Science teaching in basic education: unveiling the nervous system through primers and mental maps

O ensino de ciências na educação básica: desvendando o sistema nervoso através de cartilhas e mapas mentais

Enseñanza de ciencias en educación básica: desvelando el sistema nervioso a través de primers y mapas mentales

Lucas Silva de Almeida[1], Tamie Thayane Damasio Kisaki[2], Gesline Fernandes de Almeida[3], Rebeka Mayara Almeida de Oliveira[4], Waldineia Almeida da Silva Bomfim[5], Juliana Nascimento Andrade[6], Marcos Lázaro da Silva Guerreiro[7], Rejane Nunes Lopes de Oliveira[8]

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REVISA

1. Renan Baleeiro State College. Salvador, Bahia, Brazil.
https://orcid.org/0000-0003-3535-0097

2 Polyvalent State College of Camacan. Salvador, Bahia, Brazil.
https://orcid.org/0009-0009-8301-0207

3 State University of Feira de Santana, Professor of the Department of Biological Sciences. Feira de Santana, Bahia, Brazil.
https://orcid.org/0009-0008-8916-9844

4 State University of Feira de Santana, Professor of the Department of Biological Sciences. Feira de Santana, Bahia, Brazil.
https://orcid.org/0009-0000-9830-523X

5 Bahia Department of Education, Maria Quitéria State College. Feira de Santana, Bahia, Brazil.
https://orcid.org/0009-0001-0424-2504

6 State University of Feira de Santana, Professor of the Department of Biological Sciences. Feira de Santana, Bahia, Brazil.
https://orcid.org/0000-0002-3158-2475

7 State University of Feira de Santana, Professor of the Department of Biological Sciences. Feira de Santana, Bahia, Brazil.
https://orcid.org/0000-0002-9413-4733

8 State University of Feira de Santana, Professor of the Department of Biological Sciences. Feira de Santana, Bahia, Brazil.
https://orcid.org/000-0001-7277-7538

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RESUMO

Objetivo: o estudo visou um relato de experiências entre os autores sobre a tutoria do módulo três durante o curso EAD no ano de 2022. **Método**: Este curso com atividades síncronas e assíncronas, para professores da educação básica e estudantes de graduação, foi realizado em outubro e novembro, do ano de 2022 e culminou na construção de uma cartilha com mapas mentais, temas e estratégias trabalhados durante o curso como materiais pedagógicos para o ensino fundamental II. **Resultados:** A cartilha intitulada: as consequências do consumo de álcool ao sistema nervoso, teve como parceria professores de duas escolas básicas. Esta apresenta informações anatomofisiológicas a respeito do funcionamento do sistema nervoso e o álcool. A temática explica como o funcionamento do sistema nervoso pode ser afetado pelo uso de bebidas alcoólicas; compreensão das alterações causadas ao funcionamento do sistema nervoso pela ingestão de álcool e instrumentalização dos professores com mais um recurso pedagógico. **Conclusão:** Dessa forma, foi possível a promoção da sensibilização dos estudantes quanto aos aspectos negativos do uso de bebidas alcoólicas. Assim como, prevenção nos jovens quanto ao seu uso indiscriminado, colaborando com a popularização da ciência.
Descritores: Ensino de Ciências; Sistema Nervoso; Cartilhas; Mapas mentais; Álcool.

ABSTRACT

Objective: the study aimed to report experiences between the authors regarding the tutoring of module three during the EAD course in the year 2022. **Method:** This course with synchronous and asynchronous activities, for basic education teachers and undergraduate students, was carried out in October and November, 2022 and culminated in the construction of a booklet with mental maps, themes and strategies worked on during the course as teaching materials for elementary school II**. Results:** The booklet entitled: the consequences of alcohol consumption on the nervous system, was partnered with teachers from two basic schools. This presents anatomophysiological information regarding the functioning of the nervous system and alcohol. The theme explains how the functioning of the nervous system can be affected by the use of alcoholic beverages; understanding the changes caused to the functioning of the nervous system by alcohol intake and providing teachers with yet another pedagogical resource. **Conclusion:** In this way, it was possible to promote student awareness regarding the negative aspects of the use of alcoholic beverages. As well as prevention among young people regarding its indiscriminate use, collaborating with the popularization of science.
Descriptors: Science Teaching; Nervous system; Booklets; Mental maps; Alcohol.

