Pedagogical Architecture Trail: Virtual Environment of Learning of the Initial and Continuing Training Course in Educational Robotics in Basic Education – Instituto Federal of Education, Science and Technology - RO - IFRO

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Abstract. *In epitome, the creation of the Initial and Continuing Training course in Educational Robotics is presented within the pedagogical architecture Trilha. The processes of implementation of the plugin for the implementation of the trail in the virtual environment are also presented, in the methodology of the Grouped Trail, which does not obey a predetermined order, where the student can work autonomously, defining the order of learning that most fits your profile. The course proposal meets the accessibility methodology. It is concluded that the use of pedagogical architecture in learning paths supported by computational thinking will enable students to complement their learning and develop new skills.*

Resumo. *Em epítome apresenta-se a criação do curso de Formação Inicial e Continuada em Robótica Educacional dentro da arquitetura pedagógica Trilha. Apresentam-se também os processos de implantação do plugin para implantação da trilha no ambiente virtual, na metodologia da Trilha Agrupada, que não obedece a uma ordem pré-determinada, onde o estudante pode trabalhar com autonomia, definindo a ordem de aprendizado que mais se encaixa em seu perfil. A proposta do curso atende à metodologia de acessibilidade. Conclui-se que a utilização da arquitetura pedagógica em trilhas de aprendizagem apoiada pelo pensamento computacional possibilitará aos alunos complementarem seu aprendizado e desenvolverem novas capacidades.*

1. Introduction

Since the advent of the digital revolution, we have gone through an uninterrupted process of technological improvement, with solutions to the most diverse daily problems, as well as adding a new meaning of communication and data storage to our social relationships. Thus, industry 5.0 has provided robotic, digital and automation advances, as well as the questioning, insights, innovation and creative potential of the human being are of equal value in the manufacturing process. And in the face of the covid-19 pandemic, education 5.0 is related to society 5.0, aimed at social protagonism and stimulates the increasing integration between human beings and technology. In 5:0 education, using the internet, which is a large repository of information, where videos, texts, infographics can be found, that is, materials or content available to everyone and this causes infoglut [unnecessary overload of information and tasks]. Giving access to

content is different from learning to use it and giving meaning to it [Pallof and Pratt, 2002].

In view of this, the Pedagogical Architecture - AP is presented, which, according to Carvalho, Aragón and Menezes [2005], provide an opportunity to think educational proposals in line with the possibilities offered by technology. This means that instead of looking at a pedagogical proposal independently of the technological elements of digital literacy and inserting it later, it starts to integrate the pedagogical aspects in its possibilities of use and application, to reflect on the new educational proposals established for the initial and continuing training course in Educational Robotics in Basic Education [Ifro, 2022].

The realization of this course promotes academic exchange, adds other activities in the field of teaching, research and extension, giving visibility to the Federal Institute of Rondônia (IFRO) and the Fluminense Federal University (UFF) in the service of teachers and graduates of the public education network, target audience of PPC application.

It is known that the Initial and Continuing Training Courses and Programs for professionals are offered by the Federal Institutes and are aimed at training, improving, specializing and updating at all levels of education, in the areas of Professional and Technological Education, according to Art. 3, of Law 11,892/2008.

In the current knowledge society and with the phenomenon of globalization and the consequent need for a more attractive, efficient and creativity-enhancing education, learning educational technology along the lines of robotics has become essential for teachers.

Because robotics is aligned with the Maker culture and general competences in the National Common Curricular Base - BNCC [Brasil, 2018], both in the elementary and high school stages, which assigns the National Education Council [CNE] the task of standardizing the teaching Computing in Basic Education, a process that is currently underway. Among them is autonomy, digital literacy and the construction of logical thinking, which we can develop through working with robotics.

For this to be possible, we cite the Pedagogy of Uncertainty, which presents the skills required to educate for uncertainties: Educate to seek solutions to problems; Educate to transform information into knowledge; Educate for authorship, expression, dialogue; Educate for research, for the creation of novelties allowing subjects to carry out experiments, simulations; Educate for autonomy and cooperation [Carvalho, et al, 2005].

Computing has not only changed the world, but also our way of being in the world and working with "computational thinking" which denotes a set of cognitive skills necessary to understand, define, model, compare, solve, automate and analyze problems [and solutions] in a methodical and systematic way, through the construction of algorithms in different areas of knowledge.

