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Active methodologies: a reflection on the contribution of flipped classrooms during the COVID-19 pandemic period

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ABSTRACT

This article presents reflections and highlights of educational products developed during the COVID-19 pandemic in the field of active methodologies, with an emphasis on the flipped classroom method. Its main objective was to reflect on the importance of active methodologies, combined with the advancement of technologies, in the transition process from traditional education to an innovative teaching model that places the student at the center of the teaching/learning process. The study was conducted using a qualitative, exploratory approach with a bibliographic procedure, focusing on recent works in formal and non-formal technical and vocational education in Brazil, using the EduCapes Portal database and applying the term "flipped classroom" as a search tool. Five educational products were selected. In the end, it was found that the teaching model addressed and developed by the authors of the highlighted educational products made significant contributions to technical and vocational education in Brazil during the mentioned pandemic period, despite the challenges and difficulties encountered in their implementation.

KEYWORDS: Active Methodologies. Flipped Classroom. Educational Products.

1 INTRODUCTION

The society of this century has been experiencing constant changes and a rapid movement of social transformation. According to Chiavenato (2014), these changes are stimulated by factors such as economic, social, cultural, technological, demographic, political, and ecological changes that act together and systemically in an incredible dynamic field of forces that produce extraordinary results, bringing about transformations, unpredictability, uncertainty, and perplexity. These changes have significantly impacted people's lives, the relationships established among them, the world of work, and the school. The latter, perhaps, is the one that has been most "shaken" (as described by the authors), given the historical solidity of its structure (DIESEL; BALDEZ; MARTINS, 2017).

In light of the above, this manuscript proposes to reflect on the contributions of active methodologies in the process of renewal and transformation that education has undergone in recent years, experienced more deeply during the COVID-19 pandemic. These changes involved the use of technologies, such as online platforms, particularly Google for Education, which made a significant contribution.

Within the integrated high school education in the federal education system, students were able to experience this teaching method, which is not so new but was until then little implemented in the network, involving teaching platforms, the use of technology, the use of the internet, the provision of content on digital platforms, the completion of activities, and their submission using these platforms. The most commonly used one was Google Classroom, replacing the physical classroom, as it offers various online and free resources.

De Lima Araújo and Frigotto (2015) consider integrated education not only as a way of offering vocational education at the secondary level but also as a pedagogical proposition that commits to the utopia of holistic formation, which is not satisfied with the socialization of fragments of systematized culture and understands access to a formative process, including schooling, as a right for all, promoting the development of their broad physical and intellectual faculties.

De Lima Araújo and Frigotto (2015) state that it is a mistake to consider the possibility of a single method being valid for all situations in integrated education since there is a myriad of procedures that, depending on the subject matter, students, and specific educational purposes, can enhance the understanding of the world, as proposed by the integrated education project, addressing practical issues related to the didactic process of experimenting with this teaching modality, in light of references identified with a pedagogy focused on the social.

Given the statements of these two renowned authors in Professional and Technological Education (PTE), the use of active methodologies can be seen as a proposal for variation in these teaching methods, which, in turn, cannot serve as a basis for all, in order to achieve only a stereotyped model of the student. The particularities of each student must be taken into consideration, as well as the fact that the teaching and learning process begins long before teachers and students enter the school environment.

But would it be possible to find Educational Products (EP) within the EduCapes platform that could contribute to a modern education, with the theme of "Flipped

Classroom" (FC) placing the student as the reference in the process of knowledge construction?

This manuscript aims to reflect on the importance of active methodologies, combined with technological advancements, in the transition process from traditional education to an innovative teaching model that places the student at the center of the teaching/learning process, with a view to their social participation as an active, autonomous, and protagonist subject in knowledge construction. Thus, the study will gather EP that were developed during the COVID-19 pandemic.

2 THEORETICAL FOUNDATION

This topic presents the theoretical foundation of this study. Initially, it discusses the contributions of Lev Vygotsky's theory of learning, highlighting the category of learning mediation through social interaction, which aids in a critical reflection on the pedagogical practice of the teacher mediated by active methodologies. It then delves into active methodologies, with emphasis on the FC method, Information and Communication Technologies and the challenges of their implementation in education, as well as the basis for the theme defined in this study. Lastly, it explores the concept of EP and their role as mediators in the teaching/learning process.

