Sports Humanities

Digital educational resources in school physical education: an exploratory study on the MEC RED platform

Everton Cavalcante[1], Allyson Carvalho de Araújo[2]

[1]*Universidade Federal do Rio Grande do Norte, Instituto Metrópole Digital, Natal, RN, Brazil;*
[2]*Universidade Federal do Rio Grande do Norte, Departamento de Educação Física, Natal, RN, Brazil.*

Associate Editor: Angelina Zanesco. [1]Universidade Metropolitana de Santos, Faculdade de Medicina, Santos, SP, Brazil; [2]Universidade Estadual Paulista "Júlio de Mesquita Filho", Departamento de Educação Física, Instituto de Biociências, Rio Claro, SP, Brazil. E-mail: angelina.zanesco@unesp.br.

Abstract - Aim: This work aims to identify the perception of school Physical Education teachers concerning the use of a digital educational resources (DERs) platform. **Methods:** An exploratory study was carried out with nine Physical Education teachers from different locations and teaching systems in Brazil. These teachers used some functionalities offered by MEC RED, a DERs platform provided by the Brazilian Ministry of Education, and presented their experience of use in a focus group. **Results:** Discussions among the participating teachers from their experience of using MEC RED led to identifying potential benefits and obstacles to using DERs in teaching Physical Education at school, motivations for using a DERs platform, and the usefulness of MEC RED in this context. **Conclusion:** From the participants' point of view, a DERs platform can support teachers in locating and selecting resources that could be used in their classes. MEC RED was found partially suited to these teachers mainly because it presents low availability of DERs related to school Physical Education, which may demobilize the use of this platform. The findings of this study can contribute to understanding the needs of school Physical Education teachers to create, use, and share DERs, promote a collaborative culture among them, and structure better DERs platforms.

Keywords: school physical education, digital educational resources, learning objects repositories.

Introduction

A digital educational resource (DER) refers to any material in a digital format that can be used in the pedagogical practice, with a well-defined educational purpose and the potential to support and contribute to the teaching and learning process[1,2]. A DER can be understood as:

> "[…] any digital resource that can be used in the education scenario, thus covering a broad context and encompassing various terminologies commonly established in the last two decades regarding the subject, such as, for example, learning objects, open educational resources, reusable educational objects, among others. These resources can be in different formats (text, image, video, audio, webpages), serve different levels of audience and purposes, have different sizes or granularities (independent atomic content, lessons, chapters, books), and be of diverse types (animations, simulations, tutorials, games), run on different platforms (personal computers, tablets, smartphones), have different licenses and conditions of use (free, paid, open and adaptable, closed), and address different themes and disciplines[3]."

The expansion of access to digital information and communication technologies (DICTs) fostered the integration of these technologies into the teaching and learning process, thereby significantly boosting the use of DERs in education. In Physical Education, recent studies point out the dialogue of this area with media and technology in terms of their integration into curricula[4,5], the different language uses through skills prescribed by the Brazilian National Common Curriculum Base, BNCC (http://basenacionalcomum.mec.gov.br/)[6], and the teaching approach linked to the media-education theory[7]. Responding to the historical moment of the COVID-19 pandemic, it is also possible to recognize the increase of studies related to technology use by teachers in emergency remote teaching[8-10], some of them related to the creation and use of DERs. However, to accomplish their role when used by teachers, DERs should allow for different ways of teaching and learning, besides bringing students closer to the taught contents and contributing to the development of competencies and skills[11]. This means that DERs empowered by the media convergences of digital technology could allow for different language modalities (written, oral, visual, sound, tactile, and gestural representations, among others) to teach different thematic contents presented in BNCC[6].

Despite the significant insertion of technologies (particularly the digital ones) in school and the increasing use of DERs in many fields, this move is still incipient in Physical Education as judged by the small number of systematized resources available to this subject, regardless of the teaching stage[12]. It is possible to notice that many teachers are unaware of what DERs are, the various possibilities of using them in teaching, and how they can facilitate the teaching and learning process[13], in addition to the several factors that often make teachers not use these resources[14-16]. This contrasts with the acknowledged potential of DERs to contribute to the pedagogical practice and student learning in the context of school Physical Education[12,14,17-19].

DERs are widespread on the Internet, but they are often poorly organized[20]. This scenario poses an obstacle to teachers, who should locate and select resources of interest or that meet their needs among many options to be analyzed, considering their pedagogical intentions, the available resources and infrastructure, and their reality and of their students. This type of competency (locate, select, and analyze resources) required from teachers is covered by existing pedagogical frameworks for teacher education, even though not systematically[21]. Several platforms aggregating DERs have been developed to enable teachers to search, filter, and access DERs produced and shared by other educators from a single place and through the Internet, optimizing the time and effort required to prepare their classes.

This work aims to identify the perception of school Physical Education teachers concerning the use of a DERs platform. For this purpose, an exploratory study was carried out with MEC RED (https://plataformaintegrada.mec.gov.br/), a nation-reaching open platform officially launched in November 2017 as part of a Brazilian Ministry of Education initiative to foster the pedagogical use of DICTs in Brazilian education, called *Educação Conectada*. MEC RED is at the core of one of the dimensions of such an innovation program as a space to aggregate and access DERs. The platform stores and references thousands of resources on different subjects, types, and teaching stages. Teachers can use MEC RED to publish DERs, search for resources of interest, and exchange experiences regarding the use of these resources.

