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Images in textbooks: Analyzes articles in science teaching journals

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ABSTRACT
With the evolution of technologies, the image, which invades the contemporary world and proliferates, becomes a powerful and broad tool that can be used as an object of knowledge construction. In the present work, we seek to make an analysis of how articles published in journals of Science Education have approached the use of the photographic image in science and biology textbooks. Our research is a bibliographic review of the articles available in four national journals in the last 10 years (2010 – 2020). The consultation was carried out directly on the websites of the journals. We searched for keywords such as "Textbook", "Science/Biology". Subsequently, the abstracts of the articles were read in order to know which of them approached the image, especially the photographic image in their studies. We understand that in the analyzed articles, the photographic image is still little researched within the Science Teaching.

Keywords: Image, Photographic image, Textbook, Science Teaching, Biology.

1 INTRODUCTION

In the contemporary world, where there is a large amount of technological resources around us, the image[1] exerts a strong influence on people's daily lives by establishing new ways of reading the world. They are published in magazines, *billboards*, posters, pamphlets, television, computer, *smartphones,* social networks, including textbooks. Thus, when reflecting on the images we encounter on a daily basis, we realize their importance in our lives, whether to communicate, teach or learn, regardless of the content. However, in this society populated by images, it is not enough just to reflect on their presence, it is also necessary to think about their content, their condition of existence, problematize and know the probable effects they cause in individuals (MACIEL, 2016). For this, it is necessary to stimulate the education of the look and the development of the reading of the images.

Images are also important sources of knowledge in the school discursive universe, as well as an instrument of visual language in pedagogical activities. They help us explain concepts from drawings, schemes, graphics, photographs, illustrations. They favor the learning of contents of the different fields of knowledge, among them, in the teaching of Sciences and Biology. The photographic image, for example, establishes relations with the verbal text that refers to it, and can help students understand the contents. Studies that aim to analyze the types of images present in textbooks and the

[1] The author refers to drawings, prints, illustrations, photographs, diagrams, schemes, graphics and other modalities of visual representations.

resources that facilitate their interpretation is only the beginning for the development of research related to the imagery content of the textbook (SILVA, 2018).

Based on these notes, we present the following questions: how are studies involving these imagery resources being conducted? Can we find articles published in journals that can analyze the photographic images conveyed in science and biology textbooks? If so, how are these images being used in this teaching resource? For this, our work focused on analyzing how studies on images are being approached in Science textbooks (final grades of Elementary) and Biology (High School), especially the photographic image in the journals of Science Education in order to identify subsidies that help teachers in the choice of the textbook.

2 IMAGE AND THE SCHOOL SPACE

We noticed that, over the years, visual language and imagery representation was gaining more space, replacing words as a means of communication. In this scenario, some questions arise: What do the images represent to us? What do they communicate? What is their role in the educational process? According to Costa (2013), the image arouses emotion, promoting reactions, impacts the observer, while the written text requires decipherment and more reading, establishing a certain distance between the text and its reader.

For Santaella (2012), images are called *representations* because they are created and produced by human beings in the societies in which they live. Also according to this researcher, these visual representations are artificially created and require the mediation of skills, instruments, supports, techniques and also technologies.

It is possible to say that the image as a visual representation promotes meanings in the mind of the reader as long as he is able to establish a relationship with the thing seen (SARDELICH *et al.,* 2015). The study of these representations, from *semiotics*[2], can be analyzed from signs, and by conducting semiotic studies with images, which can help us to reveal their mode of production of meaning, their meanings and also their worldview. First, however, we need to develop the practice of critical reading of images in order to understand all their values, and this requires learning and knowledge. In this sense, Santaella (2012, p. 9), highlights that the reading of images means,

> [...] acquire the corresponding knowledge and develop the necessary sensitivity to know how the images present themselves, how they indicate what they want to indicate, what is their context of reference, how the images mean, how they think, what are their specific ways of representing reality.