2.1 Lev Vygotsky's Theory of Mediation

The article by José Moran titled "The Role of Methodologies in School Transformation" provides an understanding that active methodologies are not a recent theme, but rather the "sense of urgency" in contemporary education (BACICH; MORAN, 2018, p. 1). This postulate is important as it elicits more in-depth theoretical reflections on active methodologies, seeking to overcome simplistic and purely pragmatic definitions attributed to their understanding.

Therefore, for the purpose of theoretical foundation in this research work, which focuses on EP based on Active Learning Methodologies (ALM), a brief review and discussion of Vygotsky's theory of learning mediation becomes necessary. This is because this interactionist category emphasizes the significant mediating function of these methodologies in educational and formative processes within the student's zone of proximal development, particularly regarding the contextualization of the real learning needs of the individual.

The relevance of the Theory of Mediation to pedagogical practice resides in the general postulate of Vygotsky's work, which prioritizes the understanding that the construction and implementation of teaching and learning methodologies should not occur in isolation from the historical and sociocultural context in which the student is situated. This is because learning, reception, production, and sharing of knowledge depend on the interaction between the individual and other people, as well as the prevailing historical-cultural constructs of the social context in which they live and develop (VYGOTSKY, 1991; VYGOTSKY; LURIA; LEONTIEV, 2010).

In this approach, the comprehension of how social interaction interferes with human learning and subsequent development is emphasized. This is because social interaction allows for the internalization/appropriation of constructs from the

sociocultural environment by the individual, making them an active and creative social being (VYGOTSKY; LURIA; LEONTIEV, 2010).

This assertion justifies that Vygotsky's theory of mediation (1991) falls under the cognitivist and sociointeractionist perspectives, premised on the understanding that the development of cognitive dimensions cannot be comprehended without reference to the social and cultural context in which it occurs. According to the theory's author, the social, historical, and cultural contexts are key components of cognitive development.

Therefore, social interaction facilitates the mediation of human learning actions in and with the world, given that "mediation is the basis for the higher psychological processes of the human being" (VYGOTSKY, 1991, p. 3). In other words, these processes refer to human development through interactive learning with elements of the sociocultural context, awakening the conscious thought about oneself and others, critical perception and memorization, communication, concept formation, problem-solving, mastery of volitional and emotional feelings (VYGOTSKY, 1991; PEREIRA *et al.*, 2023).

In the methodological theorizations of Vygotsky (1991) and Vygotsky, Luria, and Leontiev (2010), the social relations/interactions established among people are constructs that foster learning, given that these same relations are processes of mediating human action with the object of learning. However, human actions in the world depend on the mobilization of instruments (systems of technological tools and systems of symbolic/language and numerical signs, among others) sociohistorically constructed in and through sociocultural formations.

According to Vygotsky (1991), at every moment in history, humans create new instruments to act and interact in order to meet their needs within the social environment. This consequently modifies culture and learning, equally modifying themselves. It can be inferred from this that the human being is a social and creative being. This capacity distinguishes them from animals.

In Vygotsky (1991) and Vygotsky, Luria, and Leontiev (2010), it is understood that school is the social space of multiple interactions between people, knowledge, and cultures. As such, it is also the space of socio-cultural differences. Therefore, the implementation of technological pedagogical mediation requires methodologies of active learning centered on the student's protagonism, in line with the new mediations and transpositions of knowledge made possible by digital technological tools and linguistic signs of our days. In this case, the FC emerges as an important mediating possibility, as it brings together zones of learning and student development in different learning environments and time frames.

Vygotsky (1991) suggests that learning occurs within the zone of proximal development, defined as the distance between the student's actual cognitive development level, which refers to their ability to solve problems independently, and their potential development level of problem-solving capacity under the guidance of someone more experienced or an adult.

Therefore, it is understood that the zone of proximal development encompasses all the functions and activities that the student can perform only with assistance. The person who intervenes to guide them can be an adult (parents, teacher, guardian, foreign language instructor) or even a peer who has already developed the required skill (PEREIRA *et al.*, 2023).

From the above, discussing ALM requires reflecting on pedagogical mediation in Vygotsky (1991), whose theory based on socio-interactionism brings important contributions to the understanding that these methodologies are educational actions that function as mediators of the teaching and learning process, acting directly in the zone of proximal development.

In the relationship between teacher, student, and knowledge in teaching/learning events, it is urgent that the methodology used allows for interactivity. This is where the FC constitutes itself as an active methodology that mediates this process, as it allows the teacher and student to work on knowledge before, during, and after school activities. This leads to the understanding that the FC method starts in the world of life and enters the world of school and vice versa, as a zone of proximal development that develops not only in the classroom but beyond it, thus overcoming the traditional method through social interaction.