Computational thinking is seen today as one of the skills needed by the 21st century citizen [Pinto & Guarda, 2018].

Robotics is a great way to teach computational thinking, as students can visualize, interact, and connect different elements of playful way, making the learning of abstract constructions present in computational thinking much easier.

The proposal means restructuring didactic-pedagogical practices in order to provide children with the necessary skills to respond to the challenges of unpredictability resulting from the evolution of scientific and technological knowledge. And to promote this growth, and provide better conditions for advances and changes in this new scenario, it is necessary to apply a pedagogical architecture that fits this new model for the development of computational thinking.

For the development of the Educational Robotics course, the pedagogical architecture will be the Trail, which allows students to make choices when tracing different paths, which can be starting points for discussions to exchange experiences, debates on difficulties and on work strategies which, in turn, mobilize metacognitive processes and thus facilitate the pedagogical appropriation of environmental resources and actions with telematics[1] .

Pedagogical architecture on the trail emerged as an integrated, systematic and continuous development of people and professionals. In this scenario, Federal Institutes need to ensure that graduates leave the institution ready for the tasks and challenges of everyday life, which is the purpose of technological courses. In these educational institutions, the tracks intend to combine the students' needs with the transmitted content, making them protagonists of their studies, promoting heutagogy [Garcia, 2021, p.221]. For this, it is important to consider the individualities of each student and the limitations of the pedagogical team and teachers.

The Educational Robotics Course used the methodology of the grouped learning path to organize VLE actions, and the Guide for Activities in Moodle.

It is known that learning is not consolidated in the same way for all students, each student has their own limitations and individualities in the process of content assimilation. Thus, it is necessary to think of methods that include everyone, including people with disabilities, and ensure that learning takes place effectively.

Thus, the use of technological tools must be combined with traditional tools. Lectures, books, games, videos and podcasts are some examples of important tools to compose a learning path.

The purpose of using the method is to transform technical knowledge into a complete learning process, which encompasses the development of competencies: digital culture, digital technology and computational thinking [Garcia, 2021, p.188]. Thus, the pedagogical trail architecture consists of experiences that facilitate the absorption of knowledge through the combination of different types of activities during training in an educational institution.

Our goal working with the pedagogical trail architecture is to make the student go through a continuous sequence of activities on a certain contents. In this sense, the

[1] A combination of the words telecommunication (telephone services, optical fiber, satellite, cable, etc.) and informatics (software, computers, network systems, peripherals, etc.), and refers to any system that transmits data over the network, whether in text, image or sound. https://www.crtrj.gov.br

trails work with a combination of content to be passed on to the student, so that their learning can be of quality. This happens from the involvement of several materials on a single topic, making the student have contact with several fronts and not see the subject from a single perspective.

Even the student who needs to go through the learning leveling process will be in the same place in relation to the content as the other colleagues, with no delays and inequalities and, thus, the quality will be evidenced in the process.

In this article we aim to report the pedagogical directions that were selected by the multidisciplinary team, professors and coordinator, aiming to needs of each content/class/student, in the application of the Educational Robotics Course in an accessible and inclusive way. The team chose to create something flexible, in stages, allowing them to develop autonomy in choosing the paths to follow, to promote engagement and content assimilation, using the methodology of pedagogical architecture in a grouped path.

2. Methodology

Today the pedagogical architecture of learning paths is used in several stages of education, gaining prominence in higher and professional education. The trails are divided into two methodologies: linear and grouped.

Linear trail that the acquisition of new knowledge depends on previously acquired knowledge. Thus, learning is organized into modules, so that knowledge is arranged in a linear sequence and will be released as the student achieves success in the previous activity, and thus the teacher is responsible for directing the path to be followed by the student [Activesoft, 2022].

In the Clustered Trail methodology, the organization of the trail does not follow a predetermined order, as is the case with the linear model. In this model, students can work on their autonomy, defining the learning order that best fits their profile. Subjects that have a greater number of ramifications and that do not depend on prior knowledge should be allocated in this learning path model. This model was adopted in the Educational Robotics Course [Activesoft, 2022].

The Educational Robotics Course, to insert the trail methodology in the VLE activities, used the Guide for Activities in Moodle[2], supported by Bloom's Taxonomy, which makes it possible to define educational objectives and assess the student within this perspective.

The tools chosen within the VLE: Resources and Activities are intended to classify and facilitate the exchange of information on curriculum development and the assessment plan [Bloom et al., 1977].

