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Active methodologies and Youth and Adult Education: a study of science and biology teaching

ARTICLE

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Abstract
Young people and adults who return to school require engaging methodologies that can stimulate their pursuit of knowledge, rather than lead to school dropout in the face of a traditional model that does not consider the particularities of its students. Given the importance of this issue, a bibliographic study was conducted on active methodologies applied to the teaching of Science and Biology in Youth and Adult Education (EJA). The research aimed to outline a profile of the bibliographies by analyzing the effectiveness of different methodological concepts and approaches on the subject. For this purpose, 11 articles from the past seven years were selected, using academic platforms such as Google Scholar, Scielo, and CAPES. A heterogeneity in the methodologies used was observed, which proved to be excellent tools for fostering differentiated and efficient teaching, as well as promoting greater socialization between student and teacher, student-to-student interaction, and enhancing their confidence as active protagonists in their learning process.
Keywords: EJA. Learning. Education. Active methodology.

Metodologias ativas e a Educação de Jovens e Adultos: um estudo do ensino de ciências e biologia

Resumo
Os jovens e adultos que retornam à escola necessitam de metodologias atrativas que possam estimular a busca pelo conhecimento, ao invés da evasão escolar diante de uma escola com modelo tradicional que não observa as particularidades de seus estudantes. Dada a importância do tema, realizou-se uma pesquisa bibliográfica acerca das metodologias ativas aplicadas ao ensino de Ciências e Biologia na Educação de Jovens e Adultos (EJA). O objetivo foi traçar um perfil das bibliografias e analisar a eficiência das diferentes concepções e abordagens metodológicas sobre o tema. Para isso, foram selecionados 11 artigos dos últimos

sete anos, utilizando as plataformas acadêmicas: *Google Scholar, Scielo* e CAPES. Verificou-se uma heterogeneidade nas metodologias utilizadas, que se mostraram excelentes instrumentos para fomentar um ensino diferenciado e eficiente, além de uma maior socialização tanto estudante - professor, quanto a interação estudante-estudante, fortalecendo a confiança deles como protagonistas.
Palavras-chave: EJA. Aprendizagem. Educação. Metodologia ativa.

1 Introduction

In contemporary times, despite scientific and technological advances in various areas of education, it is still possible to find outdated teaching models in schools, with predominantly traditional methodologies and practices, where the teacher is just a transmitter of content and students are seen as receivers, without having the opportunity to improve their skills or build their own knowledge, without any protagonism (Nascimento; Rosa, 2020; Paiva; Fonseca; Colares, 2022).

According to Moran (2015), formal education is at an impasse in the face of changes in society: how to go through a gradual process of evolution in order to become relevant and ensure that everyone learns efficiently to know, to build their life projects and to live with others. It is therefore necessary to review the processes of organizing the curriculum, methodologies, as well as times and spaces. When this aspect is evaluated, taking into account Youth and Adult Education (EJA), the need for change becomes more evident, because this modality is also in a process of transition.

In this period of transition in EJA, there needs to be a reorganization of the different spaces and times, as well as a new pedagogical positioning of the teacher with solid teaching training, which takes into account the diversity of the subjects and can truly include all students in the process of mutual teaching and learning. The aim is to overcome the ties of different knots: “knots already tied, the tight and secure knot” (Souza Maria and Fontoura, 2018, p. 121). For Cruz (2019):

> Youth and Adult Education - EJA is a unique modality, serving an adult public, which is made up of subjects who for different reasons were unable to complete

> their studies in the regular time, it can be understood that this modality has an eminently compensatory and inclusive character (Cruz, 2019, p. 10).

According to data from the PNAD Contínua (Continuous National Household Sample Survey), released by the Brazilian Institute of Geography and Statistics (IBGE, 2023), the illiteracy rate in Brazil fell from 6.1% in 2019 to 5.6% in 2022. Despite this reduction, Brazil still has almost 10 million people aged 15 or over who can neither read nor write. More than half of these illiterate people live in the Northeast and are elderly. Youth and Adult Education (EJA) is a type of education that seeks to tackle this harsh reality in Brazil.

It is a political and social reparation that aims to guarantee access to education for all and reduce social disadvantages among Brazilians. For this reason, legislation aimed at the full development of the individual is of fundamental importance to ensure that people who, for whatever reason, did not have access to regular education at the appropriate age have adequate educational opportunities. One such piece of legislation is the National Education Guidelines and Bases Law (LDB), Law No. 9.394, of December 20, 1996, which in its Article 37 ensures that:

> Education for young people and adults will be aimed at those who did not have access to or continue their studies in primary and secondary education at the proper age.
> §Paragraph 1 - The education systems shall ensure that young people and adults who were unable to complete their studies at the regular age are given appropriate educational opportunities free of charge, taking into account the characteristics of the pupils, their interests, living and working conditions, by means of courses and examinations.
> §Paragraph 2 - Public authorities will make it possible and encourage workers to access and remain in school, through integrated and complementary actions (Brasil, 1996, p. 22).