Next, we will discuss some ALM, their definitions, with a focus on the FC, which is the focus of this present work.

2.2 Active learning methodologies

ALM have a critical-reflexive education conception based on stimulating the teaching and learning process. They consist of a pedagogical technique based on instructional activities that engage students, resulting in their involvement in the pursuit of knowledge (MACEDO *et al*., 2018).

Active methodologies are the interrelation between education, culture, and school, developed through active and creative methods, centered on student activity with the intention of facilitating learning (BACICH; MORAN, 2018).

There are several types of ALM, some of them, according to Fonseca and Mattar (2017), are:

- Blended Learning: a mixture of face-to-face and online education.
- Peer Instruction: students teach and learn from their peers.
- Case Method: students discuss and present solutions based on cases proposed by the teachers.
- Problem-Based Learning (PBL): students learn in small groups with tutor teachers from problems.
- Project-Based Learning: students work for an extended period investigating and responding to a problem question.
- Research: production of works for disciplines, scientific initiation, with the teacher as a supervisor.
- Gamification: the use of game mechanics and thinking to engage, motivate actions, and promote learning and problem-solving, making dense content more accessible (ALVES, 2018).
- Flipped Classroom: supported by Digital Information and Communication Technologies (DICT), it changes traditional practice, making activities that were previously done in the classroom happen outside of it and vice versa.

As mentioned earlier, the focus of this manuscript will be on the FC.

Active methodologies are responsible for mediating between the theoretical and practical aspects of teaching and learning, although the academic environment may not perceive their relevance (MACEDO *et al.*, 2018).

2.3 Flipped classroom

The FC is an active methodology that consists of a learning strategy characterized by the inversion of the classroom and is carried out in pre-class, in-class, and post-class moments (DE LIMA BENEVIDES; AMORIM NETO, 2021).

According to Horn and Staker (2015), American authors, within blended learning, the FC emerges as an educational program characterized by study moments using networked resources through digital platforms, and moments that take place in the classroom, allowing interaction between students and teachers, and enhancing student engagement.

Pioneering authors of the FC method, Bergmann and Sams (2016), define this methodology as the inversion of what was previously done in classroom moments and is now done at home, and what traditionally was assigned as homework is now done in the classroom. In this inversion method, students have prior contact with the content before class, and during the classroom moment, face-to-face meetings are used more actively in the students' learning process, where the teacher, as a facilitator, proposes discussions, practical activities, demonstrations, and addresses doubts that arise during the pre-class study period (BERGMANN; SAMS, 2016).

Barroso (2020) defines Google Classroom as a virtual classroom provided for free by Google, which serves as an excellent tool for implementing the FC, as it allows teachers and students to log in from any computer or mobile device to access class assignments, course materials, and receive feedback. This tool provides teachers with a platform to communicate with students, assign and receive assignments, and provide other resources for learning.

Table 1 outlines the three moments of the FC method, highlighting its three stages of implementation, based on the contribution of De Lima Benevides and Amorim Neto (2021).

Table 1 - The three moments of implementing the FC method.

Flipped Classroom	
Pre-class	Students can start studying the activities, which can be in the form of video lessons, educational games, books, textbooks, online forms, among others, made available on educational platforms. The most commonly used platform in Brazil is Google Classroom, as it is free and offers various resources. The activities proposed on Google Classroom can include video links from YouTube, reading articles, interactive game websites, digital forms, or any other material related to the subjects that serve as a basis for later discussion in the classroom.
In-class	After accessing the content of video lessons, educational games, textbooks, digital forms, or other materials provided on Google

	Classroom, students participate in classroom discussions aimed at collective knowledge construction.
Post-class	Consists of posting, carried out by the student, of evaluative activities proposed by teachers within the platform, uploading their responses.

Source: Adapted from De Lima Benevides and Amorim Neto (2021).

In this way, the classroom becomes more attractive and meaningful for the student. The three highlighted methodological moments enable the student to become the protagonist of their own learning. This demystifies the figure of the teacher as the holder of knowledge, transforming them into mediators of the educational/formative process and updating traditional education with innovative, student-centered teaching.

2.4 DICT and the challenges of their implementation in education

Costa, Duqueviz, and Pedroza (2015) conceptualize DICT in education as mediating tools for learning that contribute to the improvement of the teaching and learning process by incorporating technological instruments into the educational/formative process. These include electronic and technological devices such as computers, the internet, tablets, smartphones, and any other device that allows internet navigation.