The Interactive Portable Document Format [PDF] feature stands out in the methodology of creation and implementation of the environment, as it concatenates in a single document the possibilities of inserting films, e-books, games, podcasts and mind maps, short videos, texts and these documents will be accessible. This, according to Fausto [2021] can increase inclusive learning, which is essential for students to respect

[2] Available at https://bit.ly/37jRyoh

the processes of creating documents with accessibility, so that they are understood by the assistive resources of the tools.

It is important to digitally include the person with a disability both for access and for the usability of the system, hence, during the implementation of the Course, the need for the Inclusive VLE emerged. And so it enhances and promotes the integral development of all students.

The creation of the VLE was modeled in an Inclusive and Accessible way, an environment designed, anchored and planned to be accessible, but it is noteworthy that to achieve the support technologies of this environment, the organizational design was used, so that the user action make the environment even more accessible [Fausto, 2021].

The Moodle Atto text editor was also used, which makes Ava inclusive and allowed the organization of information using titles, subtitles and labels, facilitating the reading of text using assistive technology, meeting the system's usability regulations. This tool also provides access to the Accessibility Checker and whether or not the inserted content is adequate, as well as in the Office [Fausto, 2021], including for proposing inclusive assessment activities in the environment.

And the evaluation process in the environment should consider the following criteria: dedication, project development, research and preparation of materials can be used to close the final grade, which can be added to the concept of the discipline, with the objective of solving problems, applying the techniques of computational thinking. For a precise and detailed diagnosis of each student that contributes to a more efficient teaching and learning process, the tool will be Rubrica3.

It is important to highlight the installation of the Onetopic format plugin, based on the Moodle standard, which displays each topic in a tab, keeping the current tab between resource calls, so that when returning from a module such as the blog or the glossary, it returns to the tab from where it was started.

3. Results

The process that involves the construction of a learning path must consider several factors such as the profile of the class and the student to be developed; the limitations and individualities of the group, and the type of knowledge that will be transmitted. Thus, the skills and competences that the pedagogical team intends to develop are identified and the objectives to be achieved using pedagogical architecture in trails are outlined. This intentionality also permeates computational thinking, so the Moodle competency-based education model is programmed [Moodle, 2016].

In the competency frameworks, it was possible to define competency profiles according to certain themes or skills, models of Learning Plans were created to assign students to the competencies they should acquire and thus facilitate the work of the management team, as it allows the creation of models and assignment to several students [Moodle, 2016].

Thus, the importance of knowing the profile of the target audience that collaborates in the elaboration of a more assertive trail is highlighted, because the more adapted to the reality and needs of the student, the more engaging and effective the trail is, including levels of difficulty during the course process, so the student is motivated with the challenges in levels, within a gamification process, “allows all learning to be

fun, while improving students' passion, persistence and motivation to reach the next Level" Garcia [2021, p.54], resources and techniques are tools that promote complexity through scores and rewards and with flexibility, as seen in Figure 1.

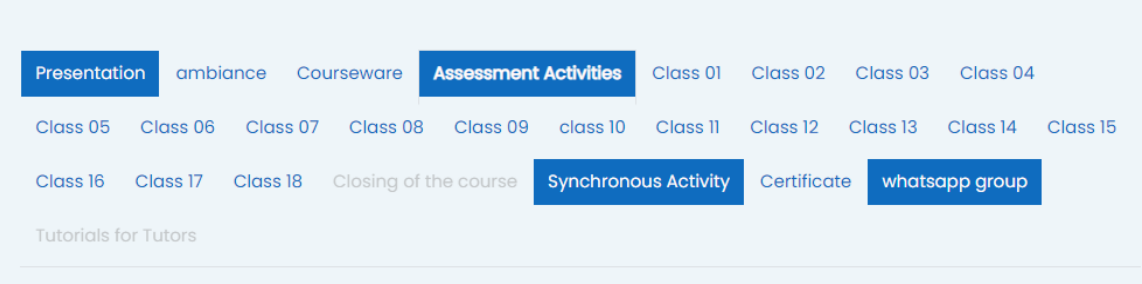

Figure 1. Visual Identity of the Educational Robotics Course

The application of active methodologies was used, with the objective of keeping the student at the center of the teaching and learning process, with the storytelling technique, which "is a narrative that, in the educational process, incorporates pedagogical elements that provide students, creativity, critical thinking and interaction" [Teodosio, 2021], seen in the Interactive PDF.