For this reason, we understand that to promote active learning and good understanding, it is important that individuals learn to read and interpret images and the development of this practice can

[2] Study of signs; process of meaning construction.

be initiated in school. Following this thought, we can reflect on the importance of the insertion of images in the educational scope, as a way of learning and teaching scientifically from this imagery language. Carlos (2008) points out that, in a world taken by the sign of the image, it is essential that the school encourages the appropriation of knowledge by the education of the look, mediated by the reading of the images. The image helps in the educational processes, optimizing the learning of contents that may be difficult to be understood, in addition to developing visual memory, communicates aspects of nature such as behaviors and ideas. However, this should all be presented in a correct, didactic way and its use should be well planned.

For its emotional, enigmatic and affective characteristics, for taking us from the first look and for being able to deceive us, the use of images in education needs information, knowledge, preparation and management, as it should happen with all educational activities (COSTA, 2013). Maciel *et al.* (2017) defend the importance of the image by placing it on the same level of communicative and epistemic resource as writing. Thus, we understand that the school is the ideal setting for the development of such awareness.

With this perspective, we can infer that students need to know how to look at the image critically, analyze them, interpret them, so that, in this way, they can elaborate scientific ideas making use of their reading. However, it is also the role of teachers to discuss and show students how to decipher visual codes, which can often be extremely complex to understand.

3 IMAGES IN TEXTBOOKS AND SCIENCE TEACHING

When reflecting on the images in the classroom, the textbook deserves to be highlighted. It is often seen as the resource most used by the teacher in his classes. About this, Silva (2018) understands that the textbook is the main mediating instrument of the teaching and learning processes used by students and teachers in schools, which refers to the need to conduct research that aims to understand how the contents are addressed in them and how these didactic sources contribute to the construction of knowledge by students.

In the teaching of Science/Biology, for example, some contents addressed They present several abstract concepts that can be difficult to understand. Thus, among the different visual representations, teachers use the images present in textbooks in order to contribute to the correct learning of scientific knowledge. About the images in textbooks, Tomio *et al.* (2013, p. 25) state that,

> In textbooks and other discursive genres worked in schools, in audiovisual materials elaborated or adopted by the teacher, in the materials produced or disseminated by students, images, in the form of drawings, photographs, diagrams, graphics, schemes and cartoons, are present and valued in the educational processes of the different curricular components and, among them, in the teaching of Sciences.

In this context, we understand that the textbook, as well as any other resource that the teacher can use in the classroom, has importance conditioned to the use that is made of it (SOARES, 2019), and that it can effectively contribute to the learning and construction of students' knowledge in the different school disciplines. However, the imagery texts that are conveyed in textbooks can create incorrect or mistaken interpretations in the minds of students about the phenomenon represented. For this reason, Souza and Rêgo (2018, p.11) highlight that if students "[...] they don't see their reality contextualized in these images, maybe they don't understand the need to appropriate this knowledge, because it may not make sense in their lives." Thus, it is essential to use resources with different types of images and visual and verbal elements to ensure more assertively the interpretation of the images presented in the textbook (SILVA, 2018).

The photographic image, for example, found in textbooks, reproduces all the external elements of the phenomenon presented, enabling concreteness to the representation of aspects related to science (SILVA, 2018; SOUZA; RÊGO, 2018). Thus, just as a text provokes meanings, that is, it stimulates interpretations in the mind of the reader, it also arouses curiosity and observation and helps in teaching through contextualization with certain content.

4 METHODOLOGICAL PATH

We used a qualitative approach and as a method of investigation, a bibliographic research was developed in journals of Science Teaching, in which we decided to investigate what research would be developed on the use of photographic images in the textbooks of Science (final years of Elementary) and Biology (High School). "The most important thing for those who opt for bibliographic research is to make sure that the sources to be researched are already recognized as being in the scientific domain." (OLIVEIRA, 2007, p.69).

Initially, we made a time frame seeking to identify the articles published in national scientific journals, Qualis A (some also of international circulation) in the years 2010 to 2020. The consultation was carried out directly in the *Sites* of the journals, in total 10, all focused on Science Education. However, of this number, only four are freely accessible, which therefore limited our consultation. The selected journals and Qualis Capes can be presented in Chart 1.