It is essential to change the process and the teacher's position, through the research-training bias, according to the form and role taken on in the stages and projects of learning new methodologies. This leads to a new way of reflecting on teacher training and self-education. It also requires a methodological approach that focuses on the subjective and intersubjective analysis of the subjects, who produce knowledge, meanings

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and feelings as they tell their stories. This process enhances formative and self-formative work in adult education, favoring the organization of lived experiences and substantially helping and improving the pedagogical work developed in educational spaces with students (Souza Maria; Fontoura, 2018).

According to the National Curriculum Parameters (PCN) (Brasil, 1997), pedagogical practices in the EJA are essential to understanding complexities and providing "non-children" students with the development of critical thinking that seeks non-dogmatic influences on the phenomena of life. The priority objective is to inherit concepts of investigation and interest in intellectual debate. Thus, as stated in the PCN, in order to give new meaning to teaching in the EJA, resources are needed that encourage students to be the protagonists of their own knowledge, with a path to producing knowledge and promoting learning. This process must take into account the individual knowledge of the different age groups present in this modality, and thus form a dialectical teaching-learning process.

Understanding this context and looking at the PPCs of degree courses, which train teachers, there is a gap in relation to equal opportunities and traditional teaching when referring to the EJA. According to Moreira and Guedes (2022), for example, it is not possible to work on all the knowledge in the National Curriculum Parameters (PCNs) for biological sciences, unless a contextualized approach is prioritized. This means working on skills and abilities that enable students to build a relationship between the content taught in the classroom and their daily lives as citizens.

In this segment, active methodologies are great guidelines that can guide teaching and learning processes, emphasizing the student as the protagonist in the construction of knowledge and prioritizing their direct and participatory involvement at all stages. Making learning more meaningful consists of motivating students, making them engaged in activities (Piffero *et al*., 2020; Bacich; Moran, 2018). The most commonly used active methodologies are Problem-Based Learning (PBL), Project-Based Learning (PBLP) and the flipped classroom. Other methods cited as common were Peer Instruction (Mazur, 2015; Mazur; Mazur, 2017), and Station Rotation (RpE) (Sousa, 2019). However, the

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question arises: are these methods the most widely used and/or appropriate in the context of EJA?

According to Ventura Costa and Venturi (2021), it is no longer acceptable for the teaching of these subjects to be limited to the mere transmission of information through lists of complex content that requires mechanical memorization. Instead, it is necessary to create spaces in science and biology teaching that encourage the construction of meaningful knowledge, enabling students to understand the world in which they live and exercise their citizenship fully, regardless of age. Training for autonomous learning, the development of critical thinking and investigative skills are fundamental to meeting the demands of a knowledge-based society.

Thus, considering that students in Youth and Adult Education (EJA) have different characteristics and therefore require a methodological adaptation in relation to traditional teaching, it is imperative to rethink pedagogical approaches, especially in the teaching of Science and Biology. In view of the above, the aim of this study was to assess whether active methodologies applied to the teaching of Science and Biology are effective in Youth and Adult Education (EJA).

2 Methodology

For this article, we opted for a longitudinal exploratory study to answer the following question: Are active methodologies applied to teaching science and biology effective in Youth and Adult Education (EJA)? The answer was based on bibliographical research of previously published materials, including scientific articles, theses and dissertations published on academic journal portals.

The longitudinal study covered the period from 2017 to 2023, and for this survey, an advanced search was carried out in three journal databases: Google Scholar, Scielo and CAPES Platform, observing the most relevant works related to the theme of active methodologies aimed at the education of young people and adults in the teaching of science and biology

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The search terms were selected based on the objectives of the study and the descriptions provided by Anísio Teixeira's Brazilian Thesaurus of Education. Boolean operators were used to direct the search: “active methodologies” AND “biology OR biological sciences” AND “youth and adult education”. To ensure the specificity of the search in the field of biology, the Boolean AND NOT “chemistry, physics and mathematics” was used, with the aim of refining and making the search more objective.

Using the databases and search terms mentioned above, we selected 11 texts published in the last seven years (2017 to 2023), produced by higher education students or teachers in the field. These texts address proposals for active methodologies for Youth and Adult Education (EJA) in the teaching of Science and Biology. The selected texts were available free of charge and were written in Portuguese or English.