In this study, nine Physical Education teachers from different locations and teaching systems in Brazil have explored some of the functionalities offered by MEC RED and presented their impressions about the experience of using this platform. This paper presents and discusses the study's main results as an investigation interest of the Research and Technological Development Network on Digital and Interactive Teaching Materials for Physical Education, MADDIs-EF (https://maddis-ef.github.io/). MADDIs-EF was founded in 2020 based at the Federal University of Rio Grande do Norte, Natal, Brazil, as a consortium of research groups from ten universities in Brazil, Chile, and Spain. It aims at carrying out studies and proposing technological solutions targeting school Physical Education teaching, including the investigation, discussion, creation, and share of DERs.

This study investigates the following research questions:

1. What are the benefits and difficulties perceived by school Physical Education teachers regarding the use of DERs?
2. How can a platform aggregating DERs, like MEC RED, be useful to pedagogical practice in school Physical Education?

Repositories and referatories of DERs: The case of the MEC RED platform

DERs are usually organized in information systems that aggregate such resources to ease their identification, access, and reuse while subsidizing pedagogical practice[22]. These systems can be classified into repositories and referatories. A repository can be viewed as a system that stores and makes several DERs openly available in a single place, thus helping users find and use them. On the other hand, a referatory does not store DERs themselves, but it resembles a catalog pointing to where the resources are available, including other repositories. There are also hybrid systems, which allow locating resources either stored in repositories or referenced by referatories[23]. The most basic functionality of any repository or referatory is allowing users to perform searches to find DERs of interest[22]. To enable such searches, DERs have a set of information linked to them, the so-called metadata. Besides standardizing information that characterizes a DER, metadata increase the probability of returning results conforming to the user's search[2].

Among some existing repositories and referatories of DERs available in Portuguese, MEC RED enables teachers to publish DERs and collaboratively report their experiences using these resources. MEC RED is classified as a hybrid repository and referatory of DERs since it stores resources produced by registered users and references resources hosted elsewhere on the Internet. The platform's target audience mainly concerns teachers working on basic education, besides acknowledging students, managers, and the school community as potential users.

The main functionality provided by MEC RED is the search for DERs available in it. To encourage interaction among users and with DERs, MEC RED allows users to (i) publish resources produced by them on the platform, (ii) organize resources of interest, including the possibility of sharing them via social networks, and (iii) interact with other users by reporting experiences regarding the use of the available resources.

Once a search is performed, MEC RED presents the corresponding results on the screen along with several options that can be used to refine and sort these results. Each result presents detailed information about the retrieved DERs, such as title, description, publishing user, type, subject to which it is related, suggested teaching stages, the number of views and downloads, language, license types, and an option to access the resource itself. If the DER is not directly hosted at MEC RED but is instead available elsewhere on the Internet, then the platform displays a message informing that the user will be redirected to another browser page.

Users can use filters to refine search results upon five criteria: subject, resource type, teaching stage, language, and keywords. It is important to highlight that the filter to refine results by subject does not provide specific ways to select DERs according to the elements organized by BNCC, such as Thematic Units, Knowledge Objects, and Skills. For this reason, teachers must analyze each DER individually regarding its relevance to the contents and learning aims of their classes.

MEC RED seems to fulfill its role in storing and systematizing DERs of the various subjects of Brazilian basic education. Nonetheless, it is worth thinking about the basis upon which it is structured and its resulting usability to understand the motivations and difficulties school Physical Education teachers face when using such a platform.

Methods

This study was primarily qualitative and counted nine (four female, five male) school Physical Education teachers from different locations and teaching systems in Brazil. These teachers were recruited through purposive sampling[24], which was used to select participants most likely to effectively contribute to the study and its purposes. They were deliberately selected by convenience from the contact network of the researchers responsible for this study upon the following criteria: (i) to be a collaborator in the MADDIs-EF network; (ii) to work on school Physical Education; and (iii) to have recognized interest, use experience, knowledge, or related publications on digital technology. The study was approved by the institutional research and ethics committee (CAAE no. 96594718.5.0000.5537).

The study was carried out in October 2021, during the COVID-19 pandemic, and consisted of three stages. In the first one, an electronic questionnaire was applied to characterize the participants' profile and gather information about the use of technology and digital materials in their teaching practice. The second stage consisted in carrying out an analysis of MEC RED, in which the participants explored the platform by following a set of guided tasks. Finally, the third stage consisted of carrying out a focus group session with the teachers to present and discuss their impressions about the experience of using MEC RED.

Survey of the participants' profile

The first stage of the study aimed to collect preliminary data about the participating teachers. Before starting to fill out the questionnaire, they were clearly informed about the purpose of the study and that all the collected responses would be treated confidentially and solely for academic-scientific purposes. They were also informed about guarantees of privacy and protection of their identity in compliance with good scientific practices and Brazilian law. To proceed with completing the questionnaire, if agreeing to participate in the study, participants had to explicitly declare that they had read, understood, and been aware of the terms.

The applied electronic questionnaire (available in Portuguese at https://bit.ly/questionario-estudo-mecred) was composed of four parts. The three first parts were related to respondents' personal, academic, and professional information. The fourth part contained questions related to the use of DICTs in teaching Physical Education at school regarding relevance, motivations, and familiarity with using digital technology in this context. Respondents could also freely inform what technological resources they use in their classes and the platforms used to find digital didactic materials for school Physical Education.

Exploratory analysis of the MEC RED platform

For the second stage of the study, the participating teachers received a script (available in Portuguese at https://bit.ly/exploracao-mecred) describing the tasks they needed to perform, aiming to explore some of the functionalities provided by the MEC RED platform. The tasks described in the script consisted of freely exploring MEC RED, first accessing the platform and then searching for DERs specifically related to Physical Education available on it. These two functionalities were chosen as the focus of the analysis because they are the most accessed ones by teachers who use the platform. The participants were allowed to perform these tasks as many times as they wished, with no minimum time established. Each participant performed the tasks independently, without any time/space synchronization or intervention by the researchers responsible for this study.