Table 1 - Selected scientific journals

Magazines	**Qualis Capes**
Brazilian Journal of Research in Science Education	A2
Journal of Science and Mathematics Teaching (REnCIMa)	A2
Science Education Research Essay	A1
Journal of Investigations in Science Teaching	A2

Source: Prepared by the authors

Based on this delimitation of the journals, we proceeded to the next stage of the research in which we performed a search of the articles with the keywords "Textbook" and then "Sciences/Biology". The volume of articles per journal is recorded in Table 2:

Table 2 – Volume of articles by journals

Periodic	**Qde.**
Brazilian Journal of Research in Science Education	7
Journal of Science and Mathematics Teaching	6
Science Education Research Essay	12
Journal of Investigations in Science Teaching	7
TOTAL	**32**

Source: Prepared by the authors

Of the productions found, all the abstracts that the journals made available were read, so that we could know which articles addressed the use of images. In order to meet the objective proposed in the study, we funneled our research in the articles that presented the use of the image in order to identify and analyze which of them addressed only the photographic image. The results can be seen in Table 3.

Table 3 – Number of articles on image and photographic image

Newspaper	**Image article**	**Photographic image**
Brazilian Journal of Research in Science Education	1	0
Journal of Science and Mathematics Teaching	0	0
Science Education Research Essay	1	0
Journal of Investigations in Science Teaching	0	0
TOTAL	**2**	**0**

Source: Prepared by the authors.

An analysis was carried out in order to verify the way the image is contemplated in the researches. To this end, we performed a complete reading of the only two articles, observing mainly the methodology used in the development of the research.

5 RESULTS AND DISCUSSION

In the journals researched in the time frame, 32 articles that used the textbook in Science/Biology Teaching were found and analyzed, of which only two contemplate the main theme, that is, the use of images. Nevertheless, in addition to the low quantity, none of them effectively stopped at the study of photographic images as a didactic resource. Next, we can observe in the table the list of articles that addressed the image in their studies

Table 4 – Articles that address the use of the image in Science/Biology textbooks

Magazines	Author(s)	Article title	Volume/Number/Year
Brazilian Journal of Research in Science Education	COUTINHO, F. A.; WILLIAMS, A. G.; BRAGA, S. A. M.; CHAVES, A. C. L.; COSTA, F. J.	Analysis of the didactic value of images present in Biology books for High School.	Vol. 10, no. 3, 2010
Science Education Research Essay	BADZINSKI, C.; HERMEL, E. E. S.	The representation of genetics and evolution through images used in biology textbooks.	Vol. 17, no. 2, 2015

Source: Prepared by the authors.

As we can see (table 4), from the abstracts made available by the journals, we made a presentation contemplating the description of the articles found, with the intention of discussing the presence of the photographic image in the selected works.

The article by Coutinho *et al.* (2010) aimed to analyze the didactic value of images present in four collections of Biology of the National Program of the Didactic Book of High School (PNLDEM) of the Ministry of Education, based on the model of working memory and the theory of cognitive load. The authors consider in this investigation to examine the different types of images that include maps, photographs, diagrams, tables, formulas, simulations, etc.

The images were classified according to four categories: "decorative", "representational", "organizational" and "explanatory". Then, for the analysis of the didactic value of the images, three principles were used derived from cognitive theory: coherence, signaling and contiguity. Subsequently, the images were categorized as "without didactic value", "with high cognitive load" and "with low cognitive load". According to the authors, the images present in textbooks besides being illustrative, perform other functions of cognitive value which contributes to learning more effectively.

Among the results found, we can mention: a great predominance of images without didactic value in high school biology books. These images, added to those with didactic value of high cognitive load, make up 69.1% of the images analyzed. For the researchers, the data presented worrying results, considering the function of the image in relation to the learning process. The authors also emphasize that the results of the research can guide teachers to the development of reading strategies of the textbook, distinguishing merely illustrative aspects of essential information present in the images.