The use of DICT as learning tools brings about important changes in the way we teach and learn, as it enables students to use technological resources, promoting their proactivity and assuming a prominent role in the autonomous and interactive acquisition of knowledge from a modern and dynamic perspective (NASCIMENTO; MACEDO; NUNES, 2022).

The pedagogical question in the digital context, with the expansion of the internet and DICT, has led educators to rethink and even innovate their pedagogical practices in the context of the 21st century, as the combination of technologies and education is still in the early stages of experimentation. Educators and students today are immersed in a dynamic, interactive, and proactive context, very different from the educational models that existed before the arrival of the internet (SCHUARTZ; SARMENTO, 2020).

Prensky (2001) coined a term to classify a generation of young people identified as speakers of a digital technological language. The most useful term he found to describe them, according to the author, is "Digital Natives," as this generation is composed of "native speakers" of the digital language of computers, video games, and the internet. The main characteristic of this generation is their ease in using new technologies.

In Brazilian education, one of the most important aspects that must be considered is the infrastructure required for the use of these technological resources as teaching tools. One key point is the internet access speed available in schools. With the digital world increasingly relying on cloud computing, which allows data to be stored online and accessed from anywhere, having good internet speed is crucial (CAMPOS; DE PAULA, 2020). However, in addition to that, it is necessary to have a teaching staff prepared to handle such tools efficiently.

Carvalho and De Lima (2019) analyzed and found that the content of the Pedagogical Political Projects (PPP) in higher education courses at the Federal University of São João del-Rei (UFSJ) emphasized the need for constant reflection on the initial teacher training at UFSJ, in order to reconsider the pedagogical use of DICT in most of its projects, as DICT have undeniably become part of our lives and everyday activities.

According to Da Silva Oliveira, De Brito, and Padilha (2022), a large portion of educators in basic education are stuck in a traditional teaching routine, where teachers act as transmitters and students as passive and submissive learners. It is evident that this reality needs improvement, and effective strategies need to be implemented in the reality of these teachers and educational institutions.

The next topic presents the definition of EP, as the concept and origin of these products will be of great importance for understanding the content of this study.

2.5 Educational products

EP are mediators in the teaching and learning process. They result from research conducted within this process and are therefore referred to as the "final product" of postgraduate courses such as professional master's in Teaching in Brazil and through the Pibid - Institutional Program for Initiation Scholarships in Teaching.

According to Da Rosa and Locatelli (2018, p. 26-27), these products have the function of "favoring learning and contributing to the quality of the educational process, especially in basic education." With this understanding from the authors, EP refers to the didactic materials developed with the aim of mediating the teaching and learning process.

These mediational tools (in the Vygotskian sense of the term) in pedagogical practices can take the form of small books, applications, activity manuals, podcasts, instructional sequences, documentaries, software, educational games, etc. In the educational/formative process, these objects serve as mediators of knowledge and/or provide relevant information to address problems identified during the production of a specific research project.

Moreira and Nardi (2010) define EP as the final outcome of research conducted in professional teaching master's programs in Brazil, which aim to improve teaching in a specific area. At the end of the program, the student must develop a new teaching strategy, meaning a new methodology for specific content, with the mediation of tangible and intangible materials.

Ultimately, it is a process or product of an educational nature, implemented in real classroom conditions or in formal or non-formal teaching settings, with the results of this experience being reported. It is essential that these products be made available on the program's webpage from which they were generated (MOREIRA; NARDI, 2010).

Therefore, to fulfill the requirements of professional master's degrees in the field of Education, students must generate EP resulting from research on teaching to be used in public schools throughout the country, in addition to dissertations and articles derived from the descriptive and analytical account of these experiences (BRASIL, 2019). Thus, such products or processes need to be applied

in real classroom conditions or in non-formal or informal teaching settings (LEITE, 2018; DA ROSA; LOCATELLI, 2018).

According to Rizzatti *et al*. (2020), professional master's programs differ from academic master's programs. As a result, students are required to develop products with theoretical-practical application within real educational and training contexts, which gives each product specific teaching and learning objectives, assuming different configurations in formats and thematic content to meet the needs of the community for which the product proposal is intended.

However, although EP are propositional models with pedagogical purposes aimed at the didactic transposition of their contents, Rizzatti *et al*. (2020) emphasize that these teaching/learning objects should not be uncritically approached within educational organizations. The function of these mediational tools is to serve as an "interlocutive product" for teachers in different educational contexts.

