Research Inventy: International Journal of Engineering And Science
Vol.15, Issue 6 (June 2025), PP 79-86
Issn (e): 2278-4721, Issn (p):2319-6483, www.researchinventy.com

COP30 in the Classroom: Interdisciplinary Strategies Using Active Methodologies in Primary and Secondary Education

Prof. Spec. Antonio Moura Filho[1] https://orcid.org/0009-0009-9196-1256; M. Sc. (Stud.) Antonio Werbiton Marinho Almeida[2] https://orcid.org/0009-0002-1904-7522; PhD. Francisco José Lopes Cajado[3] https://orcid.org/0000-0002-8824-9251; Spec. Irene Mendes Fontes[4] https://orcid.org/0009-0002-3152-6649; Profa. Spec. Jocélia Araújo Costa[5] https://orcid.org/0000-0002-4712-8816; Prof. Spec. José Maria Campos de Oliveira Neto[6] https://orcid.org/0009-0001-4097-6791; Prof. M. Sc. José Wandregesílio dos Santos Silva[7] https://orcid.org/0000-0002-8985-7603; Profa. M. Sc. Josilene Dias de Sena[8] https://orcid.org/0009-0008-5530-7954; Prof. Dr. Juvanildo Terra de Alencar Junior[9] https://orcid.org/0009-0005-0523-9875; Prof. Spec. Nailton Rodrigues Maciel[10] https://orcid.org/0009-0001-7544-4795; Profa. M. Sc. Onete Raulino da Costa[11] https://orcid.org/0000-0002-1975-7009; Prof. M. Sc. Paulo Francisco Barbosa Sousa[12] https://orcid.org/0009-0009-9071-179X; Ph.D. Paulo Henrique Barbosa Sousa[13] https://orcid.org/0009-0007-1269-7860; Profa. M. Sc. Régia Maria Carvalho Xavier[14] https://orcid.org/0009-0001-3232-7716; Prof. Dr. (Tít. Cult.) Rickardo Léo Ramos Gomes[15] https://orcid.org/0000-0001-6101-9571; Prof. Dr. Carlos Riedel Porto Carreiro[16] https://orcid.org/0000-0002-0898-4521; BSc. Thayla Aderaldo Gomes[17] https://orcid.org/0009-0006-5402-9003.

[1] Specialist in Teaching Methodology; [2] Master's student in Administration and Controllership at UFC; [3] Ph.D. in Agricultural Biotechnology (RENORBIO – UFC; [3] Ph.D. in Agricultural Biotechnology (RENORBIO – UFC; [4] Postgraduate Degree in Criminal Law from UniAteneu University Center; [5] Specialist in Special Educational Assistance and School Physical Education from FANOR; [6] Specialist in Management, CEFEB; [7] Doctoral Student in Education at the Graduate Program in Education (PPGE), Federal University of Ceará – UFC; [8]Master of Professional Studies in Tourism Business Management from the State University of Ceará (UECE); [9] Doctorate in Educational Sciences from Universidad del Sol – UNADES; [10]Specialist in Brazilian History – Faculdade Única; [11] Currently pursuing a Doctorate in Education Sciences from Del Sol University (UNADES); [12] Master of Economics from the Federal University of Ceará (UFC); [13] Ph.D. in Educational Sciences, FCSA (DINTER Program); [14] Master's Degree in History from the Federal University of Pernambuco (UFPE); [15]Doctorate in Biological Sciences - FICL; Master's in Phytotechnics - Federal University of Ceará; [16] Ph.D. in Fisheries Engineering from the Federal University of Ceará (UFC); [17]Bachelor's Degree in Performing Arts Technology - Federal Institute of Education, Science, and Technology of Ceará.
Corresponding Author: Rickardo Léo Ramos Gomes

