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THINKING ABOUT A COMMUNITY OF DIALOGUE, PRACTICE AND THEORIZATION ABOUT EXPERIMENTATION IN SCIENCES WITH THE HELP OF OER, BASED ON RDA DIAGRAMS[1]

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José Oxlei de Souza Ortiz[2], Aline Machado Dorneles[3], Luis Otoni Meireles Ribeiro[4], Igor Radtke Bederode[5] and Valmir Heckler[6]

ABSTRACT

Faced with the new post-pandemic scenario, education is in the midst of a process of reflection, seeking to understand what was produced during the COVID-19 pandemic period. Thus, this study aims to understand the process of Online Inquiry developed in a graduate curricular discipline, through the elaboration/creation of the representation of an educational scenario with the use of OER (Open Educational Resources) in Science Experimentation, from the RDA (Distance Relations in Learning) diagrams. The methodological path of the study is configured as a research with a qualitative approach, of the theoretical type, with an exploratory objective, supported in terms of technical procedures in the analysis/collation of bibliographic and documentary sources produced by teachers and students of the curricular component. It is possible to infer from the investigation that the base substrate generated by OER, with proper modeling via RDA Diagrams, provides an adequate environment for the structuring and execution of a dialogical process of inquiry in online educational scenarios, enabling the realization of a community of dialogue, practice and theorization in experimentation in Science.

Keywords: Didactic Drawing. Online Inquiry. Pedagogical Practices. Research-training.

[1] Work developed with financial support from CAPES.
[2] Doctor of Science Education
joseoxlei@gmail.com
[3]Dr. in Science Education
lidorneles26@gmail.com
[4] Post-doctorate in Education
luis.otoni@gmail.com
[5] Doctor of Education
igor.bederode@gmail.com
[6] Doctor of Science Education
valmirheckler@gmail.com

Revista ARACÊ
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INTRODUCTION

Faced with the new post-pandemic scenario, education is during a process of reflection, seeking to understand what was produced during the COVID-19 pandemic period, which impelled teachers, students, and other agents in the educational process to seek other alternatives to make teaching and learning feasible (RIBEIRO *et al.* 2020). In this movement to adapt to non-face-to-face teaching, numerous pedagogical strategies were adopted in *online* environments as a way to provide opportunities for teaching and learning processes, thus reducing educational damage due to the social distancing imposed by the pandemic.

In this context, of isolation and sanitary restrictions, both public and private educational institutions had to find in digital information and communication technologies (DICT), an important basis for classes to be offered (RIBEIRO *et al.* 2020). To carry out the classes, different teaching strategies were used, through Virtual Learning Environments (VLE); Social Networks, *mobile learning tools;* of virtual learning objects (among them: virtual laboratories and simulators, and repositories of educational materials), and the tools and interfaces of the Web have been explored/used intensively as a means of providing the teaching and learning processes.

Teachers, from basic education to higher education, use pedagogical practices that are based on the use of Open Educational Resources (OER) to conduct their activities in the classroom. Therefore, this study aims to understand the process of Online Inquiry developed in a curricular discipline of the Graduate Program in Science Education - FURG located in Rio Grande do Sul, through the elaboration/creation of the representation of an educational scenario with the use of OER in Science Experimentation, from the RDA (Distance Relations in Learning) diagrams (TORI, 2022).

It should be noted that the curricular discipline under analysis, "Online Inquiry in Science Experimentation (IOEC)", was developed throughout the second semester of 2021, with the effective involvement of 17 students and two professors. In the VLE records of the course and video recordings of the synchronous meetings, it is evident that the participants were in very different locations, with some of them being in different cities in Rio Grande do Sul, and others in the cities of the state of Santa Catarina and Ceará. This geographical distance between the participants was not an obstacle, but imposed many challenges so that they could, together with their colleagues, propose, elaborate and discuss the materials and activities of the curricular component, which had as its main

Revista ARACÊ
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focus to debate and practice the process of experimentation in Science, with the use/co-creation/sharing of OER.

In terms of structure, this article, in its development, initially highlights the methodological procedures adopted. In a second moment, it will address the theoretical foundation of the study, especially the theorization regarding: open educational resources (OER); to the Online Inquiry, focusing on the dialogic process in the practice of experimentation in Science with the collective use/co-creation of OER; to the Didactic Design of the teaching processes and to the distance relations in learning actions and the RDA diagrams.

Subsequently, in the analysis and discussion of the results, the RDA diagram is presented, which graphically represents the Online Inquiry process developed in the curricular discipline of "Online Inquiry in Science Experimentation (IOEC)", through the use of OER in Science Experimentation.

Finally, in the final considerations, a critical and reflective analysis of the investigated theme is presented, which allows us to infer, based on the *research corpus* , that the base substrate generated by the OER, with the proper modeling via RDA Diagrams, provides an adequate environment for the structuring and execution of a dialogical process of inquiry in online educational scenarios, enabling the realization of a community of dialogue, practice and theorization in experimentation in Science.