RESUMEN

Objetivo: el estudio tuvo como objetivo relatar experiencias entre los autores respecto a la tutoría del módulo tres durante el curso EAD en el año 2022. **Método:** Este curso con actividades sincrónicas y asincrónicas, para docentes de educación básica y estudiantes de pregrado, se realizó en los meses de octubre y noviembre de 2022 y culminó con la construcción de una cartilla con mapas mentales, temáticas y estrategias trabajadas durante el curso como material didáctico para la escuela primaria II. **Resultados:** El cuadernillo titulado: las consecuencias del consumo de alcohol en el sistema nervioso, fue elaborado en colaboración con docentes de dos escuelas básicas. Presenta información anatomofisiológica sobre el funcionamiento del sistema nervioso y el alcohol. El tema explica cómo el funcionamiento del sistema nervioso puede verse afectado por el uso de bebidas alcohólicas; comprender los cambios que provoca en el funcionamiento del sistema nervioso la ingesta de alcohol y dotar a los docentes de un recurso pedagógico más. **Conclusión:** De esta manera, fue posible sensibilizar a los estudiantes sobre los aspectos negativos del consumo de alcohol. Así como la prevención entre los jóvenes sobre su uso indiscriminado, contribuyendo a la popularización de la ciencia.
Descriptores: Enseñanza de las Ciencias; Sistema nervioso; Folletos; Mapas mentales; Alcohol.

EXPERIENCE REPORT

Introduction

The use of didactic resources and learning strategies are actions that facilitate the process of knowledge acquisition and, therefore, can be used in formal and informal teaching spaces. Thus, in current times, the teacher should not be restricted to merely transmitting knowledge, but also promote learning spaces with the use of innovative strategies that can contribute to a better understanding of the contents covered in the classroom and encourage this use by students.[1]

For this, it is necessary to think about the training of teachers, with a view to training an individual for strategic planning, who properly uses the necessary tools in the classroom and who plans his actions with the objective of providing students with strategic models for their learning processes.[2]

The current perspective in education is that the teacher is attentive to the use of new resources, new values and new conceptions confronted with what already exists and that prove their effectiveness in the situation of action.3 Seeking and building answers in the midst of new challenges in the educational field are goals to be built and discussed together with teaching and learning experiences in favor of integrative actions.[4]

Continuing education is now a strategy used by teachers as they become learners and, in this way, are able to improve and form new concepts and new ideas to deal with content and approaches in a more contextual and integrative way. It is true that the results are not short-term, but foster skills and competencies in a long, complex and continuous process.[5]

From this perspective, one of the contents that can be approached using innovative learning strategies in Basic Education, precisely in Elementary School, is the Human Body and the Nervous System. Of all the systems that make up the human body, the nervous system has a central function and responsibility among all, as it is formed by a set of tissues distributed throughout the body, forming a communication network throughout the body with several anatomical divisions.[6,7,8] It has two fundamental parts: the central nervous system (CNS), which perceives command stimuli and triggers responses, and the peripheral nervous system (PNS), which is composed of pathways that conduct stimuli to the CNS and its organs.[8]

In addition to the anatomical-physiological presentation, in general, it is necessary to unite theory with practice using everyday examples. Thus, it is important for the teacher to emphasize the relationship between the use of substances that can alter the proper functioning of the nervous system, such as alcohol. And in this way, make students understand that alcohol has a multifocal action, as it is a psychotropic substance that depressants the central nervous system (CNS), which can lead to simultaneous alteration of several neuronal pathways, impacting the neurological system and causing biological and behavioral changes in the individual. In this way, it results in difficulties in the storage of information and logical reasoning, difficulty in motor coordination, in addition to the stimulation of the reward system, which leads to understanding the development of chemical dependence.[9]

In view of the damage to health and in compliance with Law No. 13,106, of March 17, 2015, which prohibits the sale, supply and offer of alcoholic beverages, even free of charge, to minors under 18 years of age[10], it is important

to highlight the role of the school in the prevention and awareness of young people, since it is a concrete space for the construction of dialogues. among students and teachers, the high rates of use and abuse of alcohol and other drugs and their consequences. As a result, the school environment provides a space for critical and healthy reflection in the search for new transformations.[11]

Taking into account the role of the school in the constitution of thinking and learning about the nervous system, it is essential to have a teaching based on tools that can involve students in a meaningful and appropriate way to the development of critical thinking on this theme. In this way, the teaching of science using didactic resources helps in learning in an easy, playful and interactive way, influencing the integration and interaction between content and knowledge acquisition.[12,13]

The Bahia Curriculum Document[14] brings objectives of knowledge and skills to be achieved by students and the importance of using transversal themes so that students can relate the contents to everyday life. In the meantime, didactic resources used in science teaching should be used together with cross-cutting themes, such as anatomical physiology of the nervous system and the impacts of alcohol use.