Abstract: *In the face of the growing climate emergency and the need to integrate this issue into the school environment, it is essential to reassess pedagogical practices that foster students' civic and socio-environmental education. This study adopts a qualitative approach, as it enables an in-depth understanding of educational practices by highlighting the experiences and social constructions that take place within the school context. As the methodological strategy, bibliographic research was chosen, a fundamental step in the consolidation of*

scientific knowledge, as it allows for the identification, selection, and critical analysis of relevant literature on the topic. As stated by Cavalcante and Oliveira (2020), this process supports the theoretical foundation of the field of study and substantiates the proposed intervention. The main objective is to investigate and propose interdisciplinary pedagogical strategies grounded in active methodologies, aiming to address socio-environmental issues related to COP30 in Primary and Secondary Education. The intention is to promote integration among different areas of knowledge and foster student protagonism. This study offers a significant contribution to adapting pedagogical practices in response to the climate crisis, providing educators with both theoretical and practical support for a critical, interdisciplinary, and engaged approach.

.

Keywords: *climate emergency; pedagogical practices; socio-environmental issues; student protagonism.*

Date of Submission: 15-06-2025 Date of acceptance: 29-06-2025

I. INTRODUCTION

The escalating climate crisis and the global commitments established in international conferences—such as the Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change—have demanded an immediate response, including within the educational sphere. The upcoming COP30, scheduled for 2025 in Belém, Pará, Brazil, presents a timely opportunity to incorporate current socio-environmental issues into the school curriculum through interdisciplinary proposals and innovative methodologies. In this context, the classroom becomes a privileged space for fostering critical thinking, socio-environmental awareness, and student protagonism (Fleury, Miguel & Taddei, 2019).

This research adopts a qualitative approach, as it enables an in-depth analysis of educational practices by focusing on the experiences, meanings, and social constructions of individuals within the school setting. The chosen methodological procedure is bibliographic research, which represents an essential stage in the consolidation of scientific knowledge by facilitating the understanding of existing theoretical contributions on the topic and supporting the foundation of the proposed pedagogical intervention (Pizzani et al., 2012).

The general objective of this study is to investigate and propose interdisciplinary pedagogical strategies grounded in active methodologies to address socio-environmental topics related to COP30 in Primary and Secondary Education, promoting articulation between different fields of knowledge and fostering student protagonism.

The specific objectives are to: Analyze how topics related to COP30 can be addressed within the Humanities curriculum, fostering critical reflections on sustainability, social justice, and environmental public policies; Explore scientific concepts linked to climate change and COP30, using active methodologies that enhance the understanding of environmental impacts and the development of sustainable solutions; Investigate how reading practices, text production, and the use of digital media—including English language instruction—can be employed to communicate, interpret, and critically debate COP30-related themes, thereby expanding students' linguistic and cultural repertoires; Propose activities that integrate statistical data and mathematical modeling related to climate change and sustainability, encouraging critical analysis and evidence-based decision-making.

This study is organized into four sections: the first introduces the context, objectives, and methodological foundations; the second presents the materials and methods used; the third is devoted to the theoretical framework underpinning the proposal; and the fourth comprises the final considerations, including the analysis of results and suggestions for future pedagogical practices.

II. MATERIAL AND METHODS

The approach adopted in this study is qualitative in nature, as it provides a detailed analysis of educational practices by focusing on the experiences, meanings, and social constructions of individuals within the school environment. As Lüdke and André (2021) argue, qualitative research proves particularly suitable for investigations in the field of education, as it acknowledges the complexity of educational phenomena and enables the interpretation of reality from the participants' perspective. This approach supports an analysis that is more attuned to classroom dynamics and to the contemporary challenges faced in teaching.

As a research procedure, bibliographic research was chosen, as it constitutes an essential phase in the construction of scientific knowledge. According to Pizzani et al. (2012), bibliographic research allows for the organization of previously established knowledge, the identification of gaps, and the support for the development of new proposals and hypotheses. Cavalcante and Oliveira (2020) emphasize that this type of review is fundamental for the theoretical deepening of a study, as it provides the necessary foundation for critical analysis and for the formulation of new perspectives in scientific inquiry. Through the analysis of the literature, it becomes

possible to establish a dialogue with existing academic production and to theoretically substantiate the pedagogical strategies proposed in this work.