The participants had five days to explore MEC RED upon performing the tasks described in the script. The script also clarified that they should perform those tasks before participating in the focus group session. In addition, the participants were recommended to, if possible, record any relevant observation or comment, mainly concerning positive and negative aspects perceived by them when using MEC RED.

Once the platform is accessed, the search functionality enables the user to find and access the available DERs. The tasks related to this feature consisted of (i) searching for DERs, (ii) refining presented results by using filters, (iii) visualizing information about the resources, and (iv) accessing the resources themselves. A single constraint was posed to participants: they should search for DERs specifically related to Physical Education that could be used in their teaching practice at the school.

Focus group

The third and last stage of the study consisted of carrying out a focus group session with the nine participating teachers. Focus groups represent a cost-effective alternative to individual interviews as it is possible to gather a broad range of opinions, viewpoints, and insights from several participants at once. Moreover, group interaction can reveal similarities and differences among the stated opinions, facilitate an exchange of ideas and information, and allow one to build on ideas from other group members[25]. The literature indeed points out that a focus group could yield more insights than the equivalent number of individual interviews[26].

In the focus group, participating teachers reported their opinions, motivations, and eventual difficulties regarding the use of DERs in teaching Physical Education at school and their impressions on the experience of using MEC RED as a platform to search for and access resources that they could use in their classes. The focus group was planned and carried out conforming to guidelines available in the literature in terms of goal definition, participant recruitment, session organization, design of the questions to guide the discussion, and analysis of collected data[27,28].

The focus group was held in a single session in October 2021 through videoconference, using the Google Meet platform. The session had the participation of all the nine invited teachers and was moderated by the researchers responsible for this study. It lasted 2h20 and was recorded on video to allow for further data analysis, with the prior consent of all participants.

Six open-ended questions (Q1 to Q6 in Table 1) guided the focus group session. In the light of the study goals, these questions were formulated from a more general to a more specific spectrum. As the moderators posed the questions, participants freely presented their considerations for each one.

Data collection and analysis procedures

The video resulting from recording the focus group session was automatically transcribed to text using the Adobe Premiere Pro software. As this transcription process does not guarantee absolute precision in the correct decoding of words from speech to text, the researchers responsible for this study had to review the entirety of the video recording in detail and make manual corrections to the automatically generated text. The combination of automated transcription and manual review increased the accuracy of the focus group session recording.

Table 1 - Questions addressed in the focus group.

ID	Question
Q1	How do you think that the use of digital educational resources can contribute to teaching Physical Education at the school?
Q2	What are the main problems or difficulties you see in using digital educational resources in Physical Education teaching?
Q3	What would make you use a platform like MEC RED? How do you think it would be useful in your practice as a teacher?
Q4	From your point of view, what are the main positive and negative points of the MEC RED platform?
Q5	Do you think that the MEC RED platform would be useful in your practice as a teacher? Does it meet your purposes?
Q6	What suggestions for improvement would you give for the MEC RED platform? What do you wish it could have?

The thematic analysis method[29] was used to analyze data from the text transcription of the video recording of the focus group session. Widely used to analyze qualitative data, thematic analysis is essentially based on a coding process that consists of identifying patterns (codes) in the collected data and organizing them hierarchically upon common themes[30]. Four activities were carried out while following this method: (i) (re)reading the produced transcription; (ii) code generation from the analysis of text excerpts; (iii) identification of themes by combining the generated codes; and (iv) successive revision of the identified codes and themes. The coding process was entirely inductive and had no codes established a priori, i.e., all the codes and resulting themes emerged from the analysis of the text transcription.

Results and discussion

This section presents the data gathered from the participants in the first stage of the study. It also describes and discusses the results of the thematic analysis of data collected from the focus group.

Participants' profile

Table 2 presents an overview of the participating teachers' personal, academic, and professional profiles (participants are anonymously identified as P1 to P9). Regarding the teachers' self-perception of familiarity with technology and its relevance for teaching Physical Education, it is possible to observe that this group of teachers is cohesive and involved with the subject (see Figure 1 and 2). It is also possible to conclude that the different degrees of familiarity with technology somehow do not demobilize the teachers to use DICTs in their classes, as pointed out in the literature[14,31,32].

Table 2 - Summary profile of study participants.

ID	Age	Gender	Location	Municipality classification	Professional experience	Academic degree	Teaching system	Teaching level
P1	22	Male	Paraná, South Region	Low urban concentration	6 months	Graduate	State	Elementary school and high school
P2	50	Female	Pará, North Region	Large urban concentration	21 years	Postgraduate (*lato sensu*)	State	High school
P3	37	Male	Goiás, Center-West Region	Large urban concentration	12 years	Master's degree	Municipality and State	Elementary school and high school
P4	30	Female	Rio Grande do Norte, Northeast Region	Large urban concentration	3 years	Master's degree	Private	Elementary school
P5	38	Male	Ceará, Northeast Region	Large urban concentration	14 years	Master's degree	Municipality and State	Elementary school and high school
P6	24	Male	Paraíba, Northeast Region	Low urban concentration	1.5 years	Postgraduate (*lato sensu*)	State	Elementary school and high school
P7	26	Female	Rio Grande do Norte, Northeast Region	Large urban concentration	4.5 years	Master's degree	Municipality and State	Elementary school and high school
P8	30	Female	Rio Grande do Norte, Northeast Region	Large urban concentration	4 years	Postgraduate (*lato sensu*)	State	High school
P9	37	Male	Sergipe, Northeast Region	Low urban concentration	8 years	Master's degree	State	Elementary school and high school

The Brazilian Institute of Geography and Statistics (IBGE) provides the following classification of municipalities according to their population: *low urban concentration* (< 100,000 inhabitants), *medium urban concentration* (100,000-750,000 inhabitants), and *large urban concentration* (> 750,000 inhabitants).