DEVELOPMENT

METHODOLOGICAL PROCEDURES

The present study is configured as a qualitative research (BOGDAN; BIKLEN, 1999), of the theoretical type (DEMO, 2000), of exploratory objective (GIL, 2002), supported in terms of technical procedures in the analysis/comparison of bibliographic (KÖCHE, 2011) and documentary (RICHARDSON et al., 1999) sources, produced by teachers and students in a postgraduate course in Science Education at a Brazilian public university, which aimed to problematize the discussions on the exploration of open educational resources in the educational context with potential in the process of experimentation in the teaching of Science.

The construction of the empirical field took place collaboratively within the curricular discipline of "Online Inquiry in Science Experimentation (IOEC)" offered during the second semester of 2021. The central purpose of the IOEC course was to organize the students

Revista ARACÊ
ISSN: 2358-2472

and the responsible teachers in the perspective of a community with teachers. It was made up of 17 graduate professors, together with the two professors who proposed the curricular component, one of them the full professor of the discipline, called in this article a full professor-researcher (PPT), and the other, a volunteer professor-researcher (PPV).

The online inquiry is assumed as a perspective of construction and development of a postgraduate course in Science Education, which aimed to problematize the discussions about the exploration of resources in the online educational context with potential in the process of experimentation in the teaching of Sciences, contemplating theoretical-practical aspects, in a perspective of the Online Dialogic Inquiry (HECKLER and GALIAZZI, 2017; SILVA and HECKLER, 2018).

The IOEC course was structured in eight weeks with synchronous meetings using web conferencing, and with moments of asynchronous interactions in community forums within the Moodle Virtual Learning Environment (VLE), with the support of *Google Drive*, use of social network (*WhatsApp*) *and Padlet.*

In the first two weeks, the meetings were used for the group to develop/understand the Online Inquiry in Science Experimentation. The central purpose is to dialogue, inquire, propose and practice/theorize experimentation in Science with the help of Web tools/interfaces. Weeks three and four played an important role in organizing the community into working groups.

From week five, didactic-pedagogical content was used as a way to present the OER concept, and to bring understanding about the use, co-creation and sharing of OER in the community with teachers. From the flow of the weeks described above, an educational scenario was elaborated represented by an RDA Diagram.

OPEN EDUCATIONAL RESOURCES (OER)

In the current global scenario, due to the effects of COVID-19, education systems have faced numerous challenges, especially the use of tools and materials in the construction of educational activities for the digital context. In view of this, we have as a pedagogical potentiality, the use of OER, which are freely accessible educational materials, available mostly on platforms, repositories or *web* environments. In addition, OER "are educational support materials that can be accessed, used, modified and shared freely" (UNESCO, 2015 p.1). It is important to mention open educational resources by the acronym OER (open *educational resources*)" (SEBRIAM, 2021).

Revista ARACÊ
ISSN: 2358-2472

The term OER is characterized by the dynamics of the remix process, reuse, adaptation and sharing, they are learning materials, available in any media format, which is in the public domain or under an open license (SEBRIAM, 2021). OER is closely linked to a free culture, providing new perspectives, new appropriations, and innovation, through the perspective of educator, author, and collaborator (SEBRIAM, 2021). For Sebriam (2021) the "OER" are the central axis of Open Education today (SEBRIAM, 2021, P. 17).

In the context of *online* teaching, OER has become an option for educational material capable of enhancing the collaborative process between peers. Such resources played an important role within the context of the IOEC discipline, promoting creativity through co-creation and sharing during the process of experimentation in Science.

To exemplify the potential of open resources, we have the Ciênsação platform [7], created "with the support of UNESCO Brazil to promote a culture of short, clear, focused experiments carried out by students in the classroom", and which was used in the curricular component focus of the research. Ciênsação provides a collection of educational activities in an open way to assist teachers in their day-to-day classes. The resources made available were designed to assist teachers in experiments, through "hands-on" activities, with this, students are able to reinforce essential skills and competencies, enabling the experience of fascination for scientific research.

In view of this context of *online* teaching that uses OER in their activities, it is important to foster discussions and reflections on the main elements and agents that are present in pedagogical practices. Therefore, this is an opportune moment to create research that enables the dialogue of the didactic-pedagogical practices of the teachers involved. The elaboration of research focused on reflections on the actions has the future purpose of optimizing the time that is used in the elaboration and application of educational activities, thus aiming to ensure the quality of teaching.

NEW HORIZONS OF ONLINE INQUIRY IN THE DIALOGIC PROCESS IN THE PRACTICE OF EXPERIMENTATION IN SCIENCES WITH THE COLLECTIVE USE/CO-CREATION OF OER

Based on Wells (2001) and Heckler and Galiazzi (2017), it is assumed that Online Inquiry is a community of special practice in education, strongly supported by communication in internet interfaces. The central purpose of this type of community is to

[7] Ciensação: available in https://www.ciensacao.org/index.html - accessed on 19 May 2022

Revista ARACÊ
ISSN: 2358-2472

assume the participants as fellow teachers, focusing on questioning, arguing, collaborating and co-creating practices and thus transforming the subjects. When it comes to Online Inquiry in Science Experimentation, the practice to be transformed is that of Experimentation in the classroom.