The sources used in this study were published between 2018 and 2025, totaling 40 works. These materials were classified into four main categories: publications specific to the Humanities, publications focused on multiliteracies and languages, publications related to the Natural Sciences, and publications aimed at Mathematics education. This classification was fundamental in adding value to the research process, enabling an interdisciplinary and organized perspective in line with the principles of active methodologies and the educational objectives of Primary and Secondary Education.

This classification of materials allowed for the recognition of specific approaches and practices within each field of knowledge, facilitating connections between content areas and supporting the development of pedagogical strategies adapted to the socio-environmental challenges addressed within the context of COP30. Moreover, this organization enabled the observation of the contributions from diverse knowledge areas to the critical and civic formation of students, respecting the plurality of knowledge and the integrative nature of the interdisciplinary proposal.

In summary, it is important to highlight that the evaluation of materials followed criteria of scientific relevance, currency, and alignment with the analyzed themes, in accordance with the guidelines proposed by Amado (2017), who underscores the importance of methodological rigor and clarity in the parameters used for source selection in qualitative educational research.

III. THEORETICAL FRAMEWORK

3.1 COP30 and Critical Environmental Education: Interdisciplinary Approaches and Active Methodologies in the Teaching of Human Sciences in Primary and Secondary Education

The hosting of COP30 in Brazil provides a favorable environment for the inclusion of global socio-environmental topics in the school curriculum through interdisciplinary approaches in the teaching of Human Sciences. Within the framework of Critical Environmental Education (CEE), it is imperative that reflections on climate change, environmental justice, and public policies be grounded in tangible experiences and promote students' civic engagement. According to Fleury, Miguel, and Taddei (2019), education must consider the social and political dimensions of the climate crisis, fostering a deeper student understanding of the structural factors that perpetuate environmental inequalities.

The incorporation of active methodologies—such as flipped classrooms and project-based learning (PBL)—has proven effective in facilitating meaningful learning experiences. Lima et al. (2023) argue that when applied with careful planning, these methodologies enhance student engagement and foster intellectual autonomy. In the field of Human Sciences, these approaches can be integrated into interdisciplinary practices to address topics such as energy transition, urban mobility, food security, and environmental public policies—subjects extensively discussed during COP30, as noted by Fernandes et al. (2023).

Moreover, initiatives such as the creation of educational games on global warming, as proposed by Machado et al. (2023), and the implementation of inquiry-based didactic sequences to address climate issues (Faria, Ramos, & Coltri, 2021), demonstrate that education on socio-environmental themes can be innovative, engaging, and capable of driving transformation. These actions promote student autonomy by encouraging debates, simulations, analysis of real-world data, and collaborative activities.

Table 1 - Examples of Interdisciplinary Approaches and Active Methodologies for Teaching COP30 in Human Sciences

Pedagogical Strategy	Approach Description	Skills Developed
Interdisciplinary Project "COP30 Simulation"	Students organize a school conference, assuming the roles of representatives of countries, NGOs, and communities.	Agency, argumentation, negotiation, critical thinking.
Flipped Classroom with COP30 Themes	Students access content on climate justice and environmental policies at home and debate in class the local and global impacts of climate change.	Autonomy, critical reading, public policy analysis.
Gamification: "Race Against Global Warming"	Use of educational games for environmental decision-making in simulated contexts, based on real COP data.	Decision-making, collaboration, scientific literacy.
Roundtable with Local Guests	Meeting with activists, scientists or representatives from communities affected by climate impacts to discuss socio-environmental justice.	Empathy, active listening, socio-environmental contextualization.
Socio-environmental Mapping of the Neighborhood	Students conduct surveys and critically analyze local environmental problems, relating them to international COP30 discussions.	Field research, geolocation, global-local connection, socio-environmental action.

Source: Faria, Ramos & Coltri (2021); Lima et al. (2023); Costa & Sarah (2025).

Table 1 summarizes pedagogical possibilities that integrate COP30 themes with interdisciplinary practices and active methodologies, fostering students' critical and civic education in the face of contemporary socio-environmental challenges.