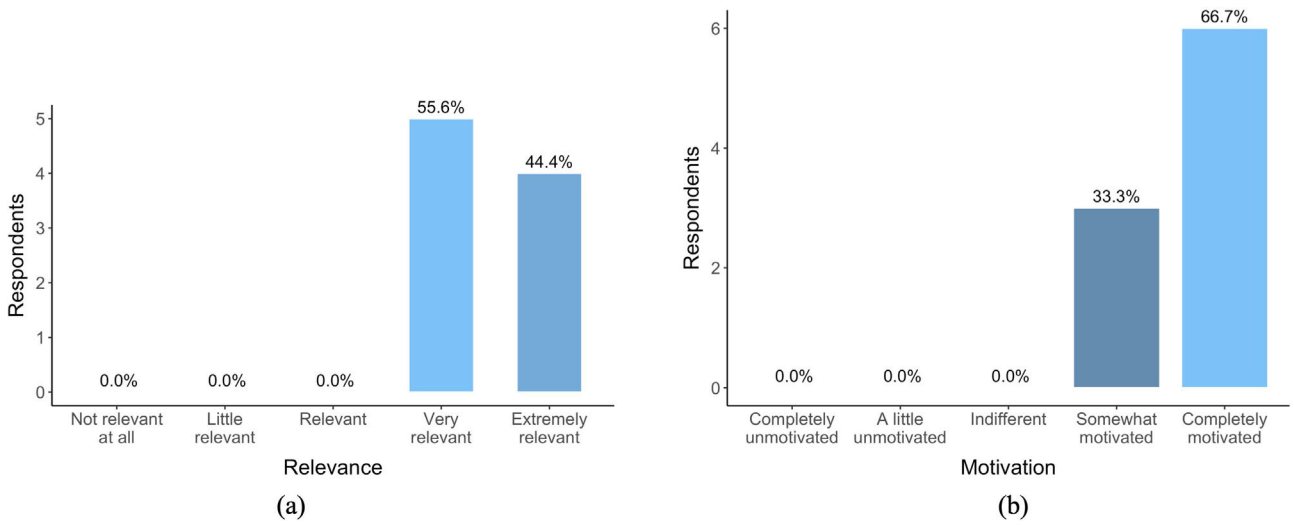

Figure 1 - Answers of the participating teachers regarding the degree of relevance (a) and motivation (b) for using DICTs in teaching Physical Education at school.

The questionnaire applied in the first stage of the study also sought to gather information about technological resources used by the participating teachers. The results shown in Figure 3 indicate that the teachers use diverse resources, with a predominance of e-books, infographics and slides, and videos and animations, which are usually easy to find, access, and use.

The participating teachers demonstrated having already used platforms to find digital didactic materials for their classes, especially *YouTube* and *Impulsiona*. They also mentioned other platforms with national or local scope, such as *Portal do Professor*, *e-docente*, and *Escola Interativa*, but none of them mentioned MEC RED. At the beginning of the focus group session, before moving on to the guiding questions, one of the moderators asked the group which participants were aware or had already used MEC RED prior to this study. Only one participant claimed to have previously used the platform, although not deeply, while the other eight participants said they had never used MEC RED until then. It is possible to infer that

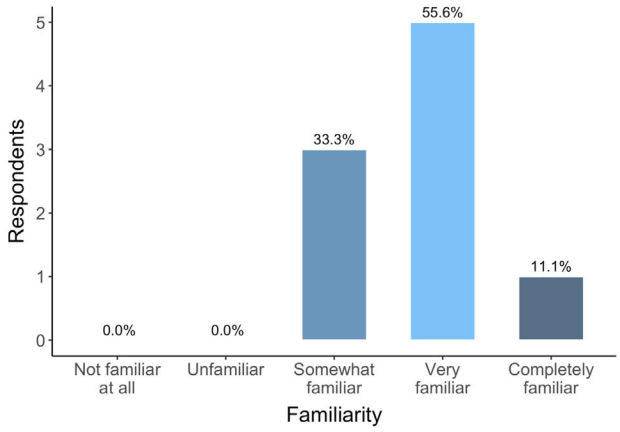

Figure 2 - Answers of the participating teachers regarding the degree of familiarity with the use of DICTs in teaching Physical Education at school.

the participating teachers have not mentioned MEC RED due to their unawareness of the platform's existence or not being part of their daily activities.

Using DERs in physical education teaching at school

Potential benefits and contributions

Figure 4 depicts some themes resulting from applying the thematic analysis method to the transcription of the video recording of the focus group session. These themes stem from the responses provided by participants to question Q1, which aimed to gather the teachers' opinions in terms of how using of DERs can contribute to teaching Physical Education at school. From such responses, it was possible to identify two perspectives on using DERs, (i) the perspective of the teacher who uses these resources in his/her classes and (ii) the effect of the use of these resources in pedagogical practice from the student's perspective.

