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Conceptions of science in Brazilian high school: a review of publications produced after the 2012 DCNEM

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ABSTRACT

The present study aims to analyze publications that approach teachers' and high school students' conceptions of science. Therefore, we carried out a literature review based on articles available on the Capes Journals Portal, published since the definition of the National Curriculum Guidelines for High School, from January 2012 until 2020. The systematic review method used was the Systematic Search Flow (SSF). Among the publications found, we observed that the pedagogical activities proposed to reflect science with the subjects involved in the research contexts were in harmony with the contextual approach of science teaching and the provisions of the high school curriculum guidelines. Another finding was the small number of articles selected for the bibliographic portfolio, which corresponded to four publications. Such quantity is an indication that the field of research on conceptions of science in the context of Brazilian high schools still needs to be explored.

KEYWORDS: Literature review. Science conception. Science teaching.

INTRODUCTION

Despite the important role it plays in daily life, the levels of understanding and interest that common people have in science are usually low (FRANCO, 2014). To illustrate the situation, it is enough to observe the results of Brazil in the examination of the Programme for International Student Assessment (PISA) held in 2018: of the 79 countries evaluated, the country occupied the 66th position in the ranking of science teaching (SCHLEICHER, 2019). The lack of interest in scientific work can result in misperceptions about what science is.

Studies carried out in recent years show that some visions of science incompatible with the educational proposal expressed in the National Curriculum Guidelines for High School persist, especially after its first reformulation, which occurred in 2012. Among such views, one can cite the reductionisms announced in Chassot (2003) and Sgarbi et al. (2018), such as presenteeism, which represents an exclusive connection to the present, without being rooted in the past and without prospects for the future; scientism, which is the exaggerated belief in the power of science and/or attribution that it is only beneficial; and dogmatism, which, marked by positivism, is presented as one of the marks for lack of scientific literacy. There are also other distorted perceptions about science, such as the belief in the continuous and accumulative progress of scientific knowledge or the non-recognition that its construction is inserted in a social and historical context (PÉREZ et al., 2001; COSTA et al., 2017). Faced with this reality, the need for discussion and reflection on the scientific education of the new generations is reinforced.

Scientific literacy is an educational process whose importance has been repeatedly reinforced because, by enabling greater knowledge about scientificity, it gives students better conditions to develop skills to deal with situations of daily life and society, basing their decisions on scientific knowledge. (TEIXEIRA; FREIRE JR.; EL-HANI, 2009; SASSERON, 2013), which can make them integrate scientific concepts into their personal values; understand that the use of scientific and technological knowledge is under the rational control of society; recognize that there are ethical limits to the use of this knowledge in the development of the well-being of humanity; know and apply the main concepts, hypotheses and scientific theories; discern between what is the product of the science development process and what is the result of personal opinion; understand that scientific knowledge is susceptible to change; and, finally, enrich their vision of the world. (SASSERON; CARVALHO, 2011).

In the same sense, Scheid, Ferrari, and Delizoicov (2016) present other purposes of science education, such as developing in students an understanding of what science is, the way it works and develops, its methods and values, the bond it has with technology and its social, historical, and cultural dimensions. For Sasseron (2013), understanding the nature of science is one of the structuring axes of scientific literacy, which is even one of the subsidies to address issues related to scientific investigation in class.

Those meanings are in harmony with those recommended by Matthews (1995) and Santiago et al. (2017), who argue that science teaching should be guided by a contextualized approach that takes into account the social, historical, philosophical, technological, and ethical circumstances inherent to scientific knowledge. For the author, the contextual approach in science education

contributes to motivating students, to humanizing teaching and to a better understanding of scientific concepts, since the way they are developed and improved is portrayed. It also allows us to understand that scientific thinking is dynamic and undergoes transformations over time, allows us to understand its methods and know the fundamental episodes in the history of science.

The way science is approached in the classroom by the teacher affects the conceptions that students have about it. Such perceptions have been the object of research since the beginning of the last century. Teixeira, Freire Jr., and El-Hani (2009), for example, reveal that, generally, students bring inappropriate images of science and scientists in their minds. Among the inadequacies, there is a lack of understanding about the nature of scientific knowledge, the view of the knowledge produced as definitive and absolute truth, and the idea that science is made from observations and experiments of an impersonal character, which disregard the scientists' subjectivity and the historical and social context.