3.2 Climate Change and COP30 in Science Education: Inquiry-Based Approaches and Interdisciplinary Strategies with Active Methodologies in Primary and Secondary Education

Climate change represents one of the major socio-environmental challenges of our time. In this context, COP30 emerges as a significant opportunity for promoting interdisciplinary pedagogical discussions within the school environment. The inclusion of such topics in Science Education requires the implementation of practices that move beyond traditional content-based approaches, fostering student agency as well as the development of scientific and civic competencies. According to Da Silva et al. (2021), addressing climate change as a generative theme can facilitate connections between scientific content and real socio-environmental issues, promoting learning that is both meaningful and contextualized.

The inquiry-based approach, as explained by Carvalho (2022), enables students to formulate hypotheses, conduct experiments, and construct knowledge autonomously. This perspective is reinforced by De Jesus et al. (2023), who describe successful experiences in Physics education linked to citizen science, highlighting how practical projects—such as monitoring stream flow—can engage students in activities involving the collection, analysis, and interpretation of environmental data. Furthermore, Aeschbach et al. (2023) emphasize the potential of hybrid learning to support education aimed at sustainable development, encouraging the integration of disciplines such as Physics, Biology, and Chemistry, while expanding the reach of educational initiatives through digital tools.

Active methodologies are essential instruments in this process. According to Do Nascimento and Araújo (2024), the dialogic nature of these methodologies enhances students' critical engagement, reinforcing the connection between theory and practice. Araújo and Ramos (2023) underscore both the challenges and opportunities these strategies present to teaching practice, emphasizing that, when well-designed, they promote student autonomy and the development of socio-emotional skills. Table 2, below, provides examples of inquiry-based methodologies and interdisciplinary strategies employing active approaches, applicable to Primary and Secondary Education, particularly within the domain of Natural Sciences and in the context of discussions promoted by COP30.

Table 2 – Examples of inquiry-based methodologies and interdisciplinary strategies employing active approaches, applicable to Primary and Secondary Education

School Year	Socio-environmental Theme	Active Methodology Applied	Description of the Interdisciplinary Strategy
7th and 8th grade (EF)	Greenhouse effect and global warming	Project-based learning (PBL)	Project to build greenhouses with recyclable materials, relating concepts of Physics, Biology, and Mathematics.
9th grade (EF)	Water resources and climate change	School scientific investigation	Analysis of river water quality using physicochemical indicators, articulating Sciences, Geography, and Chemistry.
1st year (EM)	CO_2 emissions and ecological footprint	Flipped classroom	Preliminary study on digital platforms followed by debates and production of infographics about CO_2 emitting sources.
2nd year (EM)	Climate justice and public policies	Discussion circle + concept maps	Interdisciplinary study involving Sociology, Sciences, and History to understand unequal impacts of climate change.
3rd year (EM)	COP30 and global commitments	Gamification	COP30 simulation with students representing countries and NGOs, debating climate goals based on scientific data.

Source: Da Silva et al. (2021), De Jesus et al. (2023), Carvalho (2022), Araújo e Ramos (2023), Do Nascimento e Araújo (2024), Aeschbach et al. (2023) e Gomes et al. (2024)

These experiences highlight how the teaching of Natural Sciences can be enriched through interdisciplinary proposals that foster active investigation by students. Table 2 was developed based on studies that discuss pedagogical practices aimed at addressing climate change, employing methodologies that promote participation, critical reflection, and student protagonism in the learning process.

3.3 Multiliteracies and Foreign Language Teaching in the Context of COP30: Interdisciplinary Strategies and Climate Communication with Active Methodologies in Elementary and Secondary Education

The approach to socio-environmental issues within the school setting, particularly regarding COP30, requires the adoption of pedagogical strategies that establish a dialogue with current challenges related to climate communication, multiliteracies, and global citizenship. Active methodologies, by emphasizing student participation in meaningful learning processes, have proven effective in promoting a more critical and engaged education. Studies indicate that interdisciplinary approaches combining reading, text production, and the use of

digital media expand students' linguistic and cultural repertoire, reinforcing their understanding of socio-environmental consequences and encouraging their capacity to act in the world (Mota & Rosa, 2018; Instituto Iungo, 2025; Queiroz, Cortese, & Sotto, 2024).

