


SCIENTIFIC METHODOLOGIES IN EDUCATION: A CRITICAL REVIEW AND PROPOSAL OF NEW PATHS

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ABSTRACT

The study focused on scientific methodologies applied to education, to identify gaps in the proposals of the main authors and explore how these methodologies could be updated to meet the demands of the contemporary educational context. The central problem of the research asked: what are the gaps present in the scientific methodologies proposed by the main authors and how can these methodologies be updated to meet the demands of the contemporary educational context? The general objective was to critically analyze the scientific methodologies applied to education, highlight their contributions, identify limitations, and propose new paths for their updating. The methodology adopted was based on a bibliographic review, using as main sources classical and contemporary works by recognized authors in the field, such as Gil (2008), Lakatos and Marconi (2017), Creswell (2010), Bardin (2011) and Minayo (2002). The analysis focused on systematizing methodological contributions, identifying convergences and divergences, and proposing methodological innovations, considering current technological and social demands. The results and analyses indicated that, although the authors studied offered bases for conducting scientific research, their approaches presented gaps in aspects such as the integration of emerging technologies, adaptation to the specificities of the Brazilian educational context, and the inclusion of multimodal data. Limitations in the practical applicability of the methodologies in educational settings marked by inequalities and restricted access to technological resources were also highlighted. However, the results showed that updating these methodologies, through the incorporation of digital tools, hybrid approaches, and ethical perspectives, can increase their relevance and impact. In the final considerations, it was concluded that the scientific methodologies analyzed remain relevant, but need adaptations to respond to contemporary demands. In addition, the need for new studies that explore the practical implementation of the proposed updates, evaluating their effectiveness in different educational contexts, was reinforced. Keywords: Scientific Methodologies. Education. Critical Review. Methodological Update. Educational Research.

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INTRODUCTION

Scientific methodologies play a fundamental role in the advancement of educational research, providing theoretical and practical tools that allow us to investigate, understand, and propose solutions to the challenges that permeate the field of education. These methodologies are responsible for guiding researchers in the collection, analysis, and interpretation of data, ensuring scientific rigor and the validity of the results. Over time, several authors have contributed to the development of scientific methodologies, with approaches that encompass quantitative, qualitative, and mixed methods. However, in the face of social and technological transformations, it is essential to revisit and question these contributions, analyzing their limitations and identifying possibilities for progress.

This research is justified by the need to provide a critical analysis of the scientific methodologies used, highlighting both their contributions and their gaps. Although authors such as Gil (2008), Lakatos and Marconi (2017), Creswell (2010), Bardin (2011) and Flick (2009) have consolidated accepted approaches, the advancement of technology, social demands and contemporary educational challenges require reflection on the applicability of their proposals in the current context. Furthermore, understanding the limitations of each approach allows not only the improvement of research practices but also the proposal of new paths that meet the needs of education in constant transformation. This study aims to fill this gap, contributing to the academic and practical debate on the evolution of scientific methodologies in the educational field.

The question that guides this research is: what are the gaps present in the scientific methodologies proposed by the main authors, and how can these methodologies be updated to meet the demands of the contemporary educational context? Based on this question, we seek to explore the contributions and limits of consolidated methodological approaches, highlighting elements that can be revised or expanded to promote advances in the field.

The objective of this research is to conduct a critical analysis of scientific methodologies applied to education, highlighting the contributions and gaps present in the works of the main authors and proposing new paths for updating these methodologies. The text is structured to initially address the methodology used in the research, detailing its bibliographical approach and the selection criteria for the works analyzed. Next, a critical analysis of the contributions of authors such as Gil (2008), Lakatos, Creswell (2010), Bardin (2011), and Flick (2009), among others, is presented, highlighting their specificities

and limitations. Subsequently, the relevance of these methodologies in the Brazilian educational context is discussed, highlighting convergences, divergences, and gaps. Finally, new methodological perspectives are proposed that integrate the contributions analyzed, concluding with reflections on the challenges and opportunities for the advancement of educational research.