Another study that contributed to the understanding of the subject, carried out by Lederman (1992), promoted a detailed literature review of works that investigated students' and teachers' conceptions of the nature of science. Lederman pointed out that assessments of students' conceptions revealed that they do not understand the nature of science properly. Likewise, studies that assessed teachers' perceptions indicated that they also did not have the desired level of understanding. As the teachers' understanding of science implies how it is presented to their students, one of the conclusions drawn by Lederman suggests that we cannot expect teachers to teach what they do not understand.

For Tobaldini et al. (2011), a teacher who has a simplistic view of the nature of science tends to focus on the products of science, presenting them as results disconnected from their historical and social context. On the other hand, a teacher who understands the transience of scientific knowledge and the underlying socio-historical-philosophical aspects may be able to promote reflections on how its construction occurs and correlate the factors that interfere in it. Even so, even if a teacher has a good understanding of the nature of science, the incorporation of such conceptions into teaching practice is a complex process that does not always occur automatically, i.e., the topic must be discussed and reflected in a broad and constant way (TOBALDINI et al., 2011).

In the same sense, El-Hani (2006) emphasizes the importance of a contextual approach in the training of teachers and researchers, where science learning is always connected to learning about science, taking into account the processes of construction of scientific knowledge in their historical, philosophical, social, and cultural dimensions.

It is possible to perceive how important it is that teachers and students have a good understanding of what science is and the impact that social and historical contexts have on its construction. Thinking about it, we questioned how those conceptions had been approached in the scientific literature.

It is noteworthy that the field of scientific literacy is a broad and fertile territory and for this reason, this study does not intend to bring this concept to the center of the research. In this sense, it is used here to highlight the importance of understanding what science is and reflections on its nature, which, as observed in Sasserom (2013), are part of the scope of scientific literacy. Thus, this work is the

result of a literature review based on scientific publications that deal with teachers' and high school students' conceptions of science, available for reading on the Capes Journals Portal, which aimed to analyze studies that addressed the understanding of the nature of science.

The time frame chosen corresponds to the period of validity of the National Curriculum Guidelines for High School Education (DCNEM), from 2012 to 2018, plus the years 2019 and 2020, established by the Ministry of Education (MEC) as a transition period for the new high school. In this way, we sought to identify the texts available in the database whose investigations were carried out between 2012 and 2020 and which focused on the theme "conception of science" with teachers and students in the context of Brazilian high school.

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THE RESEARCH TIME FRAME

Aiming to impose a time limit for the bibliographic survey, the period between 2012 and 2020 was defined. Resolution N. 2, of 30 January 2012, of the National Education Council, which established the National Curriculum Guidelines for High School Education (BRASIL, 2012) inspired this choice. The normative act defined science - together with the dimensions of work, technology, and culture - as the basis of the proposal and curriculum development, which must be integrated into education, and established that the high school curriculum must guarantee the development of actions that promote understanding of the meaning of science.

According to Corrêa (2016, p. 9383), the 2012 DCNEM inaugurated an important transformation of high school education, as they announced: "structural changes that differ in language, in the principles of human education, in the structure of the curriculum and, above all, in the relationships established between education and society". The author emphasizes that the new guidelines sought to consolidate a high school education concerned with a human and integral formation in the dimensions of work, science, technology, and culture, giving new meanings to the school and enabling dynamics and reflective experiences for students.

Silva and Colontonio (2014) invite educators to exercise a critical look at the DCNEM, so as not to run the risk of fragmenting the intended citizen's integral formation, giving the curricula and practices only an air of innovation. The authors defend the search for meanings for the dimensions of work, science, technology, and culture. However, they claim that it is necessary to go further: they must be justified and legitimized in the curriculum, exploring them in history, in power relations and the social interests that surround them. In other words, the authors defend that such dimensions be addressed in the curricula and in the classroom in a contextualized way.

Regarding the contextual approach in science teaching, Oliveira and Macedo (2014) point out that the new DCNEM present the theme without imposing closed or crystallized concepts and provides subsidies for its understanding,

comprehension, and application in science teaching, leaving teachers to explore contextualization to resignify learning.

In general, we can say that the 2012 guidelines defended a curriculum concept that integrated the dimensions of science, technology, culture, and work in a consistent and organic way. It was a proposal that established a single path with disciplines aimed at the integral formation of youth. As a consequence, scientific formation and the very conception of science had as an epistemological basis the relationship between thought and materiality and the natural sciences were integrated with the human and social sciences.