From the *teacher's perspective*, DERs are typically used as means, that is, as tools or instruments that can contribute to the teaching and learning process (as mentioned by participants P3, P8, and P9), enhance the knowledge of what is taught (as mentioned by participants P1, P6, and P7), and support pedagogical practice (as mentioned by participants P2 and P7). This view is in line with what is understood by DERs, i.e., digital artifacts that can be used in teaching practice and contribute to the teaching and learning process in the development of contents, competencies, and skills[1,3,11]. However, the teachers participating in the focus group raised other understandings for DERs. They highlighted how to go beyond such a classic view towards providing new possibilities in pedagogical practice for addressing contents and promoting interdisciplinarity. This is evident in participant P7's speech:

> […] I can see that it is an expansion: there are new possibilities for you to see the contents of your course. Then when we can see new possibilities, new ways of seeing this same content or thinking about this same knowledge, it contributes to the teaching of my course. So, I believe it comes in a much more potent way for my student. [*sic*] - participant P7

From the *student's perspective*, DERs can be viewed as inducing elements, i.e., capable of provoking feelings and stimulating knowledge in the students of teachers who use these resources in their classes[12]. In the view of the participating teachers (more specifically, P2, P3, and P6), DERs can motivate students, thus encouraging their engagement and participation in the classes through expanding knowledge (as mentioned by participants P3 and P8). DERs can also contribute to constructing knowledge regarding the covered contents (as mentioned by participant P7). According to one of the participants (P2), this inducing characteristic of DERs may be related to the notably visual, technological, and creative features of these resources, being intrinsically linked to digital culture and often aligned with the reality of the students or being familiar to them. Apart from some differences in emphasis, the participants' opinions were complementary and

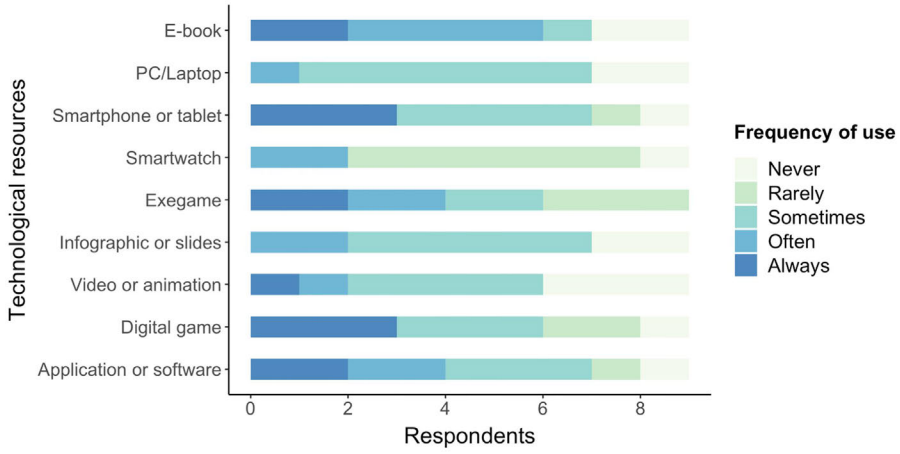

Figure 3 - Answers of the participating teachers regarding technology resources used in teaching Physical Education at school.

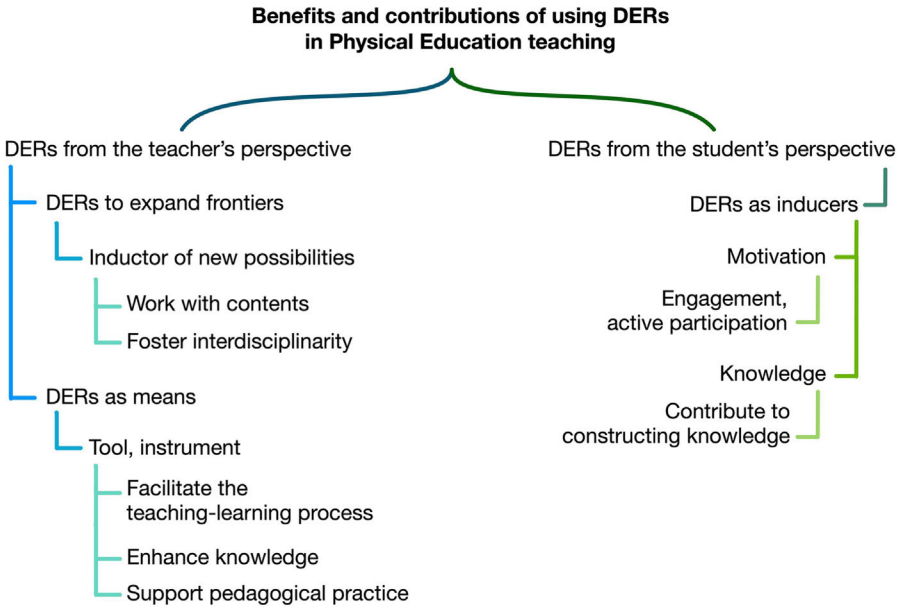

Figure 4 - Themes elaborated from the focus group regarding the benefits and contributions of using DERs in Physical Education teaching at school.

could not be correlated to a given professional experience or education level.

Potential problems and difficulties

Question Q2 sought to raise problems and difficulties faced by teachers in using DERs to teach Physical Education at school. Table 3 summarizes a set of five factors identified as possible obstacles to using DERs based on the answers provided by the participating teachers to this question. Despite having been raised in a focus group with Physical Education teachers, it is reasonable inferring that these factors could also be observed in pedagogical practice using DERs in other subjects since these are problems and difficulties commonly faced by many basic education teachers when using technology resources in their classes. Such data are also partially in line with findings of factors that mobilize or demobilize the use of technology by Physical Education teachers[14].

Table 3 - Factors as possible obstacles to the use of DERs in teaching Physical Education at school.