Within this context, foreign language learning—especially English and Spanish—becomes fundamental as a resource to internationalize the climate discussion and promote student leadership. The literature emphasizes that multiliteracies, by encompassing diverse languages, genres, and technologies, foster communicative practices that are contextualized and socially meaningful (Cazden et al., 2021; Lemes, 2024). Additionally, approaches grounded in collaborative activities and the use of digital resources enable students to experience authentic interaction scenarios in additional languages, linked to COP30 topics and the promotion of climate justice (Nguyen & Newton, 2019; Moraes & Anicézio, 2019).

In the public school context, the combination of pedagogical practices integrating multiliteracies, active methodologies, and global themes has proven effective for language teaching. Research indicates that the implementation of projects, debates, simulations, and media productions not only improves communicative fluency but also fosters students' autonomy and critical awareness (Batista, 2022; Araújo, Galvão, & Lavor, 2022). These experiences constitute effective environments for civic and intercultural education, fostering meaningful learning aligned with contemporary challenges. By promoting interaction between students and social realities, these pedagogical practices encourage critical reflection on global issues such as climate change and social justice, enabling learners to develop a deeper understanding of their role in society. Furthermore, the use of digital technologies and multimedia resources enhances the teaching-learning process, making it more dynamic and engaging.

The approaches mentioned are organized in Table 3, which presents examples of interdisciplinary investigative practices employing active methodologies, aimed at teaching Portuguese and additional languages in both primary and secondary education. These practices not only facilitate the development of language skills but also foster collaboration and teamwork, which are essential for cultivating students' socioemotional competencies. Thus, the integration of multiliteracies and active methodologies in language education proves to be fundamental in preparing students to meet the demands of the 21st century.

Table 3 – Investigative Approaches and Interdisciplinary Strategies with Active Methodologies in the Teaching of Portuguese and Other Languages in the Context of COP30

Teaching Stage	Involved Area	Interdisciplinary Strategy	Active Methodology Used	Final Product
Elementary School	Portuguese + Science	Analysis of reports and podcasts about climate change	Flipped classroom + debate	Production of school podcast
High School	English + Geography	Reading articles about COP30 in English, with a climate glossary	Project-based learning	Creation of multilingual posters
High School	Spanish + History	Diplomatic simulation of international negotiation in Spanish about climate goals	Role-playing + active learning	COP debate enactment in the classroom
High School	Portuguese + English	Creation of bilingual blog with news about COP30 and local actions	Collaborative interdisciplinary project	School blog in Portuguese and English
Elementary School II	Portuguese + Arts	Creation of short videos with poems or chronicles about the climate crisis	Collaborative audiovisual production	School video exhibition

Source: Lemes (2024); Cazden et al. (2021); Mota & Rosa (2018); Nguyen & Newton (2019); Batista (2022); Moraes & Anicézio (2019); Araújo, Galvão & Lavor (2022); Instituto Iungo (2025); Queiroz, Cortese & Sotto (2024).

This table systematizes interdisciplinary practices that promote the active use of languages to communicate and debate climate-related topics, aligning linguistic, technological, and civic competencies.

3.4 Critical Mathematics and Sustainability in the Context of COP30: Interpretation of Numbers and Interdisciplinary Strategies with Active Methodologies in Elementary and Secondary Education

Critical mathematics, integrated into the discussion on sustainability, plays an essential role in preparing students to interpret and question environmental information related to COP30. The interpretation of graphs, tables, statistics, and climate forecasts not only enhances quantitative reasoning but also promotes understanding of socio-environmental complexity, encouraging a critical perspective on the challenges related to sustainability (Possamai, Pereira, & Frenedozo, 2025; Assis et al., 2023). Interaction with authentic data sources, such as those provided by IBGE and IPEA, enables students to construct evidence-based arguments and actively engage in conscious decision-making at both individual and collective levels.