METHODOLOGY

The methodology adopted in this study was based on bibliographic research, considered appropriate for the purpose of analyzing and criticizing the contributions of renowned authors in the field of scientific methodologies applied to education. This type of research is characterized by the analysis of already consolidated theoretical sources, enabling a reflection on the topic. The approach was qualitative, focusing on the interpretation and understanding of the ideas and proposals presented in the selected works, highlighting their contributions, gaps, and relevance to the contemporary educational context.

The instruments used consisted of books, academic articles, and recognized scientific publications, prioritizing authors with notable relevance in the field of scientific methodology. The works were selected based on criteria such as recurrence in academic references, theoretical scope, and relevance to the topic investigated. Data collection was carried out systematically, using physical and digital libraries, academic databases, and specialized publishers as the main sources. This approach guaranteed access to up-to-date materials recognized by the academic community.

The methodological procedures involved reading and critically analyzing the selected works. During this stage, key concepts, methods, and approaches presented by each author were identified and organized thematically to facilitate comparison between their proposals. Categorization techniques were used to systematize the information, with an emphasis on identifying methodological contributions, limitations, and possibilities of application in the educational context. In addition, we sought to understand the theoretical perspectives underlying the approaches presented, connecting them to the demands and challenges of current educational research.

The analysis focused on the interpretation of central ideas and the critical evaluation of methodological contributions, considering aspects such as applicability, scope, and alignment with the needs of contemporary educational research. The comparison between

authors allowed us to highlight convergences and divergences in their approaches, in addition to identifying gaps that could be explored in new methodological proposals.

CRITICAL ANALYSIS OF THE MAIN AUTHORS

This topic is structured in thematic groups that organize the authors according to their main contributions and methodological approaches, allowing a systematic analysis of convergences, divergences, and criticisms. The structure seeks to explore the dialogues between authors who address complementary issues while highlighting gaps and proposing innovative paths for educational and social research. Thus, the text begins with the analysis of authors focused on discourse and qualitative methods, moves on to discussions on the integration of quantitative and qualitative methods, and, finally, deals with the general foundations of scientific methodology and innovative approaches in social research.

DISCOURSE THEORY AND QUALITATIVE TEXT ANALYSIS

Discourse theory and qualitative text analysis represent a central approach to research in several areas, including education, as they allow us to understand social interactions mediated by language and the meanings underlying discourses. In this field, Bakhtin (1992), Brandão (1993), and Bardin (2011) stand out for their fundamental contributions, each offering complementary but distinct perspectives on how discourse can be analyzed systematically and critically. Their works provide a solid theoretical basis for exploring the relationship between language, context, and social practices while raising important questions about the limitations and possibilities of these approaches.

Bakhtin (1992), with his theory of discourse genres, presents a contextualized view of the role of language in social interactions. He argues that discourses are not mere individual expressions, but products of specific cultural and social practices. This perspective provides tools for analyzing how meanings are constructed and negotiated in different contexts, including the educational environment. However, a recurring criticism of Bakhtin's (1992) approach lies in its level of theoretical abstraction, which can hinder its practical application in empirical investigations. One proposal to overcome this limitation would be to translate his theoretical concepts into accessible methods applicable to educational research, about the analysis of pedagogical practices and teaching materials.

Brandão (1993) complements this discussion by offering a systematic introduction to discourse analysis. His approach emphasizes how texts and discourses reflect and shape social structures, highlighting communicative practices and their impacts on the dynamics of power and ideology. Brandão's (1993) contribution is relevant to studies that investigate institutional discourses, such as school curricula and educational policies. Despite this relevance, his work presents a gap in that it is limited to the textual and communicative context, without exploring other forms of discursive representation, such as visual and digital resources, which have gained increasing importance. One avenue to be explored would be to adapt its methods to deal with multimodal analysis, expanding its applicability to contemporary communicative practices.