A historical part of how the concept of Online Inquiry evolved in the face of the proposition and research of this way of developing disciplines in Graduate Studies is recorded in the book Online Inquiry in Physics Themes: research-training with teachers (HECKLER, 2019). For Heckler (2019), it is important to take a more in-depth and critical perspective, based on the Historical-Cultural Theory of Activity and from the ideas and practices of the online dialogic inquiry community with Science teachers.

To understand the context and empirical field of the research, it is important to emphasize that the curricular discipline of Online Inquiry in Science Experimentation (IOEC) was carried out in a Graduate Program in Science Education, from August to November 2021, remotely, that is, without any face-to-face meeting at the University, due to the context of distancing that was imposed by the pandemic. What's more, even though it is an Online Inquiry discipline, this "online" differs from remote teaching. The Online Education practiced is investigated in the CIEFI research group[8], which is supported and considers face-to-face meetings important.

It is also necessary to understand the historicity of the IOEC curricular discipline, and to analyze the experience of its participants. This is the fifth offer of the discipline in the program. In none of these offers were the topics, themes and practices of experimentation in Science the same. This is considered as a differential of creativity and dynamism. Starting from the proposition and interest of the participants, in an attempt to be and constitute a community of practice with teachers who seek to improve some experiments and activities of their colleagues and thus transform a classroom practice not dissociated from the change of beliefs through theorizing.

In addition, it is believed that the "[...] scientific knowledge is the result of a social construction", being constantly updated, under construction, inviting resignification, interference, completion, co-creation and authorship. It is not possible, from this point of view, to understand it as a closed, complete and finished message, which needs to be assimilated, learned and memorized (PIMENTEL; CARVALHO, 2020).

[8] CIEFI Research Group: available at: https://ciefi.furg.br/ - accessed on 19 May 2022

Revista ARACÊ
ISSN: 2358-2472

But, what happened differently in this discipline besides being remote? The remote perspective did not affect the course, as a methodological proposal and involvement of the 19 participants. For this, records were retrieved that could verify that the discipline had already practiced dialogic inquiry with a focus on *online education* for a decade. In other words, the form of involvement and the perspective assumed demonstrates a great participation of the 19 participants in the activities within the VLE (*moodle*) and in the asynchronous meetings via web conference.

With this, the curricular discipline was prepared and applied in a shared way between two professors, from the areas of Physics and Design, enhancing the process of interdisciplinarity and expanding the processes of creativity and collaboration in the construction of activities. What changed the perspective of the discipline was the participation of a volunteer teacher/researcher with experience and focus on the development of the theme of Open Educational Resources for experimental activities shared in the community.

For this, the description of the activities developed in the discipline was initially analyzed, it was observed that research devices were constituted with the theme OER in Science Experimentation, through the process of co-creation of the members of the online inquiry community with teachers. It is considered as research potential, the analysis of the entire course taken by the discipline throughout the semester, to collect elements and information, which served as subsidies for the construction of the didactic design of the discipline.

SEARCH FOR THE FIRST ELEMENTS OF THE SCENARIO: ANALYSIS OF THE DIDACTIC DESIGN OF THE IOEC DISCIPLINE

The analysis process of this research takes place from the immersion in the records of the collective of participants in the Virtual Learning Environment (VLE) and the memories of the professor-researcher responsible for the discipline in the Graduate Program in Science Education PPGEC/FURG, together with the memories and records of the volunteer professor-researcher who worked with the discipline, as well as, the records of the analyses made by the other participants in this research.

A quick dive into the discipline provided the opportunity to visualize different research devices, as an itinerary that enables research-training based on the analysis of records. There are some research devices: description of the activities in each topic of the

Revista ARACÊ
ISSN: 2358-2472

VLE (didactic drawings at each stage); teaching plan, digital library built in a collective forum; *links* to theoretical texts; written in weekly forums; videos of the recordings of synchronous meetings; tasks with collective and individual activities; collective proposals for experimentation in Science; experimentation activities in Science transformed into OER.

These devices are fundamental for researchers to materialize an action research based on the analysis of the marks and the way of structuring the collective classroom environment. For Santos and Silva (2009), the first step towards the use of didactic design is that it "will need to realize that it can enhance communication and learning and not underuse online interfaces that bring together a set of *hardware* and *software elements* intended to enable aggregations, associations and meanings such as authorship and co-authorship to students (SANTOS; SILVA, 2009, p.274).