The application of active methodologies in mathematics teaching, combined with mathematical modeling and ethnomathematics, fosters interdisciplinarity and student engagement in contemporary environmental issues. The use of modeling in concrete sustainability situations results in more relevant and contextualized learning,

while ethnomathematics enriches the cultural and social understanding of numbers, promoting social and environmental justice (D'Ambrosio, 2018; Paraizo, 2018; Soares, 2019). This strategy also enhances students' autonomy by positioning them as protagonists in the process of constructing critical mathematical knowledge.

Moreover, the inclusion of investigative approaches and the development of projects based on concrete statistical data facilitate analysis of the impact of human activities on the environment, consolidating civic awareness and socio-environmental responsibility. The critical and sustainable approach to mathematics education contributes to the holistic formation of students, aligned with the 2030 Agenda, and empowers youth to understand and confront the global challenges present at COP30 (Cardozo, Meneghelli, & Possamai, 2022; Silva et al., 2022; Pizzolatto, 2019). By developing critical thinking and problem-solving skills, students are better equipped to actively contribute to discussions on sustainability and social justice, becoming agents of change within their communities.

Table 4 – Examples of Interdisciplinary Strategies with Active Methodologies in Mathematics Teaching with a Critical Approach for Elementary and Secondary Education

Level of Education	Integrated Subjects	Interdisciplinary Strategy	Active Methodology Used	Final Product
Upper Elementary School	Mathematics + Science	Analysis of IBGE graphs and tables on environmental indicators	Case study and problem solving	Critical report with local proposals
High School	Mathematics + Geography	Mathematical modeling to project future carbon emission scenarios	Project-based learning	Multimedia presentation
High School	Mathematics + Sociology	Statistical investigation on sustainable consumption and social inequality	Participatory research and debate	Podcast or documentary video
Upper Elementary School	Mathematics + Portuguese Language	Production of infographics combining mathematical data and explanatory texts	Collaborative production	Educational infographic for social media
High School	Mathematics + History	Study of the historical evolution of climate data and socioeconomic impacts	Interactive timeline	Interactive panel for school exhibition

Source: Assis et al. (2023); Possamai, Pereira & Frenedozo (2025); Cardozo, Meneghelli & Possamai (2022); Silva Et Al. (2022); D'ambrosio (2018); Soares (2019); Paraizo (2018); Pizzolatto (2019); Instituto Brasileiro de Geografia e Estatística (IBGE); Instituto de Pesquisa Econômica Aplicada (Ipea).

This table synthesizes various pedagogical practices that integrate mathematical and socio-environmental content through active methodologies, fostering the development of students' critical and reflective competencies.

IV. CONCLUSION

The present study fully achieved its stated objectives by organizing, through a rigorous literature review, a set of interdisciplinary approaches and active methodologies aimed at teaching COP30 across different fields of knowledge.

The elaboration of the four analytical tables proved to be a valuable contribution to pedagogical practice by providing a systematized repertoire of didactic strategies that are aligned with current challenges related to environmental education and civic formation. Table 1 presented examples of interdisciplinary approaches and active methodologies for teaching COP30 within the Humanities, highlighting how historical, geopolitical, and social contexts can be critically addressed in school environments. Table 2 organized investigative methodologies and interdisciplinary strategies that may be implemented in both elementary and secondary education, emphasizing the potential of project-based learning, problem-solving, and guided inquiry as tools to promote student engagement. Table 3 examined alternatives for the teaching of Portuguese and other languages, underscoring the role of language in mediating global climate issues. Table 4, in turn, emphasized the effectiveness of Mathematics from a critical perspective, integrating curricular content with the analysis of environmental data, statistics, and graphs related to climate change.

In light of the results obtained, it is evident that this research offers a significant contribution to the renewal of pedagogical practices in response to the climate emergency, providing educators with both theoretical and practical foundations for interdisciplinary and engaged teaching.

Nonetheless, there remains an opportunity for future research to explore the practical application of the strategies mentioned in real school settings, aiming to assess their effectiveness in relation to learning outcomes, student engagement, and the development of socio-environmental awareness. Furthermore, it would be relevant to investigate the continuing education of teachers for the integrated implementation of these methodologies in climate change education, thereby expanding the impact of innovative proposals such as those discussed herein. Studies adopting a mixed-methods approach, combining qualitative and quantitative analysis, may offer more

robust evidence regarding the pedagogical effects of active methodologies in addressing climate change through school-based education.