> Teachers can freely reuse, revise (adapt, modify, translate), remix (combine two or more materials), redistribute (share), and retain (have their own copy) the different products generated in Professional Master's programs critically, adapting them to the needs of their different student groups, and returning new EPs to society in a continuous cycle (RIZZATTI *et al*., 2020, p. 2).

In light of the above, the EP serves as an instrument of mediation and didactic/methodological transposition of knowledge. It functions as a facilitator, assisting in the implementation of activities to achieve the teaching/learning project within the zone of proximal development, serving as potential learning objects.

3 METHODOLOGICAL APPROACH

This manuscript was developed using a qualitative research methodology. The choice of approach was made based on Gil (2002), considering the need for the research to delve more flexibly into the studied reality. In this perspective, an exploratory study was conducted with the objective of gaining a deeper familiarity with the analyzed object through reading, analysis, and interpretation of the material in order to make it more explicit and bring forth reflections (GIL, 2002).

Special emphasis was given to recent works within the FC method, demonstrating its contribution to teaching in Brazil, especially those developed during the COVID-19 pandemic as a way to solve the impossibility of face-to-face classroom meetings imposed by social distancing measures. The research, in terms of procedure, was conducted through bibliographic means, as books and articles served as the basis for its development (GIL, 2002).

The first step of this article was to search for e-books and articles using the Google Scholar tool, focusing on various concepts related to the topics addressed, including books and article publications from the last five years. The aim was to bring clarity to the object of study and enrich the theoretical framework.

The second step involved researching EP developed in the field of active methodologies, specifically FC, and applied in formal and non-formal settings of PTE. The research was conducted in November 2022. The EduCapes Portal database was used, employing the term "flipped classroom" as a search tool. Five

EP were selected based on their availability within the platform's database and the year of publication, giving priority to the most relevant and recent works. Works with similar characteristics were excluded, favoring the most recent ones.

As this is a bibliographic study and does not involve human subjects, there was no need for submission to an Ethics and Research Committee (ERC) as this study does not pose any risks.

4 RESULTS AND DISCUSSION

This section presents the EP developed in formal and non-formal settings of PTE that received attention within the proposed work, specifically in the field of ALM, particularly the FC method. According to Fonseca and Mattar (2017), supported by DICT, this method alters the traditional practice by shifting activities that were previously done in the classroom to outside the classroom, and vice versa.

All of these EP share the common characteristic of being applied in high school, an ideal space, as noted by De Lima Araújo and Frigotto (2015), for expanding the understanding of the world by addressing issues related to the didactic process, and utilizing the classroom, which Vygotsky (1991) classifies as the zone of proximal development.

Out of the first 100 results found in the search, 68% were discarded because they were developed and published between the years 2004 and 2019, outside the COVID-19 pandemic period. Please refer to Table 2, which presents the publication years of the first 100 products found in the EduCapes portal database.

Table 2 - Results of EP obtained from the EduCapes platform according to the publication year.

Publication Year	Number of Products Found	Products Found (% of total)	Products Published during the pandemic period
From 2004 to 2019	68	68%	
2020	18	18%	32 (32%)
2021	9	9%	
2022	5	5%	

Source: Research data (2022).

As mentioned above, the products found from 2004 to 2019 totaled 68 and were discarded as they did not fall within the COVID-19 pandemic period. In 2020, 18 products were found, in 2021, nine products were found, and in 2022, five PE were found.

After a comprehensive review of the 32 products found within the scope of this study and based on the publication year, priority was given to the most relevant and recent works, selecting five PE to be part of this study. Products with similar characteristics were excluded, with a preference for the most recent ones.

The following highlights the developed products available on the EduCapes Portal and selected for this study.

4.1 Product 1 - flipped classroom

The PE developed by Barroso (2020), titled "Flipped Classroom," is presented in the form of a booklet developed in the PTE Master's Program (ProfEPT) at the Federal Institute of Education, Science, and Technology of Rio Grande do Norte (IFRN), Mossoró Campus. This product is an integral part of the master's dissertation titled "Teacher Training Actions on the Flipped Classroom Methodology at IFPI-Campus Piripiri" and aimed to contribute to teachers' understanding of the FC methodology, its advantages and disadvantages, and how to implement it in their classes.

Barroso (2020) divided the booklet into three sections: Module I - What is the Flipped Classroom?; Module II - Advantages and Disadvantages of the Flipped Classroom; and Module III - Putting it into Practice.