With the update of the DCNEM in 2018, based on Law n. 13.415, of February 16, 2017, which changed the conception of high school, the guidelines assume a new epistemology, in which thinking is focused on "non-systematized -practices derived from creative responses to solve problems of daily work and social relations, in an effort to understand and systematize them" (KUENZER, 2017, p. 349), from themselves and not from the mediation of theory.

METHODOLOGICAL ROUTE

Before detailing the methodological procedures used, it is necessary to mention the study promoted by Azevedo and Scarpa (2017), which encouraged this research. The authors carried out a literature review on works that focused on conceptions about the nature of science and demonstrated that, although the number of publications has increased, there are still few literature reviews focused on this topic. In their conclusions, they pointed out that the field of research on the nature of science in Brazil is still vast and needs to be explored to understand better how the historical and social contexts impact students' and teachers' conceptions of science.

From the indicated gap, this study sought to verify publications on the nature of science available on the Capes Journals Portal, related to teachers' and high school students' conceptions of science. Therefore, a systematic literature review was carried out based on the method *Systematic Search Flow* (SSF), developed by Ferenhof and Fernandes (2016), which details and systematizes the flows of the review process.

In general terms, this method was elaborated from the analysis of the advantages and disadvantages of other research methods for reviews and

> [...] uses searches in databases to allow easier replication of research, avoiding possible researchers' biases in choosing articles through exploratory methods, which is a disadvantage found in other methods of literature review, such as narrative review. The SSF is a non-random or exploratory method, as it follows a rigorous methodological procedure that guarantees the repeatability of the research, minimizing researchers' tendencies that may arise from the choice of random documents (LOPES *et al*., 2019, p. 6).

To complement the gaps found and detail the stages of the review well, Ferenhof and Fernandes (2016) structured the SSF in four phases and eight activities, as shown in Chart 1.

Chart 1 - Phases and activities of the *Systematic Search Flow* (SSF).

Phases	Activities
Definition of the research protocol	Define the search strategy
	Consult in database
	Organize the bibliographic portfolio
	Standardize the selection of articles
	Compose the portfolio of articles
Analysis	Consolidate data
Synthesis	Prepare reports
Writing	Write bibliographic review

Source: Adapted from Ferenhof and Fernandes (2016).

The first phase of the SSF method aims to elaborate the research protocol to be adopted and results in the composition of a bibliographic portfolio formed only by the articles that, in fact, will be part of the research. The procedure begins with the establishment of the search strategy that will be used, such as the definition of key terms, the logical operators that will be used in the search, the types of documents to be retrieved, languages, and publication period. Then, the databases of interest are selected, and the search is carried out. In the next step, the bibliography found is organized, preferably using some *software* bibliography organizer. In the fourth step, titles, abstracts, and keywords are read for the selection of publications that are aligned with the chosen theme. In the final activity of the research protocol definition phase, a final screening is carried out, based on a reading of the publications in full, to exclude those that are not in accordance with the research topic (FERENHOF; FERNANDES, 2016).

In the second phase, analysis, the data of the collected works is consolidated to allow extracting general information, such as the journals in which they were published, the year of publication, etc. The use electronic spreadsheets to cross-reference the data obtained is recommended. The third phase is in which information from each of the selected publications is extracted, and observations are made about the analyzed works (FERENHOF; FERNANDES, 2016).

DEFINITION OF THE RESEARCH PROTOCOL AND COMPOSITION OF THE BIBLIOGRAPHIC PORTFOLIO

Since the scope of the study encompasses teachers' and high school students' conceptions of science, the terms "*concepção de ciência*" and "science conception" were defined as search descriptors, with the application of the logical operator "or", as the interest was to reach national or foreign research publications on the subject. However, among the foreign publications found, only those dedicated to studying the Brazilian national scenario were analyzed, given that the impacts of the DNCEM only exist within the territory they regulate.

After tracing the parameterized search strategy, the database of the Capes Journal Portal was consulted to locate articles with the pre-established

parameters, whose result returned 233 publications. Then, the works found were analyzed to identify which of them were aligned with the proposed theme. For this selection, the articles that presented the search descriptors in their title, abstract, or keywords in addition to their research contexts were evaluated, so as to select only those that involved studies on students' and teachers' science conceptions within the context of Brazilian high school education. It is important to highlight that few publications in foreign languages were found among the evaluated works, most of which were translations of articles published in Portuguese with the possible aim of achieving greater visibility.