To improve their educational practice, teachers must be in tune with the elements of our socio-technical time and with the social context of the participants (SANTOS; SILVA, 2009). For the aforementioned authors, in the search for the "[...] teacher to guarantee quality in his authorship, he will need to rely not only on the *online* computer, but on a didactic design that favors the expression of dialogue, sharing and creative and collaborative authorship" (SANTOS; SILVA, 2009, p. 274). The authors state that

> […] Didactic design can make use of propositions and interfaces for the co-creation of communication and learning in your online classroom. They should favor bidirectionality, a sense of belonging, exchanges, criticism and self-criticism, thematic discussions, collaborative elaboration, exploration, experimentation, simulation and discovery [...] (SANTOS; SILVA, 2009, p.274).

To this end, as a way of understanding the scenario of the discipline, a summary table was elaborated as a way to represent the items of the didactic design of the discipline (stages organized in weeks), with the themes and activities developed. It is important to emphasize that the joint action of the participants leaves marks on the VLE, which are subject to further analysis, which is assumed here as research-training devices. Through this didactic design, subsidies were taken to help in the construction and argumentation of some of the elements of the RDA Diagram of the curricular discipline.

As a way of analyzing the didactic design of the discipline, Chart 1 is presented, highlighting three topics, namely: themes, activities developed and Research-Training devices, these were the three axes of the didactic design that gathered information about the main elements that constituted the discipline over the weeks offered.

Revista ARACÊ
ISSN: 2358-2472

Chart 1 – Didactic design of the discipline Online Inquiry in Science Experimentation with the use of OER.

Weeks	Thematic	Activities developed	Research-Training Devices
01	Experimentation in Science	Synchronous Meeting, Reading and viewing videos, and Synchronous and asynchronous dialogues	Recorded Video Conference, Chat, Use of Videos, Community VLE Forum, PDF Material, Teaching Plan
02	Collective Ideas of Experiments Wall	Presentation of a Proposal for an Experiment, Construction of a Collective Ideas Wall, Synchronous Meeting, Reading of material, Synchronous and asynchronous dialogues	Recorded Video Conference, Chat, Shared Cloud Document, PDF Material, *Hyperlinks*
03 and 04	Organization of the community of practice	Organization of the community divided into groups, Creation of the group on the social network, Presentation of the experiment of Group 01	Recorded videoconference, Chat, Community VLE Forum, PDF material, Teaching plan, Social Network (*WhatsApp).*
Pre-meeting 05	Understandings of the OER concept	Readings and viewing of videos, answer a questionnaire to collect data from the community	PDF material, Online Form, *Podcast, hyperlinks*, Social Network (*WhatsApp*).
05	Find and use OER	Presentation of the experiment of Group 02, individual writing in the forum	Recorded videoconference, PDF material, Chat, Community VLE forum, Teaching plan, *hyperlinks*, Social Network (*WhatsApp*)
06	Copyright and OER Curation Process	Readings and viewing of Videos, Presentation of the experiment of Group 03, post of collective activity in the forum	Recorded videoconference, Chat, Use of Videos, *Padlet*, Community VLE Forum, teaching plan, hyperlinks, PDF material, Social Network (*WhatsApp*)
07	Co-Create, Remix, and Share OER	Posting of an experiment version (OER) with individual forum writing	Recorded Video Conference, Chat, Community AVA Forum, *Hyperlinks,* Social Network (*WhatsApp*)
08	Writing, Reflecting and Communicating Understandings	Experience Report on OER in the Online Inquiry in Science Experimentation, Presentation of the experiment of Group 04	Recorded Video Conference, Chat, Community AVA Forum, Material in PDF. *hyperlinks,* Social Network (*WhatsApp*)

Source: Prepared by the authors and the TEDCOM/IFSUL Research Group, based on the research carried out.

Chart 1 highlights the existence of a set of collective activities, with the proposition and debate of experiments in groups and collective writings. It is also evident the existence of a set of individual activities, such as weekly writing, readings, interaction with videos and texts and the communication of comprehension in speech and writing. This set of interactions with the materials made available and co-created in the VLE interfaces and

Revista ARACÊ
ISSN: 2358-2472

other computational environments result in research devices, which allow the study of the practice that took place in the discipline.

In conducting the discipline, it was sought to establish a horizontal relationship, where teachers and students (also assumed as teachers in training) dialogued on an equal footing, defining the directions of the educational process. The differences between the subjects involved, in addition to being an element that distances them, is seen as something very powerful, capable of contributing considerably to teaching and learning, as long as they are explored in favor of the educational process, in shared situations of co-creation.

This does not mean that there is no directivity on the part of teachers, much less that this directivity would be an impediment to the student's protagonism and autonomy, it is only known, and seeks to materialize, an open and plural educational process, in which everyone has a voice. Therefore, it is possible to (re)think the didactic designs for the network community in an online context, seeking inspiration in the values and practices arising from cyberculture (PIMENTEL; CARVALHO, 2020).

In this sense, the holding of extra meetings, the inclusion of complementary material and bibliography, the way in which the tasks were proposed, the weekly division, are not choices devoid of intentionality. However, it is important to realize that the teachers, in addition to demanding, exposed what were the didactic-pedagogical purposes of the tasks, giving meaning to them.