Bardin (2011), with his work on content analysis, proposes a systematic methodology to categorize and interpret texts, highlighting the importance of organization and rigor in the treatment of qualitative data. His approach is used in educational studies, especially in the analysis of curricular documents and pedagogical discourses. The systematicity proposed by Bardin (2011) is one of his main contributions, as it provides researchers with a clear path to deal with large volumes of qualitative data. However, his emphasis on textual aspects can be considered a limitation in contexts where other types of qualitative data, such as images, videos, or digital interactions, also play significant roles. To overcome this limitation, it would be pertinent to expand the application of content analysis to encompass multimodal data, aligning it with the demands of contemporary research.

When analyzing these three authors, convergences emerge, such as the shared focus on language as a mediator of social meanings and the valorization of systematicity in discourse analysis. However, there are notable divergences regarding the theoretical depth and practical applicability of their approaches, with Bakhtin (1992) assuming an abstract approach, while Brandão (1993) and Bardin (2011) offer structured methodologies. The common criticism among the need to adapt to contemporary demands, such as the inclusion of multimodal and digital data in discursive analyses, is therefore proposed. In this sense, an update of these methodologies is proposed, incorporating emerging technologies and interdisciplinary approaches that broaden their scope and relevance in the educational field and beyond.

QUALITATIVE RESEARCH IN EDUCATION

Qualitative education research is a methodological approach that seeks to understand educational phenomena based on the experiences, meanings, and contexts experienced by individuals. This perspective has been widely explored by authors such as Bogdan and Biklen (1994), Flick (2009), and Triviños (2009), who have made significant contributions to the field. Their works stand out for emphasizing the flexibility and analytical depth necessary to investigate complex issues, such as pedagogical practices, social interactions in the classroom, and institutional dynamics. Despite the convergence in their approaches, each author brings specificities that broaden the spectrum of methodological possibilities, while at the same time presenting limitations that can be addressed to respond to the contemporary demands of educational research.

Bogdan and Biklen (1994) are recognized for presenting a practical and accessible approach to qualitative research in education. In their work, the authors highlight the importance of techniques such as interviews, participant observation, and document analysis, indispensable tools for capturing the complexity of interactions in educational contexts. They emphasize that the qualitative researcher must adopt a reflective and ethical stance, respecting the voices and perspectives of the participants. However, a limitation of Bogdan and Biklen's (1994) approach is the absence of a discussion on the integration of new technologies in the data collection and analysis process. With the increasing use of digital platforms and technological resources in the school environment, it would be pertinent to update their techniques to incorporate tools such as qualitative analysis software and data collection in virtual environments.

Flick (2009), in turn, broadens the methodological horizon by exploring the diversity of qualitative methods and their applications in different contexts. He presents a stable introduction to qualitative research, highlighting its ability to access subjective and contextual dimensions of the phenomena investigated. Flick (2009) also addresses issues related to data triangulation, a valuable resource for increasing the reliability and validity of qualitative analyses. However, despite his significant contribution, his work lacks a more detailed approach to the impact of digital technologies on qualitative methodologies. The inclusion of analytical tools based on artificial intelligence, for example, could enrich methodological practice, allowing for faster and more comprehensive analyses, especially in studies involving large volumes of data.

Triviños (2009) focuses his attention on the application of qualitative research in social sciences, with an eye on the particularities of the educational field. He explores how qualitative methods can be used to understand the social and cultural dynamics that influence teaching and learning processes. Their work highlights the importance of contextualizing research, considering historical, cultural, and institutional factors that shape educational practices. However, a clear gap in their approach is the lack of a more in-depth reflection on ethical issues and the social impacts of qualitative research. Incorporating an ethical perspective would allow researchers not only to produce knowledge but also to contribute to significant social and educational transformations.