The author states that the arrangement of the modules was designed so that teachers could, based on this basic knowledge, explore methodologies that enhance student learning, placing them at the center of teaching and learning and making them more effective in this process.

This work deserves recognition for not focusing solely on a classroom or a limited group of students but for being targeted at teachers. In this way, each teacher can expand the reach and bring this teaching method to their classes, which can improve the classroom environment and make it more engaging for students, aligning with Vygotsky's theory (1991) of transforming social relations into mental functions.

The author listed some obstacles in implementing this methodology. The first challenge to be faced is related to the increased use of the internet since excessive simultaneous internet access in the same location can result in slowness and failures in implementing the method.

According to Campos and De Paula (2020), a student's experience with the technology involved in their learning process can be hindered if access to these resources is precarious. It is necessary to have adequate infrastructure for the optimal use of this tool, including a good internet access network.

Other difficulties listed by Barroso (2020) are related to students not being able to view web classes, unfamiliarity with the FC practice, lack of technological knowledge for accessing teaching platforms and viewing online content, mismatch between the subject content and the content taught in the traditional model, divergent levels of web classes and activities, and lack of practical training.

The difficulties listed above by the product's author can be mitigated through the implementation of curricula that promote the development of digital technology skills. This generation, known as digital natives (PRENSKY, 2001), possesses characteristics that allow them to easily automate skills related to digital technologies.

This product is available at the following link: http://educapes.capes.gov.br/handle/capes/582026.

4.2 Product 2 - flipped classroom and teaching electrodynamics

Pepe (2020) developed an educational product in the form of a didactic sequence as part of the dissertation titled "Application of the Flipped Classroom Method to Teaching Electrodynamics in High School" for the Professional Master's Program in Physics Teaching at the Federal Fluminense Institute (IFF). The aim was to explore the learning process when applying differentiated didactic material on electrodynamics.

The author employed the didactic strategy of the "flipped classroom," dividing the actions into 12 moments. What added richness to this work were the various stages of its implementation, prioritizing review and always emphasizing more effective learning to ensure excellent student achievement.

Pepe (2020) used instructional tools such as videos, games, simulators, investigative questionnaires, experimental classes, college entrance exam questions, concept maps, and dynamics to promote meaningful learning, allowing education to adapt to the changes imposed by technological advances (DIESEL; BALDEZ; MARTINS, 2017). Methodologically, this research was developed as a case study with high school students from a third-year class as the target audience.

Pepe (2020) concluded that the instructional material was effective in arousing greater student interest and motivation, as well as making them protagonists in the teaching and learning process. Students who had previously been unmotivated in their physics learning, due to their passive participation in knowledge construction, showed willingness and excitement to contribute actively to the process. They demonstrated indications of greater ease in interpreting the physical laws present in technological processes within the context of electrodynamics.

The work succeeded in promoting significant learning of electrodynamics content, empowering students to take responsibility for their knowledge construction. Digital technologies were utilized, moving away from the traditional physical classroom and working in a hybrid manner, as strategies to make learning less tedious. This approach also proposed using active methodologies as instructional activities to engage students, resulting in their involvement in the pursuit of knowledge (MACEDO *et al*., 2018).

This product is available at the following link: http://educapes.capes.gov.br/handle/capes/572447.

4.3 Product 3 - flipped classroom in teaching analog electronics

Camelo (2022) developed an educational product in the form of a didactic guide as part of the dissertation titled "The Use of Flipped Classroom in Teaching Analog Electronics: An Applied Research," conducted in the Professional Master's Program in Professional and Technological Education (ProfEPT) offered by the Federal Institute of Education, Science and Technology of Maranhão (IFMA), Campus São Luís - Monte Castelo.

The author presented a model of the FC for teaching analog electronics, applied through a didactic sequence and supported by digital tools. At the beginning of the product, he introduced the concept of a didactic sequence, the

concept of the various tools used, and the concept of the FC, which, according to De Lima Benevides and Amorim Neto (2021), is an active methodology that involves inverting the traditional classroom and is carried out in pre-class, in-class, and post-class moments.

Camelo (2022) developed this product for teachers and students of the Analog Electronics discipline in TPT courses. However, he explains that the product, despite being focused on teaching Analog Electronics, can also serve as a model to guide educational practices in other subjects.

The author aimed to contribute to improvements in the teaching process of Analog Electronics by promoting a new, highly interactive approach in the classroom, suitable for contemporary students. The product serves as support in the search for innovative pedagogical practices in PTE.