The very title of the weekly activities: "Didactic Drawing", whose meaning refers to Art, which in its genesis, deals with the uncertain, because it knows that nothing is ready and finished, as well as the educational proposals (teaching and learning) based on horizontality. Proof of this is that the students adopted different ways/strategies to fulfill the same tasks, evidencing the freedom made possible by a horizontal teaching practice, which was not limited to a mere discourse.

It is also noteworthy the way in which the OER was worked. The contents related to the theme were divided and distributed over several weeks, being the result of a consistent digital curation, which resulted in the availability to students of videos, guides, syntheses, among others, allowing them to "Identify OER", "Find OER" and "Use OER".

Revista ARACÊ
ISSN: 2358-2472

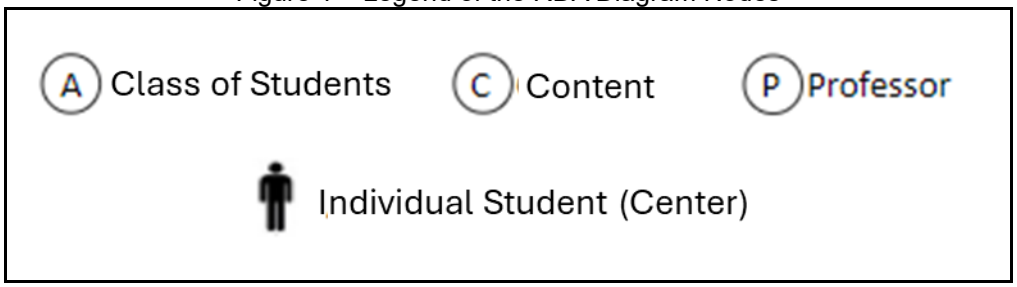
VIEWS ON DISTANCE RELATIONS IN LEARNING ACTIONS AND RDA DIAGRAMS

During the pandemic period, it was possible to highlight the contribution of DICT in education, contributing to more dynamic and interactive learning, and minimizing the feeling of distance (RIBEIRO et al. 2020). The value of a face-to-face class is known, but the pandemic years came to transform the relationships between the virtual and physical space, "[...] although it is not yet possible to perfectly replace the face-to-face encounter or the experience of direct manipulation of an object of study, interactive technologies can substantially minimize the effects of distance on learning" (TORI, 2022, p. 101).

As a way to understand the infinite possibilities of distance relations and components present in educational activities, Tori (2022) developed a process of visual representation, in which it is called the RDA diagram (Distance Relations in Learning). The main purpose of the RDA Diagrams is to enable "[...] a graphic representation that can show all these relationships synthetically and visually simultaneously, thus facilitating the characterization, study, and comparison between different educational activities" (TORI, 2022, p. 153).

To facilitate the understanding of the RDA Diagrams, as well as to support their elaboration, Tori (2022) prepared an initial legend, with the main elements of the RDA Diagram, used in the representation of educational scenarios, as shown in Figure 1.

Figure 1 – Legend of the RDA Diagram Nodes



Source: Adapted from Tori (2022).

The central node represents the reference student, and it is in relation to this student that the relationships are considered. The other nodes - the teacher (P), the other students in the class (A) and the learning content (C) - orbit around the central node (TORI, 2022).

The nodes of the RDA Diagram can be connected by edges, which: if they have a double meaning (bidirectionality) - represent interactivity in this relationship; if it is one-way - indicates the autonomy of the original node; if it is solid - indicates synchronous

Revista ARACÊ
ISSN: 2358-2472

relationship; if it is dashed - indicates asynchronous relationship and if they connect the central node to the teacher (P) or to the content (C) - they indicate the possibility of individualized interaction (TORI, 2022).

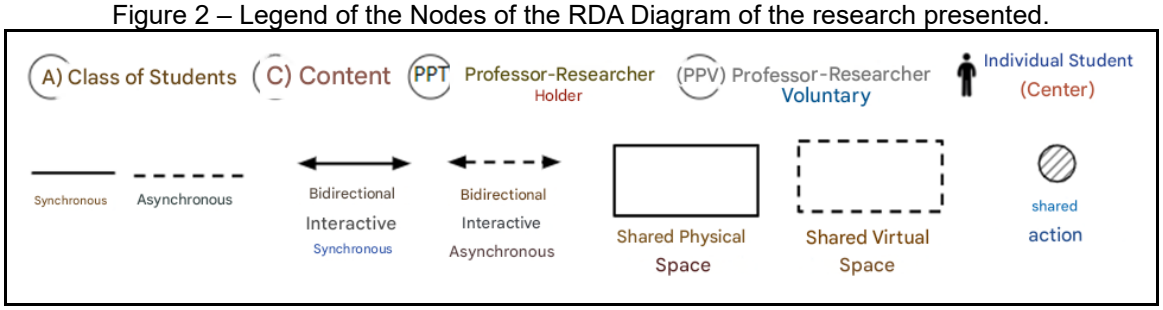
Orbital nodes (A), (P), and (C) may contain additional written information. And the physical or virtual proximity between nodes can be represented by a rectangular area surrounding them, which, if continuous, means the physical common presence, and if dashed, means the virtual common presence (TORI, 2022).