When analyzing the contributions of these authors, we identify a convergence in the recognition of qualitative research as an indispensable tool for understanding the complexity of educational phenomena. However, there are divergences regarding the level of detail on emerging technologies and ethical reflections in their approaches. The limitations highlighted suggest the need for methodological updates that incorporate technological innovations and a critical look at the social implications of research. Thus, we propose expanding qualitative techniques, with the inclusion of digital tools and the appreciation of ethical practices that respond to the demands of the contemporary educational context. These updates are essential to strengthen the relevance and applicability of qualitative education research.

INTEGRATION OF QUANTITATIVE AND QUALITATIVE METHODS

The integration of quantitative and qualitative methods has proven to be an approach to understanding complex phenomena, especially in the educational field. This methodological perspective seeks to take advantage of the advantages of both approaches, allowing for analysis. In this context, Creswell (2010) and Baptista and Campos (2010) stand out as authors who contribute to the development and application of integrated methods. Although they share the view that combining approaches can expand the analytical capacity of research, each author presents specificities in their proposals, which enriches the debate on methodological complementarity.

Creswell (2010) is recognized for his contribution to the structuring of mixed methods, which combine quantitative and qualitative elements in a planned and integrated manner. He presents a systematic approach to the development of research projects that use mixed methods, emphasizing the importance of aligning methodological choices with

the objectives of the investigation. Creswell (2010) proposes different integration models, such as triangulation, in which methods are applied independently and results are compared; sequential explanatory design, in which quantitative data are deepened with qualitative analyses; and the sequential exploratory design, in which qualitative analysis informs the collection of subsequent quantitative data. Although their approach is comprehensive, one limitation identified is the need for greater contextualization for research conducted in developing countries, such as Brazil, where technological resources and methodological training of researchers may be limited. Proposing the adaptation of their models to the cultural and structural specificities of the Brazilian context would be a promising way to increase the applicability of their contributions. Baptista and Campos, in turn, stand out for emphasizing the complementarity between quantitative and qualitative analyses, especially in the field of applied sciences. The authors argue that the integration of methods is not limited to combining data, but should seek a real interaction between the approaches, allowing the results of one to inform and expand the understanding of the other. One example is the use of quantitative analyses to identify general patterns, which are then deepened through qualitative investigations. The practical application of this proposal is relevant in educational studies, where issues such as school performance can be explored using statistics and, at the same time, complemented by analyses of the perceptions and experiences of teachers and students. Despite this innovative approach, the work of Baptista and Campos (2010) could benefit from greater detail on the operational challenges of integration, such as the need for interdisciplinary skills and the greater demand for time and resources for conducting mixed studies.

The contributions of Creswell (2010) and Baptista and Campos (2010) converge in defending integration as a methodological strategy capable of expanding the depth and breadth of analyses. Both recognize the importance of aligning methods with the research problem and ensuring coherence between the chosen approaches. However, their perspectives differ in terms of focus and detail. While Creswell (2010) presents structured and detailed models, but with less adaptation to specific contexts, Baptista and Campos (2010) emphasize the flexibility and interaction between approaches, without exploring operational issues.

A relevant criticism of the proposals of both authors is the need to incorporate the role of emerging technologies, such as big data analysis tools and artificial intelligence, which can facilitate the integration of large volumes of qualitative and quantitative data. In

addition, training researchers in mixed methods is a challenge that requires special attention, especially in educational contexts that face resource and infrastructure limitations. Proposing new training strategies and accessible application models can strengthen the relevance and applicability of methodological integration in the educational field. By aligning technological advances and the specific demands of educational contexts, method integration has the potential to transform research practices and educational policies.

GENERAL SCIENTIFIC METHODS

General scientific methods play a central role in academic research, providing the basis and guidelines for conducting investigations in different areas of knowledge. In the educational context, these methods are essential to ensure the rigor and organization necessary for the production of relevant and reliable knowledge. Authors such as Gil (2008), Lakatos and Marconi (2017), and Prodanov and Freitas (2013) have stood out in this field, offering contributions that range from the formulation of research problems to the presentation of results. Their works are used in undergraduate and graduate courses, serving as indispensable manuals for students and researchers in training.