The article by Badzinski and Hermel (2015), presented as a general objective to verify how the contents related to genetics and evolution, indicated in the National Curricular Parameters of High School (PCN+) of Biology, and to analyze the images about these contents present in textbooks of Biology of High School indicated by the National Program of the Didactic Book (PNLD) 2012, in order to identify how they are displayed and what can be the effectiveness of their use in the teaching process and learning in the classroom as they are presented in books.

The contents and images of geand evolution of six high school biology textbooks. The pages of the analyzed books dedicated to the previously established subjects were quantified. Subsequently, the proportional relationship between the total number of pages of the book and the total number of pages on subjects related to genetics and evolution was performed. The images analyzed were classified according to the categories presented by Perales and Jimenez (2002) and used by Heckel and Hermel (2013, 2014), which are: Degree of iconography, Diagram, Functionality, Relationship with the main text, Verbal Labels, and Scientific content. According to the authors, all the existing images in the chapters referring to genetics and evolution were analyzed, with the exception of the images related to problem solving and exercise.

The researchers concluded that the books evaluated did not present all the suggested contents and exposed different approaches to common content. Regarding the proportionality between the two contents evaluated in the textbooks, it was noticed that genetics is seen with greater importance even by the authors of the books. Most of the images were classified as photographs, with informative and scientifically correct functionality. With the accomplishment of this research, the authors hope point out aspects that demonstrate the attention and care that the teacher should have when using the textbook as a resource in the classroom. They also suggest the development of future works that could address the ways in which teachers and students read these images, which would enable better use of them.

We noticed that none of the articles analyzed by us focused only on the study of photographic images in Science/Biology textbooks, as we expected to find, since it is the focus of our interest. Although we can see that Coutinho *et al.* (2010) when developing his research on images in general, presented photography within the visual modality researched, corroborating what was said by Silva (2018), emphasizing the importance of the textbook in the educational field highlighting the need to conduct different research that analyze how the images are being conveyed and used in this resource in order to verify if the knowledge linked to them achieve their objectives.

The work developed by Badzinski and Hermel (2015), even not focusing on the study of photographs, showed in the results of their analysis that Most of the images classified as photography corresponded to 33.87% and the schematic drawing corresponded to 33.48%. Thus, as mentioned by Souza and Rêgo (2018), photographic images have a prominent role, offering concreteness to the presentation of science contents. However, Badzinski and Hermel (2015, p.451) point out that "[...] A book adorned only with photograph-like images can cease to be a book, to become a simple album with descriptive captions." We believe photographic images with good selection criteria and in specific contexts can contribute to the process of building students' knowledge and to the practice of teachers not only in the teaching of the curricular components of Science and Biology.

6 FINAL CONSIDERATIONS

In this research, we made efforts to analyze articles that address the image, especially the photographic image in the textbook of Science and Biology and that were published in national journals of Science Education. The research allowed us to verify the almost inexistence of this type of discussion, which makes us emphasize the need for studies with this theme. It was evident that there are productions on the textbook of Science and Biology, although, few involving contexts on imagery resources, especially on the use of the image, and none of them delved exclusively into the theme of the photographic image. Thus, we noticed that the image is, therefore, little researched in the scope of science teaching, because we only found two articles among four journals in a time frame of 10 years. We believe that there may be other articles in other journals not covered by this research that address the use of the photographic image in the textbook in Science Teaching, but the sample shows the low production.

For Badzinski and Hermel (2015), the textbook is one of the most used materials in the classroom, being fundamental in the teaching-learning process. Certainly, because they are full of images and make the contents more interesting, studies that analyze the existence of images in school books deserve relevance. The authors also point out that "[...] The use of images in Biology books has great relevance, especially in view of the widely abstract contents that this curricular component has, having importance in the construction of knowledge" (BADZINSKI; HERMEL, 2015, p.437).

The role of the teacher seems to us to be the key to the beginning of work with the image, because it is up to him to choose the textbooks and propose learning strategies for the students, these, in turn, must use their cognitive capacity to give meaning to the information visualized and to be able to establish relationships in different contexts.