The author presented the concept of the FC and its advantages. Then, he detailed its three moments: before class, during class, and after class, providing a clear description of what happens in each stage of applying this active methodology. His work includes the provision of several links to books that assist in the implementation of the product, always emphasizing the role of the teacher as the main mediator in using the FC method. Vygotsky (1991), in his theory, explains that this mediation, along with social interaction, whether in-person or online, is crucial for cognitive development and knowledge construction.

The classroom moments were conducted through Google Meet due to the COVID-19 pandemic. In total, five classes were held to implement the product, where the author clearly describes the content of each class and its strategies, providing an easily replicable opportunity for the product in other locations. The author concludes with the assessment stage described as the "after class" phase. He mentions the main advantages of flipping the classroom within the educational product, ranging from flexible schedules for accessing activities on platforms to creating favorable conditions for students to pause, rewind, or fast-forward content according to their comprehension speed.

This is the autonomy that allows students to interact from a modern perspective, according to Nascimento, Macedo, and Nunes (2022), which is responsible for bringing about important changes in the ways of teaching and learning, taking a prominent role in knowledge enhancement enabled by the use of DICT.

This product is available at the following link: http://www.educapes.capes.gov.br/handle/capes/716625.

4.4 Product 4 - didactic sequence for teaching geography: the use of smartphone pedagogy based on the flipped classroom methodology

Nascimento, Macedo, and Nunes (2022) developed a digital EP in the form of a didactic sequence, stemming from the research titled "Flipped Classroom with Smartphone Support: Didactic Sequence for Teaching Geographic Coordinates in a Rural School," conducted in the Professional Master's Program in Teaching and its Technologies at the Federal Institute of Fluminense (IFF).

This educational product aimed to analyze how the use of smartphones, with the support of the FC, can contribute to the teaching and learning process of

cartography content. The target audience for this product was first-year high school students in the district of Morangaba, in the city of Campos dos Goytacazes, Rio de Janeiro.

The didactic sequence was created to enhance the pedagogical practice of Geography teachers in Basic Education by implementing the FC approach, with the aim of placing the student in a prominent position for independent knowledge acquisition, with proper mediation from the teacher. However, it can also be used in other teaching and learning contexts, as long as appropriate adaptations are made to the specific application reality.

The authors begin the didactic sequence by introducing various concepts necessary for a good understanding of the product. To facilitate communication with students, a WhatsApp group was created, which also served as a platform for sharing content for the "pre-class" phase, such as links to YouTube videos and texts. The product was implemented in four class sessions and concluded with an evaluation.

The authors effectively incorporated technological advancements (through the use of smartphones) into the classroom in a positive manner, acknowledging that technology is constantly evolving (CHIAVENATO, 2014).

Smartphones are widely popular tools that nearly all students possess. People are increasingly dependent on the use of cell phones and other technologies. This work deserves recognition for utilizing smartphones as educational tools, overcoming their potential use for social media and procrastination. However, teachers must be mindful of distractions that smartphone use in the classroom can bring, such as accessing social media or unrelated content during class time.

In the third phase of this product, students share videos with their peers during the classroom session, which depends on the school providing Wi-Fi access to all students and ensuring excellent internet connectivity.

After watching the videos, each student orally presents what they have watched. This moment is reserved for addressing doubts and sharing knowledge, but it carries the risk of compromising the entire methodology if the internet connection does not allow for uploading and downloading videos. Having a good internet speed is crucial for implementing technology in education (CAMPOS; DE PAULA, 2020).

This product is available at the following link: http://educapes.capes.gov.br/handle/capes/701824.

4.5 Product 5 - hybrid methodology in history teaching

Andrade and Ferrete (2020) developed a TP in the form of a Didactic Guide as part of their Master's program in Professional and Technological Education (ProfEPT). It was created as part of their dissertation titled "Hybrid Methodology in History Teaching: A Case Study at São Cristóvão Campus." This material was applied to the 3rd year of the Integrated Technical Course in Agriculture at the Federal Institute of Sergipe, São Cristóvão Campus.

The authors, through this didactic guide, provide guidance on hybrid methodology as an alternative for teachers. In addition to the traditional

expository lectures used in history classes, the guide aims to stimulate the use of DICT in the teaching and learning process. It explores how these technologies can be utilized through active learning, incorporating innovative methodologies such as FC, and demonstrating an adaptation of teaching to technological advancements (DIESEL, BALDEZ; MARTINS, 2017).