Gil (2008) is recognized for his contributions to practical instructions for conducting social research. In his works, such as 'Methods and Techniques of Social Research and How to Prepare Research Projects', he addresses the stages of the investigative process in a didactic and accessible way, from defining the theme to analyzing the results. Gil (2008) emphasizes the importance of a well-defined structure, highlighting the relevance of clear objectives, well-founded hypotheses, and appropriate methods for each type of investigation. His approach combines theory and practice, which facilitates the application of his concepts in different research contexts. However, one limitation of his proposal is the predominant focus on traditional methods, with little attention to technological innovations and contemporary demands, such as the use of digital tools for data collection and analysis. Expanding his guidelines to incorporate these innovations would be a significant contribution to the field.

Lakatos and Marconi (2017), in 'Fundamentals of Scientific Methodology', present a vision of the concepts and foundations that guide scientific research. Their work is characterized by the systematization of the theoretical principles that support the scientific method, making it an essential reference for the initial training of researchers. They

address concepts such as hypothesis, variables, and operationalization, in addition to discussing the importance of rigor and replicability in science. However, the generality of their approach can be seen as a limitation in specific contexts, such as education, where demands and challenges require greater adaptation of the proposed methods. Including practical examples and case studies in the educational field could make their contributions applicable.

Prodanov and Freitas, in 'Methodology of Scientific Work: Research Methods and Techniques', offer a practical approach focused on the organization and systematization of academic work. They explore aspects such as text formatting, organization of references, and writing scientific reports and articles, essential elements for communicating research results. One of the main strengths of this work is its applicability to different areas of knowledge, guiding students and professionals seeking greater efficiency and clarity in their academic productions. However, the limitation of the work lies in the lack of attention given to emerging methodologies and new technological tools, such as data management software and qualitative analysis. Updating the techniques to include these resources could broaden the scope and relevance of its contributions.

By analyzing these three authors, it is possible to identify important convergences, such as the focus on systematization and methodological rigor. All of them offer guidelines for structuring scientific research, with an emphasis on the organization and clarity of investigative processes. However, divergences arise in the level of practical applicability and theoretical depth of their approaches. While Gil (2008) and Prodanov and Freitas (2013) emphasize practical and organizational aspects, Lakatos and Marconi (2017) adopt a generalist approach, which may limit their direct application in specific fields, such as education.

Criticisms of the works highlight the need for greater attention to contemporary demands, with regard to the integration of technologies and adaptation to specific contexts. It is therefore proposed to update the methods presented, with the inclusion of examples applied to the educational field and the incorporation of digital tools that facilitate the investigative process. These adaptations are essential to ensure that the contributions of these authors remain relevant and aligned with the needs of scientific research in the 21st century.

CREATIVITY AND FLEXIBILITY IN SOCIAL METHODS

Minayo (2002) is a central figure in the field of scientific methodology, due to his innovative and adaptable approach to social research. His work 'Social Research: Theory, Methods and Creativity' stands out for introducing elements of creativity and flexibility into the investigative process, challenging traditional perspectives. Minayo (2002) proposes a dynamic vision of research, in which methods are not considered fixed structures, but tools that must be adjusted to the specificities of the contexts and problems investigated. This adaptability allows methodologies to keep up with social and cultural changes, expanding their applicability and relevance. One of the notable aspects of her approach is the integration of creativity as part of methodological rigor. Minayo (2002) argues that creativity should not be seen as opposed to scientific rigor, but as a dimension that complements and enriches research in complex and dynamic social contexts. She highlights that the ability to innovate in methods is fundamental to dealing with contemporary demands, such as cultural diversity, and practical instructions for conducting social research. In his works, such as 'Methods and Techniques of Social Research and How to Prepare Research Projects', he addresses the stages of the investigative process in a didactic and accessible way, from defining the theme to analyzing the results. Gil (2008) emphasizes the importance of a well-defined structure, highlighting the relevance of clear objectives, well-founded hypotheses, and appropriate methods for each type of investigation. His approach combines theory and practice, which facilitates the application of his concepts in different research contexts. However, one limitation of his proposal is the predominant focus on traditional methods, with little attention to technological innovations and contemporary demands, such as the use of digital tools for data collection and analysis. Expanding his guidelines to incorporate these innovations would be a significant contribution to the field.