Factors	Description
Territorial factors	Factors related to the reality of the geographical space where teachers, students, and schools are inserted into
Structural factors	Factors concerning the physical and technological infrastructure to support the proper use of DERs
Education factors	Factors mainly related to the teachers' initial and continuing education
Instrumental factors	Factors concerning the use of DERs
Pedagogical factors	Factors related to teaching practice using DERs

Territorial factors are related to the different contrasts between the contexts and realities of teachers, students, and schools in the geographical space in which they are inserted and may influence the use of DERs. Three participating teachers (P5, P6, and P9) reported their experiences of working in schools located in diverse regions of the territory (capital city/countryside, center/suburb). They drew attention to the issue of territory because it could influence how DERs reach students considering these different contexts and realities. For instance, participant P9, who works in a municipality near Aracaju, the capital city of the State of Sergipe, Northeastern Brazil, reported:

> […] The first provocation coming to me is how students will access this if not all students are really able to. Because when we look like this: "But everyone has a cellphone." But who is everyone? Everyone is in the capital cities, in the urban centers. For those in the suburbs and far away from the centers, the reality is not quite that. So, this causes me a provocation. Digital resources are cool, but perhaps they may not reach all students. I have experience working in a city in the metropolitan region of Aracaju. However, within this metropolitan region and the city where I work, students live in villages and have difficulty having a smartphone. They have difficulties having access to the Internet. [*sic*] - participant P9

Structural factors are related to infrastructure elements that support the proper use of DERs regarding the access to technological devices by both teachers and students, Internet connectivity, and the physical infrastructure of schools, especially in the public teaching system. Reporting some cases observed in their respective reali-

ties, including socio-economic issues, four participating teachers (P1, P5, P6, and P9) described some limitations that may hamper or make it impossible to use some DERs in pedagogical practice. Students and teachers sometimes do not have access to technological devices, either individually or in the school where they are, or have technological limitations related to connectivity to the Internet. Nonetheless, it is important to note that the availability of technological devices and physical infrastructure supporting the use of DERs does not necessarily demobilize teachers regarding their interest in using them in their pedagogical practice, although this is often mentioned as a limiting factor[14,31,32].

Education factors concern the initial and continuing education of Physical Education teachers regarding media, technology, and use of DERs. Five participating teachers (P1, P2, P3, P5, and P6) raised that these topics were not addressed or were addressed very superficially in their education, whether initial or continuing, which represents a mismatch with that teacher education is a key factor for enacting technology in school[12]. Such a deficiency/insufficiency in teacher education for enacting digital culture and its elements in school Physical Education corroborates the various reflections in the literature about this issue[14,15,31,32]. Both initial and continuing education should enable teachers to be integrated into digital culture, exposing the possibilities of developing pedagogical practices that use media and technology and adhere to the current demands of Physical Education[33]. This is in line with another aspect regarded as necessary by the participating teachers, namely the need to bring Physical Education teaching closer to digital culture, a recent move in Brazilian basic education[12,14].

Instrumental factors are mainly related to the familiarity of teachers and students with the use of DERs. Two participating teachers (P2 and P5) exemplified that the pedagogical purpose of using a DER could not be achieved if teachers or students do not know how to use it, even in the absence of structural issues (i.e., devices, connectivity, and infrastructure would be available). In the case of teachers, it is reasonable to relate such a "how to use" to education factors, which may influence the level of incorporation and consequent use of DERs in pedagogical actions[14,34]. In the understanding of Batista[12], "[…] the incorporation of technology by teachers and students is fundamental to enacting technology in the educational scenario." Nevertheless, Souza Júnior et al.[31] argue that "[…] having difficulties in the technical use of digital technology does not prevent teachers from promoting pedagogical actions that enact digital culture."

Finally, *pedagogical factors* concern how teachers use DERs in terms of goals and practices. Two participating teachers (P1 and P3) pointed out that teachers sometimes lack a critical view of the use of DERs[12] and do not consider the different students' profiles when choosing and using DERs in pedagogical practice. This fact even conflicts with the understanding that such resources should be used with a well-defined educational purpose[1]. The speeches of these participants evidence this issue:

> […] It is using as-is, using without a goal, without being guided by the guideline […]. [*sic*] - participant P1
> […] That was something I called into question. We did, did, did, but what did the student say in the end? "Oh, the class was nice, I jumped, I ran, I did a lot of things…" "But what did you learn?" He/she did not know what to say. […] This was little or not questioned by the teachers who taught these classes in this sense. [*sic*] - participant P3

The discussions in the focus group led to the conclusion that the potential problems and difficulties reported by participants mainly emerge from their respective realities or experiences. For example, participants P5, P6, and P9 have mentioned territorial factors when their pedagogical experience concerns municipalities with low urban concentration or peripheral zones of large urban concentration areas (see Table 2). It is also worth shedding light on that the five participating teachers who raised educational factors as possible obstacles to using DERs in school Physical Education (namely, P1, P2, P3, P5, and P6) were those with the most recent and the oldest graduation times (see Table 2). This is indeed a symptom that the technology theme is not organically integrated into Physical Education teacher education[21], i.e., the problem is not localized but rather chronic for both initial and continuing education.

Using a DER platform

From the experience of the participating teachers, question Q3 sought to raise possible motivations that would lead them to use a platform aggregating DERs and how it could contribute to their practice. The following motivations and benefits for using this type of platform were listed: (i) the easy location of DERs, including resources hosted at other locations and referenced by the platform (as mentioned by participants P1, P2, P3, and P5); (ii) the support to teaching practice regarding class planning, optimization of the teacher's time, and expansion of possibilities to address contents (as mentioned by participants P1, P7, P8, and P9); and (iii) network collaboration as means to allow creating and sharing contents (as mentioned by participants P5, P6, and P8).