Among the didactic resources, the booklets can be neglected as a pedagogical support material for teaching about the nervous system and the impact on alcohol use and, for this, it is necessary that they have a simple language in order to favor the assimilation of important contents. These didactic resources are considered an instrument for popularizing science, as they facilitate learning, providing support for understanding for students and/or various professionals.[13]

Mind maps, on the other hand, are more flexible and non-linear forms of learning, with a logical sequence based on a radial structure that boosts memory, the reestablishment of information, and the creativity of both the creator and the reader. In addition, it is a tool that helps in the organization and identification of connections through words, images, colors, codes and dimensions present, according to Buzan[15], the creator of the mind map.

The objective of this study was to report the experiences of the participants of the EaD Course of the State University of Feira de Santana, Module[3], regarding the use of booklets and mind maps as pedagogical tools for teaching the effects of alcohol on the nervous system in the field of Basic Education.

Methodology

This work refers to an experience report, of descriptive and qualitative character, of the tutorial group of Module 3 (Anatomy and physiology of the nervous system applied to education) of the Distance Learning Course linked to the Center for Research and Extension in Science and Biology Teaching (NUPEECbio) of the Department of Biological Sciences of the State University of Feira de Santana (UEFS), in the 2022 period. The actions were developed in partnership with the Department of Education of the State of Bahia (SEC), teachers of Basic Education of the State and students of UEFS.

The tutorial group of Module 3 was composed of a total of eight members, and was formed by the following configuration: four teacher trainers-tutors from the Department of Biological Sciences/UEFS, Feira de Santana, Bahia; a teacher

from the Campo Maria Quitéria State School; a professor at Renan Baleeiro State College, Salvador, BA; Polyvalent State College of Camacan. Camacan, BA.

To carry out the activities inherent to the Distance Learning Course, and to maintain the organization and planning, the large tutorial group of the course was divided into sub-teams, with the one in Module 3 being responsible for sharing content through teaching and tutoring on: 1) Functioning of the nervous system; 2) Implications of the use of alcoholic beverages to the nervous system; 3) Equipping teachers with pedagogical resources to assist in the discussion and approach of the theme; 4) Promotion of students' sensitivity to the negative aspects related to the use of alcoholic beverages.

Virtual tools (Chart 01) were used to carry out the activities of module 3, including: (1) Google Classroom Platform, for the management of the proposed activities and repository of asynchronous activities; (2) Google Drive platform, as a virtual library; (3) Google Meet platform, for synchronous virtual meetings and (4) Instant messaging application "Whatsapp", for quick communication, when necessary. In the present work, the tutoring after the synchronous moments of teacher training was carried out for three consecutive weeks, involving asynchronous activities and monitoring of the elaboration of the final product.

The thematic stages and contents that were part of the activities developed in module 3 and during the tutoring are arranged in Chart 1, they talk to the theme Anatomophysiology of the nervous system applied to education. This theme was chosen due to the necessary approach as a form of health promotion and to fit into the general theme "Sciences: Education, Technology and Society" of the EaD Course: Science Teaching for Health Promotion in Basic School, in 2022.

Chart 1 - Stages, themes and contents related to the activities developed in module 3 and tutoring. 2023.

ETAPAS	TEMÁTICA	CONTEÚDOS
Etapa 1	Módulo 3: Anatomofisiologia do sistema nervoso aplicado à educação.	Anatomofisiologia do sistema nervoso aplicado a educação; Emoções, corpo, saúde e alterações psicopatológicas; Saúde mental em diversas idades.
Etapa 2	Tutoria	Estabelecimento de diálogos para escolha do tema, público-alvo, objetivos e metodologia para a cartilha.
Etapa 3	Construção da Cartilha	Pesquisa de artigos sobre a temática e construção e seleção de mapas mentais sobre os conteúdos para elaboração da cartilha.
Etapa 4	Apresentação da Cartilha	Produção de slides para apresentação da cartilha à todos os participantes do Curso EaD, incluindo os integrantes dos demais módulos (ao todo foram cinco módulos).

In this context, we reflect Science as a guide in the construction of critical thinking in education, technology and society. The NUPEECBio team, responsible for the Course, was composed of 16 professionals from different areas who teach classes at the State University of Feira de Santana (UEFS) and have been committed to maintaining the interaction between the University and Basic Education. This idea emerged during the pandemic and was consolidated as a strategy for discussion and training of basic education teachers. The EaD Course was structured in 4 modules, with synchronous (Google Meet Platform) and asynchronous (Google Classroom - Google Classroom) activities, totaling 80 hours of workload.

