physical Education. *Sport, Education and Society*, 20(1), 133-151. doi:10.1080/13573322.2014.962494
- Wyant, J., & Baek, J. (2018). Re-thinking technology adoption in Physical Education. *Curriculum Studies in Health and Physical Education*, 10(1), 3-17, doi:10.1080/25742981.2018.1514983.
- Wyant, J.D., Jones, E.M., & Bulger, S.M. (2015) A mixed methods analysis of a single-course strategy to integrate technology into PETE. *Journal of Teaching in Physical Education*, 34(1), 131-151. doi:10.1123/jtpe.2013-0114.