PRESENTATION AND DISCUSSION OF THE RESULTS

The main objective of the graphic representation proposed in this research arranged through the RDA Diagram, was to demonstrate in a synthetic way the relationships of interactions and exchanges between students and teachers, students and students, students and content and teachers and content, facilitating the characterization, study and comparison between different educational activities using OER, and, with this, to assist teachers in the elaboration of pedagogical practices that aim to provide an effective online inquiry process in experimentation in Science.

To begin the understanding of the educational scenario elaborated in this research, Figure 02 demonstrates the elements that make up the representation of the proposed RDA Diagram. A more expanded legend was elaborated, with the insertion of other and new elements, to represent the RDA Diagram of the discipline Online Inquiry Experimentation in Science.

Figure 2 – Legend of the Nodes of the RDA Diagram of the research presented.



Source: Prepared by the authors and the TEDCOM/IFSUL Research Group, based on the research carried out.

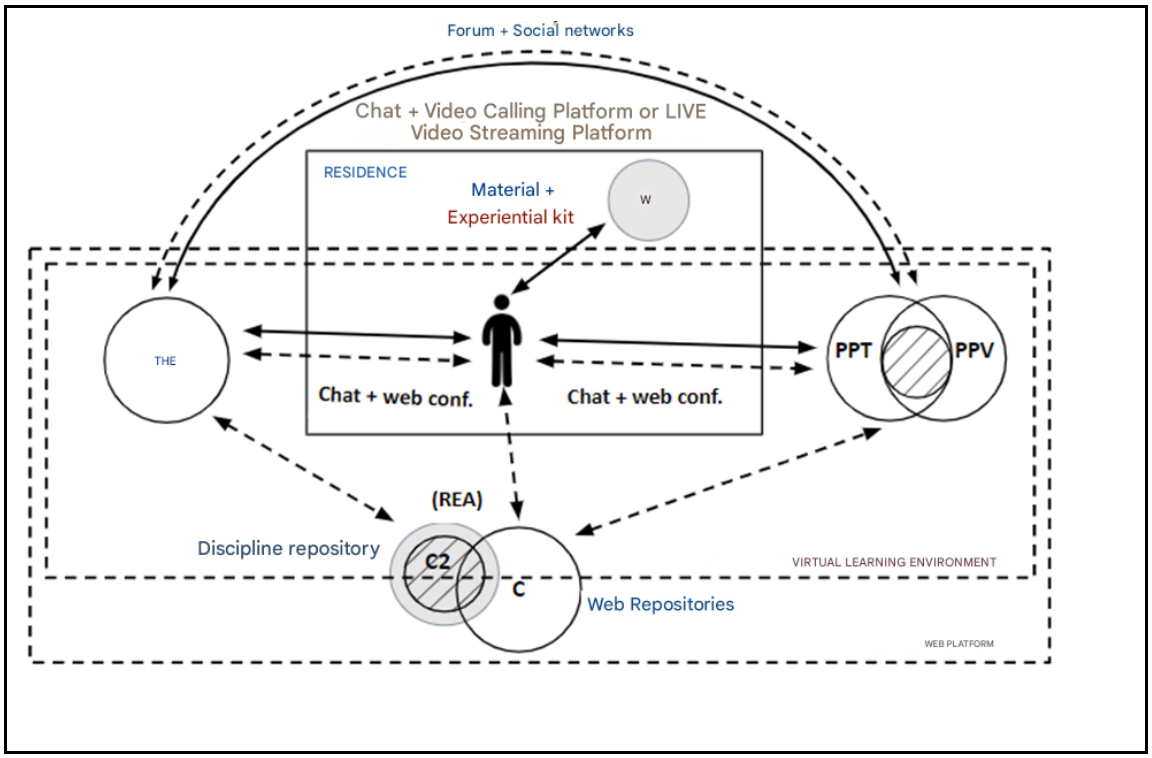
The educational scenario represented in Figure 03, below, shows the differentiated format in the conduction of the curricular discipline analyzed, which had the participation and collaboration of two teachers. This collective action was a factor that enhanced

Revista ARACÊ
ISSN: 2358-2472

discussions and dialogues during the community's activities, by bringing and bringing together points of observation and knowledge in the areas of science and design education. Another important point to be highlighted in the scenario was the use of experimental kits produced by the students, for the construction of educational resources in their own homes, and which served as a reference for the production of OER available on the web and in the repository of the curricular discipline in the VLE.

This possibility of using more than one option for sharing OER happened through the availability of a list of existing repositories on the *Web*, leaving students the autonomy to find a community or repository on the *Web* more aligned with the experiments co-created by them within the community of dialogue, practice and theorizing, materialized during the course.