The research sought to draw up a profile of these works, analyzing the efficiency of the different conceptions and methodological approaches on the subject. It is worth noting that although the main focus of the research was articles related to the teaching of Science and Biology, articles dealing with active methodologies in a more general way were also included in this review. The aim of this procedure was to provide a more solid theoretical basis and to obtain a more comprehensive understanding of the subject.

3 Results and Discussion

Table 1 shows the results of the research carried out on the chosen databases. On the Google Scholar platform, 42 articles were found, of which only 6 met the purpose of the study. When consulting the Scielo Brasil portal, only 1 article was found that met all the criteria. On the CAPES journals portal, 26 articles were found, of which 4 were selected because they were directly related to the aim of the review.

Table 1 - Results of the research into active methodologies applied in the EJA for teaching science and biology

Nº	Author(s) and Title	Database	Teaching methodology	Contents

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1	An experience of encounter between autobiographical narratives and scientific narratives in teaching biology to young people and adults (Araujo Jr; Avanzi; Gastal, 2017).	Scielo	Workshop	Zoology concepts
2	Food and Nutrition Education: Playful strategies to facilitate the teaching of Biology in Youth and Adult Education (Melo, 2019)	Google Scholar	Playful strategies	Food and nutrition education
3	Teaching sciences in EJA and applying an active methodology proposal (Cunha; Santos; Cova, 2020).	Google Scholar	Practical lessons, inverted classroom	States of matter, properties of matter, changes of state, separation of mixtures
4	Newspaper production as a teaching resource in science classes in youth and adult education (EJA) (Santana; Ximenes, 2021).	Google Scholar	Production of teaching materials	Environmental education
5	The use of playful activities in classes on viruses in the EJA (Rocha; Menezes, 2018).	Google Scholar	Playful activities, gamification	Virology
6	Science Teaching in the EJA: Mediation with Active Methodologies (MAA) and playful-virtual learning in this pandemic time (Bianchi; Fornells, 2021).	Google Scholar	Virtual teaching games	Vaccines and the body; Sustainability and the environment
7	Practical Biology activities: an Investigative Teaching Sequence about the Cell Cycle (Lima *et al*., 2020).	Google Scholar	Investigative Teaching Sequence (SEI)	Cell cycle
8	Evaluation of an Investigative Teaching Sequence on Pollution applied in the Secondary Education of Young and Adult Students (Vieira, Moraes and Godinho-Netto; 2019).	CAPES	Investigative Teaching Sequence (SEI)	Pollution, atmospheric pollutants, water and soil pollutants
9	Practices Applied to Teaching Genetics to EJA (Youth and Adult Education) Students (Carvalho *et al*., 2021).	CAPES	Practical lessons	Genetics

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10	Interactive strategies for education and health promotion in youth and adult education: an experience on Tuberculosis (Oliveira; Carvalho; Araújo-Jorge, 2018).	CAPES	Conversation circles, plays and brochure production	Public health: tuberculosis
11	Adult Education at Biological Field Stations: Building Capacity for Science Learning (Zarestky *et al.*, 2022).	CAPES	Biological field station	Natural sciences; ecology, biodiversity, hydrology

Source: Authors, 2024.

For Fernandes and Oliveira (2020, p. 87):

> The EJA plays a fundamental role in the historical and social construction of the lives of its students, taking into account the transformative role of education, because the more the student has contact with the literate environment, the more they will become independent and critical, so it is up to the teacher to select and organize classes that stimulate the practice of critical thinking, so that students have different perceptions of social events.

In this sense, following the articles chosen and presented in Table 1, Araujo Jr, Avanci and Gastal (2017) carried out action research with young people and adults from a public school in the Federal District, Brazil. The research articulated school knowledge and knowledge from experience through a workshop with zoology content. The proposal was based on the premises of Paulo Freire and his relationship with other authors, and the authors concluded that it is possible to organize activities that value the particular life trajectories of the subjects, while still teaching science.

Araujo Jr., Avanci and Gastal (2017) demonstrate the efficiency of this methodology through the life story of Jessuy, who made sure that her name was not fictitious when writing the text, reinforcing authenticity when associated with her name, “ I Am” (pronounced as in French, *je suis*). She proudly describes a story in which her mother goes hunting and brings back an armadillo for the family meal, using the difficult survival in a rural environment as a backdrop for the text. As well as presenting an academic text on the armadillo, in which she identifies its order, family, characteristics, habitat and ecological and social importance, Jessuy also explores her family relationships, the socio-economic

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conditions in which she lived, her faith and the determination of her mother, whom she refers to as a warrior.