We obtained eight publications from this first screening, which underwent another filtering stage, during which they were all read in full, to ascertain their real adherence to the proposed theme. We found that four of the articles did not align with the theme and, thus, four publications went to the analysis stage.

One of the studies excluded at this stage dealt with concepts about global warming and not about science in general (CARVALHO; WATANABE, 2019). The second addressed the concept of science in a training course for teachers of early childhood education, which is not subordinated to the DCNEM, but to the National Curriculum Guidelines for the Initial Training of Teachers for Basic Education (RODRIGUES *et al*., 2019). The third and fourth studies (SILVA *et al*., 2012; FORATO *et al*., 2012), although published in 2012, are the results of research carried out before the new DCNEM came into force. Although not selected to compose the bibliographic portfolio, we highlight the Forato *et al*.'s (2012) work was published in English in an international journal.

Chart 2 summarizes the composition of the bibliographic portfolio, indicating the screening stages and the respective amount of articles found.

Chart 2 - Composition of the bibliographic portfolio.

Activity	Number of works
Screening by reading titles, keywords, and abstracts	233 publications
Full reading screening	Eight publications
Bibliographic portfolio	Four publications

Source: By the author (2022).

ANALYSIS AND SYNTHESIS

Once the bibliographic portfolio was defined, the selected studies were analyzed, from which preliminary information on the publications was extracted, such as title, authors, data about the journals that were submitted, and year of publication, the details of which are available in Chart 3.

Chart 3 - List of articles in the bibliographic portfolio.

Title	Author	Journal	Year
Concepções de ciência de educadores e estudantes, e identificação das estratégias do ensino de ciências em uma escola localizada no interior da fundação de atendimento socioeducativo em Uruguaiana-RS [Educators' and students' conceptions of science, and identification of science teaching strategies in a school located within the socio-educational service foundation in Uruguaiana-RS]	Edward Castro Pessano; Iara Garcia Muller; Marcus Morini Querol; Vanderlei Folmer; Robson Puntel	Revista Eletrônica de Educação. ISSN: 1982-7199 Qualis A2	2014
Impacto do uso de estratégias investigativas sobre as emoções e a motivação dos alunos e as suas concepções de ciência e cientista [Impact of the use of investigative strategies on students' emotions and motivation and their conceptions of science and scientist]	Vanessa Martini da Silva; Eduardo Pacheco Rico; Diogo Souza; Diogo Losch de Oliveira	REEC: Revista Electrónica de Enseñanza de las Ciências. ISSN: 1579-1513 Qualis A2	2015
"A ciência que a gente vê no cinema": uma intervenção escolar sobre o papel da ciência no cotidiano ["The science we see in the movies": a school intervention on the role of science in everyday life]	Ana Constância Macedo Faria; Marcelo Ximenes Aguiar Bizerril; Maria Luiza de Araújo Gastal; Megue Magalhães Andrade	Revista Brasileira de Pesquisa em Educação em Ciências. ISSN: 1806-5104 Qualis A2	2015
A natureza da ciência e o erro: reflexões sobre o conto "ótima é a água" por alunos de ensino médio [The nature of science and error: reflections on the tale "Great is the water" by high school students]	Débora Cedran; Alex Lino; Marcos Cesar Danhoni Neves; Neide Maria Michellan Kiouranis	Góndola, Enseñanza y Aprendizaje de las Ciencias. ISSN: 2346-4712 Qualis B1	2017

Source: The author (2020)

The analysis of the studies presented in Chart 3 made it possible to understand how they were developed and how they approach the conceptions of science of the subjects involved in the contexts of the investigations.

The first study analyzed was Pessano *et al*.'s (2014), where they sought to evaluate the conceptions of science of 12 teachers and 32 students from a school located inside a prison unit for young people in deprivation of liberty, in the process of resocialization, and to identify the teaching strategies used in science teaching. The study applied questionnaires for data collection, where the researchers identified fragmented perceptions of science on the part of students and teachers, who used inefficient pedagogical practices, often "empty of meaning or not providing the students with the construction of a critical and investigative spirit" (PESSANO *et al*., 2014, p. 69).