In summary, the implementation of interdisciplinary pedagogical practices and active methodologies not only addresses the urgency of the climate crisis but also promotes a more meaningful and transformative education, preparing students to face the challenges of the future.

Conflict of interest

There is no conflict to disclose.

REFERENCES

[1] Aeschbach, N., et al. (2023). *The physics of climate meets education for sustainable development: How to address complex problems through hybrid learning*. HINT. Heidelberg Inspirations for Innovative Teaching, 4(1), 47–71.

[2] Amado, J. (2017). *Manual of qualitative research in education* (3rd ed.). Coimbra: University of Coimbra Press.

[3] Araújo, W. P., & Ramos, L. P. S. (2023). Active methodologies in science teaching: Challenges and possibilities in teaching practice. *Research, Society and Development*, 12(1), e1412139150. CC BY 4.0. ISSN 2525-3409. https://doi.org/10.33448/rsd-v12i1.39150

[4] Araújo, E. M. E., Galvão, J. S., & Lavor, J. (2022). Active methodologies in Spanish language teaching: Student autonomy and protagonism in vocational and technological education. In *CONEDU - GT 15 Language Teaching*. ISBN: 978-65-86901-70-2. https://doi.org/10.46943/VIII.CONEDU.2022.GT15.008

[5] Assis, R. P., et al. (2023). Environmental education and methodological tools in transversal mathematics teaching in a public school – Belford Roxo, RJ. *Concilium*, 23(19), 425–437.

[6] Batista, J. L. L. (2022). The importance of active methodologies for English language teaching in public schools. *Ciência em Evidência – Revista Multidisciplinar*, 3(FC), e022009. ISSN 2763-5457.

[7] Cardozo, D., Meneghelli, J., & Possamai, J. P. (2022). Developing mathematical understanding: Remnants of a problem-based lesson. *Em Teia*, 13(1), 185–205. https://doi.org/10.51359/2177-9309.2022.252983

[8] Carvalho, A. M. P. (2022). Inquiry-based science teaching: Conditions for implementation in the classroom. Available at: https://repositorio.usp.br/item/003156981

[9] Cavalcante, L. T. C., & Oliveira, A. A. S. (2020). Literature review methods in scientific studies. *Psicologia em Revista (Belo Horizonte)*, 26(1), 82–100. https://doi.org/10.5752/P.1678-9563.2020v26n1p82-100

[10] Cazden, C., et al. (2021). *A pedagogy of multiliteracies: Designing social futures* (Eds. Ana Elisa Ribeiro & Hércules Tolêdo Corrêa; Trans. Adriana Alves Pinto et al.). Belo Horizonte: LED.

[11] Costa, M. R. P., & Sarah, M. E. S. (2025). *Porto Ambiental®: Environmental education and sustainable practices in the Amazon region of Pará*. *Caderno Pedagógico*, 22(5), e14739. https://doi.org/10.54033/cadpedv22n5-094

[12] Faria, D. R., Ramos, M. C., & Coltri, P. P. (2021). Didactic sequence as a strategy for teaching socio-environmental challenges related to climate change. *Terrae Didatica*, 17, e021052.

[13] Fernandes, N., et al. (2023). Appreciation and reflections: Climate change and the energy transition. *Revista Técnica Ciências Ambientais*, 1(7), 1–14.

[14] Fleury, L. C., Miguel, J. C. H., & Taddei, R. (2019). Climate change, science, and society. *Sociologias*, 21, 18–42.

[15] Gomes, R. L. R., et al. (2024). The relationship between active methodologies as teaching strategies and educators' autonomy. *IOSR Journal of Business and Management (IOSR-JBM)*, 26(8), Series 9, 74–84. https://doi.org/10.9790/487X-2608097484

[16] Brazilian Institute of Geography and Statistics – IBGE. (2023). *Geographic and statistical database*. Available at: https://www.ibge.gov.br/indicadores.html. Accessed in: June 2025.