Figure 3 – RDA Diagram: Online inquiry in experimentation in Science with the use, co-creation and sharing of OER.



Source: Prepared by the authors and the TEDCOM/IFSUL Research Group, based on the research carried out.

The educational scenario represented in Figure 03 demonstrates the breadth and complexity of the series of research elements and devices that were used within the IOEC discipline. It is also possible to observe the use of virtual activities (expository and dialogic classes with the practical demonstration of the educational material prepared by the

Revista ARACÊ
ISSN: 2358-2472

groups, with suggestions for improvement by the community) that were transmitted via Video Call Platform or LIVE Video Streaming Platform, being recorded and made available in the VLE for asynchronous access.

The students, who had the possibility to watch the class LIVE and interacted with teachers and classmates, or via chat, could make notes that they thought necessary and pertinent in their materials (didactic material or digital files). Students who were unable to attend the class LIVE, on the other hand, could watch the recording of it and make notes in their educational material and participate in the debates asynchronously via forum in the VLE or social networks.

According to Figueiredo (2002), it is necessary, in any educational activity, whether online or face-to-face, to promote learning rich in exchanges and interactions, which constitutes a space of belonging, where individual and collective learning is built, which is only achieved through the contextualization of contents in educational processes. According to Figueiredo (2002),

> [...] The future of learning enriched by the use of information technologies is not only to be found in the "production of content", in the "distribution of content" – or, as it is abusively and mechanistically said, in the "transmission" of knowledge – from large electronic repositories of "knowledge" to the empty heads of learners. It is, in our view, in making it possible for the learners themselves to build knowledge, in active and culturally rich environments." (FIGUEIREDO, 2002, p. 02).

Based on what has been exposed so far, a meta-reflection can be elaborated provided by the scenario. In addition to the all-everyone interactions (among the participants), the most important factor perceived in the analyzed scenario was the interaction of the students (teachers) with the content and the interaction with the materials emerging from the collective co-creation. It can be highlighted that the students acted in two levels of interactions and learning: in the first level, the students interacted with the content through the process of constructing the experiment transformed into OER; The second level, on the other hand, was evidenced when the students presented the experiment and were provoked to reflect on what was proposed. This last level happened through community interactions, which involved questioning the pedagogical practices contained in the materials, the lesson plan, the public that would use the resource, the type of material that could be used, among others.

Revista ARACÊ
ISSN: 2358-2472

Returning to Figure 1, which highlights the role of the four main elements of the RDA Diagrams (TORI, 2022), it is possible to state that, if analyzed through the lens of Online Inquiry, in experimentation in Science, with the use of OER:

- **The individual student** - is not only a receiver of educational content/material, he offers the possibility of becoming a protagonist during the experiment, with the role of being a co-creator of the experiment and collaborating with the collective of students and teachers, through the dialogical process in the construction of the other experiments.
- **The collective of students** - becomes a learning community in a network, which through dialogues and inquiries: observes, analyzes, suggests, transforms, co-creates, remixes and shares knowledge and educational experiences with the community itself and with the external environment, in an open way, no longer in a closed, untouchable and immutable world. Experimentation and free creation are invited
- **The professors (Professor-researcher and Professor-researcher volunteer)** - are no longer in the position of a single central being in the role of the intentionality of the activity, they start to mutually exchange experiences between their areas of activity.
- **The content** - the experiment becomes an improveable object, which as the dialogues and interactions in the community take place, is updated, being made available in an open mode to the community and the external public.

The RDA diagram presented was built and analyzed by the authors of the research, together with the collaboration of the TEDCOM/IFSUL focus group, in this study some elements capable of enabling the elaboration of pedagogical practices in online educational scenarios were identified, aiming at the process of experimentation in the teaching of Science with the use of OER. The potentialities with regard to teaching and learning were observed, among which the following stand out:

- co-creation/use of specific materials for experimentation in science by students/classes/disciplines in contexts (synchronous or asynchronous);
- two-way communication (synchronous or asynchronous) between professor-researcher
- two-way communication (synchronous or asynchronous) between students;

Revista ARACÊ
ISSN: 2358-2472

- feasibility in the co-creation/use of diverse educational resources, in order to meet the diversity of activities proposed by the students;
- use of forum and social networks to streamline interactions;
- use of virtual learning environments (VLE) to manage educational processes. Such elements, added to the realization of synchronous meeting moments with students (LIVE), enable the outline of pedagogical practices based on the dialogical process of inquiry in online educational scenarios, powerful with regard to the realization of teaching and learning processes.

FINAL CONSIDERATIONS

The results presented in this research with the use of the structure of the RDA Diagrams, aim to demonstrate the use of forms of graphic representation to evidence the different educational scenarios with the use of OER, in contexts of teaching Experimentation in Sciences. This research contemplates the creation and discussion of the use of RDA diagrams, with the objective of explaining highlights that may be more recurrent in these online educational scenarios that bet on the perspective of dialogical inquiry.