The authors pointed out the training of the educators as a solution for that school environment, a proposal that sounds coherent with the idea found in Lederman (1992), who argues that teachers need to understand the nature of science so that they are able to debate it with their students. This is a point that highlights the importance of continuing teacher education to equip them with sufficient knowledge and methodologies to support their science teaching practices in contextualized, potentially transformative bases, especially in an education that aims at the resocialization of young people in a situation of deprivation of liberty.

Another solution pointed out by the researchers concerns the elaboration of an interdisciplinary institutional project that favors the teaching of science contextualized with the students' reality.

Regarding actions to discuss and reflect on the concept of science, the researchers did not implement any type of activity, just capturing teachers' and students' pre-existing conceptions and identifying the science teaching strategies that were being developed at school. Even so, the proposal of elaborating an interdisciplinary institutional project meets the formation guidelines present in the DCNEM.

The study analyzed below, detailed in Silva *et al*. (2015), sought to understand how investigative activities can impact emotion, motivation, and conceptions about science and scientists in third-graders of high school in Biology. The educational activities involved a visit to a university's biochemistry laboratories, participation in seminars, training in laboratory techniques and protocols, the elaboration of a research project to carry out a dynamic investigation, the execution of the investigation, the collection of results, and their dissemination in the form of seminars. The researchers used elements of history and philosophy to reflect on the scientific process with the students and could perceive that the investigations promoted changes in the way they understand science and what scientists do.

The case presented in the study is an example of how the contextualized teaching of science promotes concrete changes in students' perceptions. The use of research and elements of the history and philosophy of science to reflect on and experience scientific practice aligns with the transforming perspectives of education and with the ideal of human and integral formation recommended by the curricular guidelines.

Faria *et al*. (2015) researched how the use of films affected the conceptions that third-grade high school students have about science and scientists. For that, they used questionnaires, conversation circles, and participant observation. In

their investigations, they found that students brought stereotyped images of scientific activity and pointed to television, school, and textbooks as the main sources that formed their opinion. After the cinematographic incursions, reflections and debates, the students could identify the deformations on the scientists' image depicted in the films. The study stands out for the use of multiple languages to promote reflections on the role of science and the role of scientists in social dynamics. In their conclusions, the authors reinforce the need to promote a contextualized scientific education and consider that the cinema allowed the dialogue between science, culture, and school, through the critical-reflective mediation of the teacher, and stimulated students to reflect on the role of science in their lives and in society.

A fact that calls attention and that cannot be ignored is the students' indication that, besides television, the school itself and the textbooks served as a basis for the formation of their distorted perceptions about the scientific process. This finding highlights the need to invest in teacher training and in the training of other school agents so that the school as a whole can recognize the importance of the theme and use it in creative and diverse ways. Such actions include choosing textbooks that privilege the contextualized teaching of science to the detriment of those that focus only on the delivery of disciplinary content.

Finally, Cedran *et al*. (2017), based on Bachelardian epistemology, which highlights the importance of error in the evolution of scientific knowledge, carried out an investigation with students from the second and third grades of high school, during which they used the short story "Ótima é a água" [Best is water], by Primo Levi, to promote debates and reflections on the nature of science with students. The research applied questionnaires before and after the rounds of debates carried out, through which it was possible to perceive that, initially, many students had contradictory views about science and, after the reflections, they found that the activities promoted a movement in the students' thinking, stimulating their understanding of scientific thinking and the importance of error in this process.

The use of multiple languages in science teaching, such as cinema, theater, literature, etc., as found in Faria *et al*. (2015) and Cedran *et al*. (2017), exemplify how useful experiences that reconcile science and arts can be in the production of meanings for scientific knowledge and in expanding the students' cultural background. Ferreira (2015) brings some reflections on the relevance that this type of approach can have for teachers' and students' scientific formation:

> The approximation between different spheres of knowledge, such as science and literature, for example, provides an attribution/production/displacement of meanings on scientific concepts/subjects, i.e., it can take place as a didactic, cultural mediation. Science (whatever its disciplinary boundaries) and the various artistic manifestations (literature, cinema, theater, music, painting, etc.) can relate inside and outside the school environment and provide a less polarized understanding of the world, a wider cultural-scientific formation for students and teachers. The contact with diversity, inherent to multiple languages and their readings, in addition to being essential for the teachers' cultural-scientific formation, may give rise to new possibilities for professional performance. (FERREIRA, 2015, p. 3594).