> When she arrived, even though she was tired, she took care of the meal, because Saturday was going to be a special day, after all, lunch was going to have armadillo meat. We were all happy, it was a day of celebration for us, it was like getting presents. When Saturday came, we said “let's eat meat today”, and it was a feast (Araujo Jr.; Avanci; Gastal, 2017, p. 9).

The influence of Freirean pedagogy on the training of Biological Sciences teachers working in Zoology is extremely important, given that teachers in the classroom are aware that when dealing with the environment, there will be reflexive correlations between academic knowledge and the experiences acquired by their students with animals. An autonomous and problematizing pedagogy, which takes into account experiences in society and humanistic issues, results in a more solid practical foundation for the content, providing deeper and more meaningful learning in human relations.

Maia, Nascimento and Cavalcante (2023), when analyzing the state of the art of applying Paulo Freire's didactics in undergraduate courses, concluded that Freire's pedagogy remains relevant and adaptable, enabling educators to build a reflective, participatory and socially conscious educational environment. Vasconcellos, Gonçalves and Mira (2023), in their article on Freirean pedagogy in teacher training, portray the influence and relevance of the theme, as well as the implications in the current scenario, the conception of teaching as a profession and the importance of research in teacher training, considering its relationship with working conditions.

Melo (2019) promoted scientific knowledge through playful moments in Biology classes, using the theme “Food and Nutrition Education (EAN) in the EJA” as an aggregator of various contents for the creation of active methodologies. As a result, five pedagogical strategies were developed: the first consisted of a pedagogical workshop; the second, a game called “Building a Food Pyramid”; the third, a game entitled “Keeping an eye on the label”; the fourth, the application of a didactic sequence called “Diversity of Microorganisms”; and the fifth strategy consisted of a play entitled “Lipid goes to the people's jury”. It was concluded that student participation and involvement improved, in

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addition to increasing students' perception of eating habits, in terms of their ability to understand the ecological, social, political and environmental dimensions of food culture and in facilitating learning and awakening student protagonism and autonomy.

Rocha and Menezes (2018) used playful activities and gamification to promote the development of EJA students in understanding and fixing the content of viruses and viroses. According to the authors, it was noticeable that the students understood the subject better, in addition to improving socialization, both in the student-teacher and student-student relationship.

> In the first lecture, few students interacted when they were asked questions about the topic, and even when they did, they often gave the wrong answers. On the day of the game, the students who had spent the entire class silent and dispersed began to feel encouraged to play too and when they gave the answer to the case study, they justified it correctly, looking for the specific symptom of the disease, indicating that learning using playful tools was much more appropriate (Rocha, Menezes, 2018, p. 3).

Park (2014), in an article entitled “Play, games and cognitive development: doctors, neurologists, psychologists and others from the late 19th and early 20th centuries already knew what researchers are proclaiming today”, mentions that more than 100 years ago scholars in the field already knew that this type of activity contributes not only to physical performance, but also to the neurological development of children. However, activities aimed at the EJA have only recently been implemented.

The use of didactic games and the playful-virtual learning methodology is highlighted by Bianchi and Fornells (2021) as a tool that allows the student to interact with the subject matter, directing learning. The playful methodology is a pedagogical tool that allows students to integrate the knowledge they acquire with the construction of their learning through the memorization of the concepts learned in class. Playfulness makes it possible to create an environment in which meaningful learning is predominant, attracting the student's attention and their consequent interaction with the class and fixation of the content. EJA students often find it difficult to understand science vocabulary because it contains scientific terms that are often difficult to understand.

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Digital technologies (DT), such as digital games, were used extensively during the Covid-19 pandemic and were an ally during the period of social isolation (Ferreira; Cavalcante; Ribeiro, 2021). In the post-pandemic period, these technologies have become indispensable in the educational field, providing teachers with new ways of teaching and giving students better learning opportunities.

Cunha, Santos and Cova (2020) applied an active methodology proposal, combining practical lessons and the inverted classroom, in a ninth grade EJA class at a school in a municipality in the state of Rio de Janeiro. Satisfactory results were observed when there was a dialog between teacher and student about the use of equipment and the relationship between weight, mass and volume. The students were motivated from the preparation of the activity to the end of the proposed lesson.

According to Branco and Alves (2015) and Pavanelo and Lima (2017), the inverted classroom proposes that the moment of study takes place before the activities carried out in class, encouraging students to develop autonomy and responsibility for their own learning. In addition, this methodology requires action and reflection during classroom activities, taking advantage of the time to clarify doubts and carry out practical activities. For the teacher, there is a need for careful planning, clarity in explaining the content, critical reflection, self-criticism and joint analysis with the students. In this model, students stop being mere spectators and start actively contributing to the construction of knowledge.