A platform aggregating DERs can help teachers select resources that can be used in their classes, especially given the significant number of digital materials available on the Internet, often not presented in a systematized way[20]. The role of this kind of platform seems to become more relevant considering the strenuous routine of teachers working on the Brazilian basic education. Participant P7 was representative of the reality of many teachers who need to have several professional bonds and work in multiple schools due to low remuneration, besides a high

workload that does not consider pedagogical time for planning[31]. Therefore, a platform aggregating DERs can enable teachers to quickly locate and use available resources, thereby driving their efforts to other aspects of the pedagogical process rather than producing materials from scratch. The literature indeed points out the desire of teachers to share and plan classes in a collective way[8], especially when it involves integrating technology into the pedagogical practice, and this move does not necessarily relate to professional experience.

The participating teachers also discussed the influence of the COVID-19 pandemic in 2020 and 2021 on the reality of teaching and the production of materials. One of them (participant P5) highlighted the increase in the production of digital materials within the scope of Physical Education not only due to a recent move to bring this area closer to digital culture[35] but also driven by remote teaching abruptly imposed by social distancing in this period. Groups in social networks emerged as informal spaces to share digital materials and information about various platforms where it would be possible to find resources to be used in pedagogical practice. However, this was done in a significantly short time window and with no organization, thus making the teacher's task more difficult rather than easier. The relevance of a platform aggregating DERs is evident in this scenario. It allows organizing such a large volume of digital resources and information spread across several sources, besides representing a space where these resources and experiences can be shared in a network.

Evaluation of the MEC RED platform

Questions Q4 to Q6 specifically addressed an evaluation of MEC RED based on the experience of the participating teachers in exploring the platform, raising both positive and negative aspects and suggestions for improvement. Moreover, these questions sought to identify if the teachers regarded the platform as helpful in teaching Physical Education at school.

The participating teachers identified some positive aspects of MEC RED. Participants P2 and P5 emphasized the hybrid nature of MEC RED, which combines both repository and referatory functionalities so that users can search for and access DERs available on the platform and in other locations referenced by it. Participants P5, P6, and P8 discussed the community view towards sharing resources, knowledge, and experience among teachers and allowing for networked interaction. Participants P1, P7, P8, and P9 highlighted the support for class planning using resources available on the platform. In addition, participants P1 and P2 mentioned useful features and functionalities of the platform, such as (i) its search functionality itself, which allows finding DERs that can enhance pedagogical practice, and (ii) its good usability, which makes MEC RED to be presented with simplicity, navigability, and pleasant graphical user interface.

The central negative aspect recurrently raised and discussed by most of the participating teachers was the lack of dissemination of MEC RED at the federal, state, and municipal levels, as mentioned by participants P1, P2, P5, P6, P7, and P8. Participants P3, P5, and P6 also emphasized the low availability of DERs for Physical Education on the platform. The discussions in the focus group led to the conclusion that these two concerns are intrinsically related in a vicious cycle. The little publicization of MEC RED makes few users effectively share DERs on the platform, thus directly impacting the number of available resources. The existence of few contents of interest to Physical Education may demobilize teachers to use MEC RED as a space where they can search for and access DERs that could be used in their classes. Consequently, a few users view the platform's usefulness and may not feel motivated to make DERs available on it. The participant P5's speech drew attention to a lack of dissemination of MEC RED:

> […] I think this should be more publicized by MEC [Brazilian Ministry of Education]. I think this is still little publicized and should be well commented on in the training offered by municipalities and states. MEC should attempt to propagate this within secretariats, whether municipal or state, to make it more public and more accessible. […] - participant P5

The participating teachers also discussed several other negative aspects observed while exploring MEC RED. Regarding the platform's characteristics, they pointed out that the available DERs related to Physical Education are not coherent with BNCC in the elements it organizes (namely, Thematic Units, Knowledge Objects, and Skills). This issue hampers linking the use of those resources to the learning objectives in terms of content and skill development as prescribed by BNCC. Such a dissociation became more evident when participant P5 reported his experience in searching for DERs related to Physical Education in MEC RED:

> […] When I applied a more specific filter, I could realize that many of the Thematic Units were not present even within the Physical Education content, and many themes were often in other areas. For example, capoeira and dance, they were within the Arts content, and so on. [*sic*] - participant P5

Although the Dance Thematic Unit is also considered a theme within Arts, from the participant's experience, the lack of this Thematic Unit in the Physical Education area represents an incoherent relation to BNCC. It is reasonable to conclude that such incoherence could prevent school Physical Education teachers from feeling motivated to use MEC RED to search for DERs of interest to their classes.

Another issue discussed in the focus group was the quality of the available DERs since there is no clarity on an assessment of resources shared by users on the plat-

form. For example, participant P5 expressed this kind of concern:

> […] If I have the material and my material does not have a certain quality, I do not know to what extent someone inside the platform will make such an analysis […] I could also put something there with mistakes in terms of concepts […] Consequently, this could be accessed by another teacher […] Something wrong in epistemological terms, in terms of concepts within the area itself. [*sic*] - participant P5

Despite the MEC RED's purpose to enable users to freely publish and access DERs as long as they comply with the platform's terms of use, it may be relevant to find a trade-off between having a minimal quality assessment of these resources[3] and not discouraging sharing DERs on the platform. Rocha et al.[36] argue that for DERs platforms "[…] to be effective in aiding educators, the most accurate organization of the resources available in it is a primordial issue, that is, a digital curation process is needed for evaluation, organization, and quality assurance of digital educational resources." In this perspective, platforms like MEC RED should promote a culture of evaluating DERs with precise metadata to submit a resource, offering a basic assessment before sharing with other users. This could lead teachers to understand the evaluation of DERs and help them in their professional development to produce high-quality resources considering pedagogical, technological, content, accessibility, and contextual criteria. However, the proper evaluation of DERs specifically for school Physical Education still lacks further systematization[37].