Although the analyzed articles do not mention the DCNEM clearly as a basis for the actions they performed, we noticed their alignment, to some extent, with the curricular guidelines for high school. In this sense, the works by Silva *et al*.

(2015), Faria *et al*. (2015), and Cedran *et al*. (2017), who used creative pedagogical actions to encourage debate and reflection on the nature of scientific knowledge, stand out for enabling a better understanding of the meaning of science, especially for its contextualization with social, historical, philosophical aspects, which allowed to motivate students, facilitate their learning, and form a spirit of citizenship (MATTHEWS, 1995; OLIVEIRA; MACEDO, 2014).

CONCLUDING REMARKS

Assuming the understanding of the nature of science as a fundamental quantity for citizen formation, this study carried out a literature review to map the scientific works produced under the DCNEM from 2012 to 2020, which investigated teachers' and students' conceptions of science in the scope of Brazilian high school education. The initial sample resulting from the search on the Capes Journals Portal returned 233 articles, of which we identified four publications that met the scope of this research.

We found that the activities and reflections reported in the studies were in line with the 2012 high school curriculum guidelines. The quality of the works reveals that the field of studies on conceptions of science in the context of Brazilian high school education is fertile. However, the small number of publications indicates that this area still needs to be explored. A characteristic of this research that corroborates this finding is the fact that the terms used as search descriptors are broad and, for this reason, it was expected that the search on the Capes Journals Portal would return more publications.

We must keep in mind that science teaching that enables effective scientific literacy must be a constant and frequent search, and educational actions in harmony with the ideal of integral and citizen education brought by the National Curriculum Guidelines for High School was a hope for aligning science teaching with a broad conception of science. In other words, a scientific education that highlighted the social, historical, and philosophical contexts underlying the evolution of scientific thinking and that allowed reflecting on science and understanding what science is. We thought that this would be an important tool in the construction of citizenship and in the preparation of individuals to interact with the world in an authentic and creative way, enabling them to use science to support their decisions and their way of interpreting nature.

In any case, so that the levels of scientific literacy can be increasingly satisfactory, it is necessary to invest, above all, in continuing teacher education and in the training of other school agents so that the school as a whole can recognize the importance of the theme, using creative and diverse ways to approach it.

The small production of studies in the area evidenced by this research reveals the lack perceived in science teaching during the validity of the 2012 DCNEM and reinforces the need for reflection and constant debate on the nature of science. However, the perspective brought by the new high school, which began in 2022, causes dismay. Based on the flexibility of teaching, only two school subjects are mandatory: Portuguese and Mathematics. The others should be included in the formation but not throughout the educational course, meaning they may only be inserted as short-term modules. This may imply a reduction in the supply of

disciplines that depend on more qualified teachers and more sophisticated material resources and technologies, such as science laboratories, libraries, computer equipment, internet access, etc. As no one doubts the importance of science education, it seems that it can be offered in a precarious way to the majority of the population, while only a privileged class will have effective access to this knowledge that emancipates people and society. Such fragmentation may even pave the way for strengthening denialist discourses on science, which are already widely disseminated in society.

Concepções de ciência no ensino médio brasileiro: uma revisão das publicações produzidas após as DCNEM de 2012

RESUMO

O presente estudo tem o objetivo de analisar publicações que abordam as concepções que professores e estudantes do ensino médio têm sobre a ciência. Para tanto, foi realizada uma revisão de literatura baseada em artigos disponíveis no Portal de Periódicos Capes, publicados desde a definição das Diretrizes Curriculares Nacionais para o Ensino Médio, em janeiro de 2012, até o ano de 2020. O método de revisão sistemática utilizado foi o Systematic Search Flow (SSF). Entre as publicações encontradas, foi observado que as atividades pedagógicas propostas para refletir ciência com os sujeitos envolvidos nos contextos das pesquisas se harmonizaram com a abordagem contextual do ensino de ciências e com os dispositivos das diretrizes curriculares do ensino médio. Outra constatação foi a quantidade diminuta de artigos selecionados para o portfólio bibliográfico, que correspondeu ao total de quatro publicações. Tal quantitativo é um indício de que o campo de pesquisas sobre concepções de ciência no contexto do ensino médio brasileiro ainda carece de ser explorado.

PALAVRAS-CHAVE: Revisão bibliográfica. Concepção de ciência. Ensino de ciências.

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NOTES

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