According to Guarda *et al*. (2023, p. 4), “The Active Teaching-Learning Methodology requires an assessment that is consistent with the form of teaching, considering the way in which knowledge is produced and each student's contribution to their learning and to the group.”

Santana and Ximenes (2021) investigated the perception of EJA students based on the production of a newspaper as a didactic tool for teaching science, with a focus on environmental education. The authors found that the proposal to produce a newspaper as a classroom activity promoted interaction, autonomy and learning among EJA students. According to the authors, it was possible to perceive the significance and didactic potential

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of the instrument under analysis in transforming the outlook of the individual in training, as expressed in the speech of student Alan:

> That week, the teacher talked about the environment and then the newspaper. I really liked it because I didn't watch the newspaper and after the teacher's lessons I started watching it and I recommend that people do this because it gives us information about everything that happens in the world. [...] I thought it was good because the aunt did it in two different ways. Because if the aunt had just talked we would have understood, but we would have forgotten, and the teacher gave us the opportunity to produce the newspaper, because we forgot about the world and focused on what we were doing (Santana; Ximenes, 2021, p. 10).

Lima *et al*. (2020) used an Investigative Teaching Sequence (ITS) on the cell cycle (mitosis), consisting of a didactic model and practice with *Allium cepa* L. They found that the use of the SEI facilitated understanding of the dynamics involved in the cell cycle and its implications for the constitution of living beings, reducing the gap between theory and practice. Corroborating these results, Vieira, Moraes and Godinho-Netto (2019) also applied an SEI on pollution in high school for EJA students. They concluded that there was greater participation, interest and commitment, as well as an increase in student satisfaction, confidence, interaction and collaboration.

Ledoux, Barbosa and Silva (2023) analyzed the use of active methodologies (AM) in the teaching of science and biology in Youth and Adult Education (EJA) in various publications. They found that the use of active methodologies promoted an increase in student performance and motivation, with Problem-Based Learning and “learning by doing” being the most cited active methodologies.

According to Amorim and Duques (2017), educators in the EJA generally work in the same way as they do in regular education, without considering the need for an appropriate approach for these students. Since the search for new methodological tools is a challenge for teachers, there are curricular proposals with specific content that is difficult to contextualize, especially in the area of biological sciences, which makes use of many scientific terms and expositions.

Oliveira; Carvalho; Araújo-Jorge (2018) carried out an educational activity on tuberculosis (TB) in science classes with students from the Youth and Adult Education

Program in the city of Rio de Janeiro (RJ). The didactic strategy included the formulation of texts, conversation circles and internet consultations on TB. The students actively discussed the disease and reflected on health habits. The study culminated with the presentation of a play and the distribution of leaflets on TB prepared by the students. This experience highlighted the importance of interactive and dynamic activities to increase student participation, promoting understanding of the disease and contributing to health promotion and disease prevention among young people and adults.

Biological Field Stations (BFSs) are a recently recognized educational site that holds considerable intrinsic value for adult science education. Zarestky *et al*. (2022) conducted a survey of 223 US BFSs about their non-formal and informal educational outreach programs for adults. The results show that these stations offer a wide variety of science learning programs for adults, focused on experiential learning. These experiences promote interactions with the natural environment and increase participants' knowledge and skills. The study suggests that adult educators can use these strategies to enhance the professional development of science educators at BFSs and enrich the scientific learning of the general public.

4 Conclusions

This study looked at various publications to find active methodologies that can be applied in Youth and Adult Education, in order to understand the importance of these tools for teaching Science and Biology in the EJA. An analysis was made of the different types of methodologies employed, establishing a comparison between them. Given the above, a heterogeneity was noted among the methodologies applied, emphasizing that all of them were excellent tools for promoting teaching.

The publications studied showed that active methodologies are innovative and extremely important for youth and adult education (EJA). As well as making adjustments to science and biology teaching for this modality, they have had a positive impact on student performance, making them the protagonists of the action. This protagonism was

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also reflected in the improvement of the students' educational and personal training, resulting in greater socialization in the classroom, active participation, interest, commitment, satisfaction, confidence and interaction.

Youth and Adult Education yearns for new teaching and learning possibilities and Active Methodologies have proved to be efficient tools for teaching Science and Biology, with a heterogeneity in the methodologies used, excellent socialization tools, promoting both student-teacher and student-student interaction, as well as developing their confidence as protagonists.

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