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Reflection on the applicability of methodologies in Brazil reveals both opportunities and challenges. While authors such as Minayo (2002) highlight the importance of creativity and flexibility in social research, these approaches face operational limitations, such as the need for greater training of researchers and the difficulty of accessing technological resources in less privileged educational institutions. In addition, the integration of participatory and collaborative practices, proposed by Minayo (2002), is relevant for Brazil, where social inequalities require research to have a transformative impact, but these practices also demand time and resources.

The divergences identified among the authors reflect different levels of attention to technological innovations and interdisciplinarity. While Flick (2009) and Creswell (2010) explore advances in qualitative and mixed methods, respectively, Gil (2008) and Lakatos remain close to traditional approaches. This disparity points to an important gap in the methodological literature: the need to integrate emerging technological tools, such as artificial intelligence and big data, to expand the possibilities of analysis and meet the complexities of the contemporary educational context. The discussion reveals that the contributions of the authors analyzed are complementary but need adaptations and updates to meet the specific demands of Brazil. The integration of methodologies, the incorporation of emerging technologies, and the strengthening of ethical and inclusive practices are essential steps to ensure that these proposals remain relevant. In addition,

training researchers in integrated and adaptive approaches is essential to overcome the limitations identified, allowing scientific methodologies to advance toward an innovative educational practice.

PROPOSAL OF NEW PATHS

Educational research faces growing challenges that demand methodological innovations capable of dealing with the complexity and diversity of contemporary contexts. In this scenario, proposing new methodological paths is essential to expand the scope and relevance of scientific research. Among the main suggestions are the integration of emerging technologies, the strengthening of hybrid methodologies, and the incorporation of ethical and inclusive approaches, which not only respond to technical and scientific demands but also promote significant social impact.

The integration of emerging technologies, such as artificial intelligence (AI) and big data, represents a promising advance for educational research. AI tools can automate the analysis of large volumes of data, identifying patterns and trends that would be difficult to perceive manually. This is useful in studies that involve multiple data sources, such as school records, interactions on digital platforms, and performance assessments. Big data, in turn, allows access to information in real-time, enabling the dynamic analysis of educational phenomena. For example, data on student attendance and participation in virtual learning environments can be used to predict dropout risks and personalize pedagogical interventions. However, the use of these technologies requires specific training for researchers and the guarantee that the data is treated ethically and responsibly.

Hybrid methodologies, which combine qualitative and quantitative elements, also have the potential to transform educational research. The proposal of integrating approaches such as case studies with statistical analyses allows an understanding of the phenomena investigated, combining contextual insights with data-based generalizations. In addition, hybrid methodologies can be strengthened by the use of digital tools, such as qualitative analysis software integrated with quantitative databases. This combination promotes greater flexibility and adaptability in conducting research, allowing the methods to be adjusted to the specificities of each educational context.

Another essential element for new methodological paths is the commitment to ethical and inclusive approaches. Educational research must consider the cultural, social, and economic diversity of participants, ensuring that their voices are represented fairly and

equitably. Participatory research, for example, is an approach that values the active involvement of the subjects investigated in the construction of knowledge, promoting greater representation and social impact. However, to implement these practices, it is necessary to overcome challenges such as the greater demand for time and resources, in addition to investing in training researchers to deal with complex ethical issues, such as data protection and ensuring informed consent.