Andrade and Ferrete (2020) present Hybrid Teaching as a way to combine online and face-to-face instruction using Google for Education. They explain that the guide can be applied to teaching various other subjects, as long as the specificities and customization needs of the student group are considered.

The authors define active methodologies, providing brief descriptions of various types and including links to YouTube videos and books that provide more information about each methodology. They also showcase the tools available on the Google for Education platform, highlighting the hybrid teaching approach aligned with its applications. They make full use of Google's own resources, such as Gmail, Google Drive, Google Calendar, Google Classroom, Google Docs, YouTube, Google Maps, Google Earth, and the Google Cultural Institute. This demonstrates the vast arsenal of freely available tools that Google provides, greatly contributing to the teaching process.

A total of ten classes were conducted, and for each class, study materials were provided within the platforms, including e-books, videos, or other materials that supported the implementation of the active learning approach. Complementary methods were used in all classes to enhance student engagement during discussions and knowledge construction, with the teacher acting as a mediator (VYGOTSKY, 1991).

During the implementation of the TP, the authors highlighted the difficulties that may arise due to fluctuations in the school internet speed and the challenges teachers face in keeping up with students immersed in the digital world. These challenges include using technological tools and instruments to support the teaching/learning process, as well as some students struggling to adopt an autonomous approach to their studies.

According to Da Silva Oliveira, De Brito, and Padilha (2022), a large portion of educators in basic education exhibit systemic rigidity and remain confined to a traditional teaching routine, where teachers act as transmitters and students are passive and submissive.

Despite all the difficulties mentioned, a final evaluation was conducted at the end of the TP application, yielding positive results and emphasizing the importance of active methodologies for the new teaching model.

This product is available at the following link: http://educapes.capes.gov.br/handle/capes/573119.

5 FINAL CONSIDERATIONS

With the aim of bringing reflections on the contributions of Teaching Products (TP) developed within formal and non-formal spaces of PTE, we have gathered here some products in an attempt to highlight the use of active methodologies in the knowledge construction process, with a focus on the FC method.

Within the EduCapes Portal, it was possible to find numerous products developed on the SAI methodology, which brought great satisfaction with what was accomplished within the federal education network during the COVID-19 pandemic. These works served as tools for a wide range of educators who, due to the social distancing measures recommended by health authorities, were unable to meet with their students in person or had to opt for a hybrid teaching model.

Therefore, these products contributed to the creation of new teaching models, enhancing traditional education with additional tools and enabling teachers to take on a new role as mediators, while students became more active participants.

Several challenges were identified during the application of the TP. These challenges range from internet quality and physical infrastructure to the qualification of educators in handling technologies, among others. However, with proper planning and effective management, these challenges can be minimized, providing greater chances of successful implementation of these technologies in education and facilitating the application of TPs.

The aforementioned works were randomly listed from one to five and not in order of importance. They have, in turn, contributed to the transition from traditional education to innovative teaching that places the student at the center of the learning process, engaging them more actively in knowledge construction. Thus, it can be concluded that this study has gathered TP that have helped keep students connected to the classroom.

METODOLOGIAS ATIVAS: UMA REFLEXÃO ACERCA DA CONTRIBUIÇÃO DA SALA DE AULA INVERTIDA NO PERÍODO PANDÊMICO DA COVID-19

RESUMO

O presente artigo traz reflexões e destaques a produtos educacionais desenvolvidos durante a pandemia da COVID-19, na área de metodologias ativas, dando ênfase ao método da sala de aula invertida. Teve como principal objetivo tecer reflexões acerca da importância das metodologias ativas, aliadas ao avanço das tecnologias, no processo de transição da educação tradicional para um modelo de ensino inovador que coloque o aluno como centro do processo de ensino/aprendizagem. O estudo realizou-se em uma abordagem qualitativa, exploratória, de procedimento bibliográfico, dando destaque a trabalhos recentes, no ensino formal e não formal da educação profissional e tecnológica no Brasil, utilizando a base de dados do Portal EduCapes, aplicando o termo "sala de aula invertida" como ferramenta de busca. Foram selecionados cinco produtos educacionais. Ao final, pôde-se constatar que o modelo de ensino abordado e desenvolvido pelos autores de produtos educacionais em destaque, trouxeram grandes contribuições dentro da educação profissional e tecnológica no Brasil no período pandêmico citado, apesar dos desafios e dificuldades apresentados para a sua implementação.

PALAVRAS-CHAVE: Metodologias Ativas. Sala de Aula Invertida. Produtos Educacionais.

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