The tool will be the Rubric, which is a procedure, or scoring guide, that lists specific criteria for student performance and describes different levels of performance for those criteria [Bender, 2014].

About the Onetopic format plugin, this format is based on the standard Moodle format: "Topics". Supports editing by AJAX[3], essential for application in Learning Paths, figure 2.

Figure 2. Onetopic format plugin

This plugin feature allows the construction of the track in the format seen in Figure 2 and with the visual identity of Figure 1. The installed plug-ins are in the testing

[3] https://moodle.org/plugins/format_onetopic

and adaptation phase to create the Teaching Plan and fix the visual identity of the course. The H5P will also be used, with the gamification proposal of the course.

We understand that the pedagogical architecture of the learning paths allows the combination of several tools in the content transmission process and gives different options to each student respecting their individuality, mentioning here the multiple competences of Gardner [1995], which lists linguistic intelligence, logical, spatial, bodily- kinesthetic, musical, interpersonal and intrapersonal.

The theory of multiple intelligences starts from the observation of people, about how they develop important abilities and skills throughout their lives, resulting in patterns of profiles and different intelligences. These new types of intelligences can be independent or combined with others, in a multiplicity developed by individuals in different ways, in different cultures.

People learn in different ways and have different interests and abilities, including in virtual learning environments. In this environment, it is possible to conclude that the fact that they have greater ease of accessing and assimilating content in video or in written form promotes their autonomy and becomes a protagonist in their own education. It enables engagement and promotes a more active posture in relation to learning and thus develops numerous skills, such as those suggested at the World Economic Forum[4] and at the National Curricular Common Base - BNCC [Brasil, 2018], such as solving complex problems, critical thinking, creativity, emotional intelligence, etc. From this perspective, students can act effectively in each situation, mobilizing and combining intellectual and emotional resources.

Zabala [2007] complements by mentioning that in competence-based learning, actions are planned and developed in which conceptual, procedural and attitudinal components must be mobilized, at the same time and in an interrelated manner [Guarda and Pinto, 2020].

This proposal also works with learning by competences, which is a methodology that is opposed to the traditional education of teaching by subjects. Competence can be understood as the power to act effectively in each situation, mobilizing and combining, in real time, intellectual and emotional resources. It can also be considered as the ability to solve problems in any situation, or even in new situations or in different contexts. Competency-based learning connects different areas of knowledge and knowledge, resources, attitudes, values, stimuli and skills, within the Ecopedagogy proposal seen in Gadotti [2001].

Educational robotics, also known as pedagogical robotics or educational robotics, is an important resource in the teaching-learning process and explores various themes in the school curriculum. It is based on Jean Piaget's constructivist theory, which has the student as a builder of his own knowledge, interacting and producing his own learning, establishing a relationship of exchange between the environment and the object, thus obtaining an experienced learning, a learning of experimentation with a better accommodation of knowledge, placing the student as an active agent in the

[44]https://www.infomoney.com.br/carreira/as-15-habilidades-que-estarao-em-alta-no-mercado-de-trabalho-ate-2025-segundo-o-forum-economico-mundial/

process of their own learning, making this a significant learning in the assimilation of the subject studied [Silva, Blinkstein, 2020 and Schön, 1992].

4. Final Considerations

It is understood that learning is based on competences and must include educational situations in which it helps to see the meaning of what is done, in which teachers/graduates show how to do it, helping students to master the contents and procedures. autonomously and independently.

The challenge for the teacher lies in combining competences, teaching methods and active methodologies in the virtual learning environment, articulating their daily applications with problem solving, which tends to be more significant and effective, meeting the development of competences proposed in architecture. trail pedagogy.

One of the benefits of using the pedagogical trail architecture is to break with the traditional teaching model. And with the development of computational thinking, we can act in an interdisciplinary way, combining tools that complement learning and develop new capabilities. A strong point that we identified was that the pedagogical trail architecture can form a professional with a holistic vision for problem solving and better decisions, as it is supported by computational thinking.

The inclusive VLE allows everyone to have access, without the exclusion or segregation of people with disabilities and becomes a differential for the scientific actions of the proposal, thus meeting the sustainable development objectives of the 2030 agenda.

The main purpose of this training is to serve elementary and high school teachers with interdisciplinary knowledge that includes the knowledge of Computing, Educational Robotics and Education, aligned with the BNCC, with the proposal to develop computational thinking in the proposed activities.

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