In addition, the inclusion of interdisciplinary perspectives is a proposal that can expand methodological possibilities. By integrating knowledge from areas such as data science, psychology, anthropology, and sociology, educational research can approach phenomena, by considering multiple dimensions and interactions. For example, studies on the impact of digital technologies on learning can benefit from the combined analysis of cognitive, social, and cultural factors, offering integrated insights.

For these methodological innovations to be implemented, it is crucial to create spaces for the continued training of researchers, with a focus on technical skills and critical reflections. Workshops, courses, and inter-institutional collaborations can help build an academic community prepared to deal with the contemporary challenges of educational research. Furthermore, the dissemination of innovative methodological practices through publications, conferences, and academic networks can accelerate the adoption of new paths and promote the advancement of the field as a whole.

New methodological paths for educational research must combine technical rigor, flexibility, and ethical commitment. The integration of emerging technologies, the valorization of hybrid methodologies, and the adoption of inclusive and interdisciplinary approaches have the potential to transform research practices, aligning them with the needs and challenges of the 21st century. These proposals not only strengthen scientific research but also expand its social impact, contributing to innovative education.

FINAL CONSIDERATIONS

The final considerations of this study seek to answer the central research question, analyzing the gaps present in the scientific methodologies proposed by the main authors and exploring how these methodologies can be updated to meet the demands of the contemporary educational context. The analysis carried out allowed us to identify significant contributions but also pointed out limitations that need to be overcome to

expand the applicability and relevance of methodological approaches in the educational field.

Among the main findings, the authors' contribution to providing foundations for scientific research stands out. Works such as those by Gil (2008), Lakatos and Marconi (2017), and Prodanov and Freitas (2013) provide guidelines for the development of research projects, with an emphasis on rigor, systematicity, and organization. However, these proposals demonstrate gaps in terms of the integration of emerging technologies and adaptation to the specific demands of the Brazilian educational context. In an environment of constant technological transformations, the lack of guidelines on using digital tools and technological resources limits the scope of these methodologies, especially in investigations that require multimodal and dynamic data analysis.

Another gap identified is the need for greater cultural and social contextualization of methodological approaches. Authors such as Creswell (2010) and Baptista and Campos (2010) present structured and integrated models, combining qualitative and quantitative methods. However, these models lack adaptations that take into account structural inequalities and the resources available in developing countries, such as Brazil. Without these adaptations, the practical applicability of the methodologies in unequal educational contexts becomes restricted, which limits their impact and relevance.

In addition, qualitative methods, explored by authors such as Bakhtin (1992), Brandão (1993), Bardin (2011), and Bogdan and Biklen (1994), present limitations related to the inclusion of digital data and the analysis of multimodal interactions. Although these approaches provide tools for understanding social and educational phenomena, the emphasis on textual and discursive data does not address contemporary demands, such as the increasing use of visual, technological, and hybrid resources in pedagogical contexts.

Based on these findings, it is concluded that the scientific methodologies analyzed need to be updated to incorporate emerging technologies, such as artificial intelligence, big data, and digital platforms for qualitative analysis. These innovations can enhance the ability of methodologies to handle large volumes of data and respond to the complexities of today's educational environment. Furthermore, the inclusion of interdisciplinary perspectives and participatory practices can strengthen the relevance and impact of research, expanding its ability to address social, cultural, and cultural issues. Cultural and pedagogical methods in an integrated manner.

This study contributes by offering a critical analysis of scientific methodologies in the educational field, highlighting their gaps, and proposing ways to update them. However, it is recognized that there is a need for other studies that deepen the discussion on the practical implementation of these updates, especially in the Brazilian context. Future research could explore specific cases of adaptation of the methodologies analyzed, evaluating their effectiveness and identifying new challenges. In addition, empirical investigations that test the integration of emerging technologies and interdisciplinary practices in different educational settings would be valuable to complement the findings and expand knowledge about the possibilities and limits of scientific methodologies in the 21st century.

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