The use of OER in the process of continuing education of educators also demonstrates its potentiality, by providing a dynamic experimentation with open educational resources, an environment that allows the completion of the process of reflection-action-reflection, with awareness on the part of the student-educators. Immersive processes of didactic-pedagogical experimentation with digital technologies, especially with OER, require due time for maturation, criticism by the groups and presentation of results.

The pedagogical ecosystem built in the discipline allowed the groups of educators in training to fully express their creative processes, without restriction, because in freedom arises the space for the new and constructive criticism.

In this way, it is possible to conclude that the base substrate generated by OER, with proper modeling via RDA Diagrams, are the appropriate environment for the structuring and execution of a dialogical process of inquiry in *online educational* scenarios, enabling the realization of a community of dialogue, practice and theorization in experimentation in Science.

The implications for future research refer to the experimentation and adaptation of the proposal to other disciplines and areas of knowledge, seeking to know the limits and

Revista ARACÊ
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building viable alternatives for the critical training of educators. The set of OER co-created collectively with teachers, as well as the set of records (research devices), including the reflective texts, present themselves as potential for investigative deepening in future studies. In this it is assumed that research-training is not based on a path of certainties and directivity without collective bargaining. It is a living organism that requires skillful hands and a sensitive spirit of the teacher-researchers (full and voluntary), to conduct a coherent and synergistic educational process with the demands of an informational and interconnected society of the present day.

Revista ARACÊ
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REFERENCES

1. Bogdan, R., & Biklen, S. (1999). Investigação qualitativa em educação: Uma introdução à teoria e aos métodos. Porto: Editora Porto.

2. Demo, P. (2000). Metodologia do conhecimento científico. São Paulo: Atlas.

3. Figueiredo, A. D. (2002). Redes e educação: A surpreendente riqueza de um conceito. In Conselho Nacional de Educação (Ed.), Redes de aprendizagem, redes de conhecimento (pp. 1-12). Lisboa: Conselho Nacional de Educação, Ministério da Educação. Recuperado de http://eden.dei.uc.pt/~adf/cne2002.pdf

4. Gil, A. C. (2002). Como elaborar projetos de pesquisa (4ª ed.). São Paulo: Atlas.

5. Heckler, V., & do Carmo Galiassi, M. (2017). Indagação online na experimentação em ciências. Enseñanza de las Ciencias: Revista de Investigación y Experiencias Didácticas, Extra, 405-412.

6. Heckler, V., Silva, W. R. da, Silva, I. P. da, & Heckler, V. (Orgs.). (2019). Indagação online em temas de física: Pesquisa-formação com professores. Maceió: Edufal. Recuperado de https://ciefi.furg.br/images/Producao/LIVRO_INDAGAO_ONLINE.pdf

7. Köche, J. C. (2011). Fundamentos de metodologia científica: Teoria da ciência e iniciação à pesquisa (29ª ed.). Petrópolis, RJ: Vozes.

8. Pimentel, M., & Carvalho, F. (2020). Princípios da educação online: Para sua aula não ficar massiva nem maçante! SBC Horizontes. Recuperado de http://horizontes.sbc.org.br/index.php/2020/05/23/principios-educacao-online

9. Ribeiro, L. O. M., et al. (2020). Práticas pedagógicas em cenários educacionais híbridos: Pensando a docência emergencial a partir dos diagramas RDA. In Anais eletrônicos ESUD 2020. Goiânia: Cegraf UFG. Recuperado de https://esud2020.ciar.ufg.br/anais-esud-2020/

10. Richardson, R. J., et al. (1999). Pesquisa social: Métodos e técnicas (3ª ed.). São Paulo: Atlas.

11. Santos, E., et al. (2009). O desenho didático interativo na educação online. Revista Iberoamericana de Educación.

12. Sebriam, D., Gonsales, P., & Amiel, T. (2021). Educação aberta e recursos educacionais abertos (1ª ed.). Brasília, DF: Universidade de Brasília.

13. Silva, W. R. da, & Heckler, V. (2018). Comunidade de indagação online com professores: Ferramentas e princípios. Revista Areté. Recuperado de http://repositorioinstitucional.uea.edu.br/bitstream/riuea/2737/1/COMUNIDADE%20DE%20INDAGA%C3%87%C3%83O%20ONLINECOM%20PROFESSORES%20FERRAMENTAS%20E%20PRINC%C3%8DPIOS.pdf

Revista ARACÊ
ISSN: 2358-2472

14. Tori, R. (2022). Educação sem distância: Mídias e tecnologias na educação a distância, no ensino híbrido e na sala de aula (3ª ed.). São Paulo: Artesanato Educacional.

15. UNESCO/FRA. (2015). Diretrizes para recursos educacionais abertos (REA): No ensino superior. Paris: UNESCO. Recuperado de https://unesdoc.unesco.org/ark:/48223/pf0000232852

16. Wells, G. (2001). Indagación dialógica: Hacia una teoría y una práctica socioculturales de la educación. Buenos Aires: Paidós.