Discussing the importance of the image, especially the photographic image present in textbooks, can contribute to the understanding and production of meanings that this communicational element has, so that they help teachers in teaching and in the processes of construction of visual culture, thus allowing the improvement of student learning. However, it is necessary to investigate not only the presence of the image in the didactic materials (printed and virtual), but also what meanings are being constructed from these imagery representations and how they provoke interpretations and resignifications.

We also emphasize that the accomplishment of works that analyze in various forms the images conveyed in the textbooks contributed significantly to improve the quality of teaching.

REFERENCES

BADZINSKI, Caroline; HERMEL, Erica, E. S. A representação da genética e da evolução através de imagens utilizadas em livros didáticos de biologia. Revista Ensaio Pesquisa em Educação em Ciências, Belo Horizonte, v.17, n.2, p.434-454, maio-ago., 2015.

CARLOS, Erenildo João. Sob o signo da imagem: outras aprendizagens e competências. *In:* CARLOS, Erenildo João. (Org.). Educação e visualidade: reflexões, estudos e experiências pedagógicas com a imagem. João Pessoa: UFPB, 2008. p.13-35.

COSTA, Costa. Educação, imagem e mídias. 2ª ed. São Paulo: Cortez, 2013.

COUTINHO, Francisco Â.; SOARES, Adriana, G.; BRAGA, Selma, A. M.; CHAVES, Andrea, C. L.; COSTA, Fernanda, J. Análise do valor didático de imagens presentes em livros de Biologia para o ensino médio. Revista Brasileira de Pesquisa em Educação em Ciências, São Paulo, v. 10, n. 3, 2010.

MACIEL, Aníbal de M.; RÊGO, Rogéria, G.; CARLOS, Erenildo, J. Possibilidades pedagógicas do uso da imagem fotográfica no livro didático de matemática. Bolema, Rio Claro, v.31, n.57, p.344-364, abr., 2017.

MACIEL, Maria do Rosário Gomes Germano. Imagem Virtual: uso na prática pedagógica. Revista Discurso & Imagem Visual em Educação, v.1, n.1, p.72-91, jan./jun., 2016.

OLIVEIRA, Maria, M. Como fazer pesquisa qualitativa. Petrópolis: Vozes, 2007.

SANTAELLA, Lucia. Leitura de imagens. São Paulo: Editora Melhoramentos, 2012. (Coleção Como eu ensino).

SARDELICH, Emília Maria; NASCIMENTO, Erivaldo do A.; PAIVA, Camylla R. M. Projeto de cultura visual na educação básica: outros modos de ver a cultura escolar. Palíndromo, v.7, n.14, p.147-162, ago./dez. 2015.

SILVA, Marcos, V. M. Imagens no livro didático: Contribuições para o ensino de biologia. *In:* VII ENCONTRO NACIONAL DAS LICENCIATURAS/ VI SEMINÁRIO DO PIBID/ I SEMINÁRIO DO RESIDÊNCIA PEDAGÓGICA. Anais... Fortaleza – CE, 2018.

SOARES, Luciano Gomes. Imagens virtuais e atividades matemáticas: um estudo sobre representação semiótica na página do facebook Matemática com Procópio. 2019. 175 f. Dissertação (Mestrado em Ensino de Ciências e Educação Matemática) – Universidade Estadual da Paraíba, Campina Grande, 2019.

SOUZA, Lucia, H. P.; REGO, Sheila, C. R. Imagens em livros didáticos de ciências e as orientações do programa nacional do livro didático. Ensaios Pedagógicos, Sorocaba, v.2, n.3, set-dez., p.5-15, 2018.

TOMIO, Daniela; GRIMES, Camila, RONCHI, Daiane, L.; PIAZZA, Fernanda; REINICKE, Karina; PECINI, Vanessa. As imagens no ensino de ciências: o que os estudantes dizem sobre elas? Caderno Pedagógico, Lajeado, v.10, n.1, p.25-44, 2013.