Finally, regarding the MEC RED's functionalities, the participating teachers identified some problems and limitations. Participant P3 mentioned the existence of broken links to the locations where the resources are available since the platform does not have a mechanism to verify the validity of these links. Participant P1 highlighted the low precision of the search mechanism and the low relevance of results. Participants P1 and P2 emphasized the compromised usability of the platform, e.g., the need to perform several actions to accomplish a given task. Even though the search mechanism indeed needs significant improvements, such as considering singular/plural variations and using quotation marks to amplify or constrain the search, it is worth noting that the search accuracy and relevance of retrieved results are also directly related to metadata linked to a DER, which are essential to the search procedure[2]. Therefore, if metadata have low quality and do not adequately describe resources upon registering, then there is a high probability for the platform to retrieve results that are little or not consistent with what the user is searching for.

Threats to validity

External validity essentially concerns the ability to generalize obtained results. The most significant threat to the external validity of this work is related to the representativeness of the participant sample. The method used to recruit and select the nine school Physical Education teachers to participate in the study has some inherent bias since it relies on the researchers' judgment. Nonetheless, purposive sampling is not intended to offer a representative sample[38], even though it limits the interpretation of the results to the group under study. This sampling technique is often used in focus groups due to its ability to select eligible participants who suit the investigated topic and the study's aims, thereby increasing both rigor and the trustworthiness of the data and consequent results[39].

Another threat to the external validity could be the sample size, which may limit the generalization of the results. It is worth emphasizing that the focus group was designed by following guidelines available in the literature (see Section 3.3) in that the size of focus groups should range from six to twelve participants for the sake of reliability in the results[39] so that the number of participants in this study (nine) does not constitute a threat to external validity itself. Nonetheless, increasing generalizability would require carrying out other focus groups with school Physical Education teachers to assess to what extent the results presented in this work are valid in different teaching contexts.

Internal validity focuses on the conduction of the study and any factor that may have caused bias in the process. A possible threat to the internal validity is that no minimum time was established for performing the tasks in the second stage of the study (see Section 3.2). The participants' considerations could have been influenced by the time they spent using MEC RED and possibly affected the observed results. In theory, those who explored the platform for more time would expose more concerns in the focus group session than those who explored it less.

Another threat to the internal validity is related to the nature of focus groups. Focus groups are subjected to bias found in any group setting, such as the dominance or influence of one or a few members over the others in the discussion, the passivity or tendency of members to think in a similar way to maintain cohesion (the so-called groupthink)[26]. The moderators in the focus group let participants freely expose their thoughts during the focus group session while stimulating participation as much as possible as a strategy to circumvent those issues.

Conclusion

This work presented and discussed the main results of an exploratory study carried out with nine school Physical Education teachers from different locations and teaching systems in Brazil to identify their perception concerning the use of a DER platform, MEC RED. These teachers explored some functionalities offered by MEC RED and presented their experience of use in a focus

group. They pointed out that the features of a DER platform can support teachers in selecting resources that could be used in their classes, thereby contributing to class planning, optimization of the teacher's time, and an expansion of the possibilities to address contents. This is of paramount relevance considering the teachers' challenging work conditions and the need to systematize existing digital resources and information, which have increased due to the change to a teaching modality primarily mediated by technology because of the COVID-19 pandemic. These teachers evaluated MEC RED as partially fulfilling their purposes since it allows locating and accessing DERs of interest. However, the lack of dissemination of the platform and the significantly low number of resources available to school Physical Education may demobilize its use and somehow disqualify its usefulness in pedagogical practice.

The findings of this study are relevant to understanding the needs of school Physical Education teachers to create, share, and consume DERs to improve their practices. The obtained results and consequent discussions can also help structure better platforms and promote a collaborative culture among teachers, even though they always have specificities related to their work environment and professional development. Data gathered in this study emerged entirely from the participants' perceptions and quality of experience with the MEC RED platform, not necessarily related to their age, graduation time, or educational level[40]. Obstacles recurrently mentioned by the participating teachers to using DERs seem to be more related to the shape of their education, considering that Physical Education teacher education programs have not organically incorporated technology yet[21].

The exploratory study on MEC RED in the context of school Physical Education also concluded that from the participants' point of view, not all the DERs currently available on the platform are coherent and organized in compliance with what is prescribed by BNCC, the normative document that serves as the national reference in Brazil. This fact hampers linking the use of these resources to learning objectives in terms of content and skill development. Due to the generic nature of MEC RED, the results retrieved by search procedures performed on it may be less relevant and reduce their ability to meet teachers' needs adequately. A technological solution focused on Physical Education might be relevant in aggregating resources specifically related to the subject and easing the location of DERs of interest to teachers according to their needs and aims.

Future work can investigate the factors that motivate users to make DERs available on a platform like MEC RED. Moreover, the community feature of MEC RED, where teachers can share resources, knowledge, and experiences, expresses a move that might foster networked interaction permeated by digital culture. Most teachers produce materials in a unidirectional way, specifically aimed at their students and without considering that these resources could be used or even improved by other teachers. This collaboration potential can be a new perspective of thinking and leveraging the educational process regarding the production and use of DERs in pedagogical practice as a network.

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Corresponding author

Allyson Carvalho de Araújo. Universidade Federal do Rio Grande do Norte, Departamento de Educação Física, Natal, RN, Brazil.
E-mail: allyssoncarvalho@hotmail.com.

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