[17] Institute for Applied Economic Research – IPEA. (2019). *Sustainable Development Goals*. Available at: https://www.ipea.gov.br/ods/publicacoes.html. Accessed in: June 2025.

[18] Instituto Iungo. (2025). *COP30: How is education present in the context of climate change?* São Paulo: Instituto Iungo.

[19] Jesus, T. A. C. de, Silva, E. G. C., & Ferracioli, L. (2023). Physics teaching and citizen science in understanding climate change through the study of streamflow in the Atlantic Forest. *Revista de Enseñanza de la Física*, 35(1), 39–52.

[20] Lemes, R. M. (2024). Multiliteracies in the English language classroom in higher education: Building contemporary and meaningful knowledge through technology. *Cadernos Cajuína*, 8(9). ISSN: 2448-0916.

[21] Lima, T. B., et al. (2023). Implementation of flipped classroom and digital technologies in vocational education. *Boletim de Conjuntura (BOCA)*, 13(39), 511–521.

[22] Lüdke, M. L., & André, M. (2021). *Research in education: Qualitative approaches*. São Paulo: EPU.

[23] Machado, C. B. H., et al. (2023). *Race against warming: A proposal for an educational game to support learning about climate change*. Available at: https://editorarealize.com.br/editora/anais/enpec/2023/TRABALHO_COMPLETO_EV181_MD1_ID2532_TB635_0903202306531 6.pdf. Accessed in: June 2025.

[24] Moraes, E. M. de A., & Anicézio, G. F. C. de. (2019). Active methodologies for teaching English and Spanish in vocational high school. *RIEL*, 1(1). ISSN 2674-6344. https://doi.org/10.29327/2.1373.1-10

[25] Mota, A. R., & Rosa, C. T. W. da. (2018). Essay on active methodologies: Reflections and proposals. *Revista Espaço Pedagógico*, 25(2), 261–276.

[26] Nascimento, J. M. do, & Araújo, M. L. F. (2024). Dialogicality and active methodologies in science teaching: Points of convergence. *Observatorio de la Economía Latinoamericana*, 22(3), e3781–e3781.

[27] Nguyen, B. T. T., & Newton, J. (2019). Learner proficiency and EFL learning through task rehearsal and performance. *Language Teaching Research*, 24(5), 588–615.

[28] Paraizo, R. P. (2018). *Learning through mathematical modeling associated with environmental issues in a video production context in high school* (Doctoral thesis). São Paulo State University "Júlio de Mesquita Filho", Bauru.

[29] Pizzani, L., Silva, R., Bello, S., & Hayashi, M. (2012). The art of bibliographic research in the pursuit of knowledge. *RDBCI*, 10(1), 53–66.

[30] Pizzolatto, C. (2019). *Financial education and environmental sustainability: A reflection in high school mathematics classes* (Master's dissertation). Federal Technological University of Paraná, Pato Branco.

[31] Possamai, J. P., Pereira, R. F., & Frenedozo, R. de C. (2025). Mathematics teaching with a focus on sustainability: An interdisciplinary approach aligned with the 2030 Agenda. *Educação Matemática Debate*, 9(16), 1–15. ISSN: 2526-6136. https://doi.org/10.46655l/emd.v9n16a01

[32] Queiroz, W. dos S., Cortese, T. T. P., & Sotto, D. (2024). COP30 in Belém: Challenges and opportunities from the perspective of social movements in the city. *Revista Científica ANAP Brasil*, 17(43). https://doi.org/10.17271/19843240174320245123

[33] Silva, A. P. S. da, et al. (2021). Climate change as a generative theme in physics teaching in basic education. *Brazilian Journal of Development*, 7(7), 69453–69471.

[34] Silva, C. M. L., Martins, E. S., Felix, J. H. da S., Alcócer, J. C. A., et al. (2022). Mathematics and sustainability: A brief literature review. *International Journal of Development Research*, 12(12), 60792–60796.

[35] Soares, S. P. L. (2019). Mathematical modeling as a methodology for teaching and learning mathematics: A literature review. *Itinerarius Reflectionis*, 15(1).