The synchronous activities had a workload of 20 hours and were developed in 10 meetings, from August 16 to October 18, 2022, from 7:30 pm to 9 pm. The asynchronous activities accounted for 20 hours with extracurricular activities (readings of scientific articles, directed studies, videos, etc.). All synchronous meetings were recorded and made available, along with asynchronous activities, in Google Classroom. The remaining 40 hours were related to the production of didactic-pedagogical materials by the participants, with guidance from NUPEECBio teachers, focused on Basic Education.

The final product of the Course, culminating in the booklet "THE CONSEQUENCES OF ALCOHOL CONSUMPTION ON THE NERVOUS SYSTEM" was prepared by the authors who are participating professors (from UEFS and Basic Education of the State of Bahia) and monitors (undergraduate students from UEFS). The proposals aimed to improve the teaching practice based on their participation in the course and to promote critical thinking on cross-cutting issues that society, as a whole, needs to discuss. This proposal is therefore in common agreement with other authors.[10, 14]

The authors of the Booklet were guided by the professors who make up the course team according to the training and line of action of each member. The mentoring began with the presentation of all the themes worked, which were: The role of man in the environment; Health and Education: from micro to macro; Anatomy and physiology of the nervous system applied to education; Emotions, body and health. As well as, psychopathological alterations; Mental health at different ages and, finally, tools and technologies applied to Science Teaching. The tools served as a support for the production of the booklet.

The experience report involving the activities developed in module 3 and tutoring was written based on the team's reports. To this end, some questions were made available to the authors so that their comments could be part of the scope of the report, which are:1- What are your previous experiences about Distance Learning Courses (3 lines)? 2- What is your previous experience in relation to the stages, themes and content within the activities developed in module 3 and tutoring (3 lines)? 3- Write four lines about your experience in the construction of the booklet based on the learning in the Distance Learning Course: Science Teaching for Health Promotion in Basic School" year 2022 which had as its theme: "Sciences: Education, Technology and Society". Their comments were used to motivate and organize the results and write the manuscript.

The booklet was built in Power point by the authors and then the slides were transferred to the CANVA application (https://www.canva.com) to be transformed into images and printable templates (https://www.canva.com/design/DAFvRjbEMLE/hTuDF4FC3OEcTtD0vDA mbQ/edit). The partnership with teachers from basic schools such as: Renan Baleeiro State College, Camacan Polyvalent State School and Campo Maria Quitéria State School was important for targeting the target audience, which is elementary school II.

As the study was developed to be applied in Elementary School II classes, the construction of the booklet was based on the learning of contents during the EaD Course and articles and materials available on the internet and followed the following criteria: Identification of the proposed theme; Definition of the most important keywords related to the objectives of the proposed work; Establishment of inclusion criteria (having the keywords, and being in agreement with the proposed objective); Definition of the databases in which the theoretical materials were searched; Evaluation of the materials found; Interpretation of results. Exclusion mechanisms: outside the search criteria. Topics outside the study. Outside the identification of the proposed theme.

The choice of keywords was made in Portuguese and English according to the objectives, which were: nervous system and alcohol, anatomophysiology of the nervous system, alcohol and central nervous system, effects and impairments of alcohol, knowing the brain, neurons and transmission of information, neurotransmitters and alcohol, among others. To collect articles, booklets and materials available on the internet, Boolean operators ("AND") were used, which restrict the search, retrieving all existing documents in the database that show the terms used. Boolean operators are logical search operators, generally common to all databases and search engines.

Results and Discussion

The experience report involving the activities developed in module 3 and tutoring was written based on the team's reports, culminating in the experience in the construction of the booklet from the learning in the Distance Learning Course: Science Teaching for Health Promotion in Basic School" year 2022 which had as its theme: "Sciences: Education, Technology and Society". This theme follows the needs of discussion of these themes among the different members of society, having the plurality that the theme proposes.[10,14]

In stage 1, themes and concepts related to the anatomy and physiology of the nervous system and how we can apply dynamics of awareness of good mental health practices at school were worked on [8]. To this end, we discuss the importance of the nervous system, how this theme can be worked transversally in several areas in a simple, playful and objective way. Other authors also discuss the need to discuss various themes in the area of science in this way.[4,5,13]

Three meetings were made available for this stage on 09/20 (Theme: anatomophysiology for education), 09/27 (Theme: Emotions, body, health and psychopathological changes;) and 10/14/2022 (Theme: Mental health at various ages). In this last meeting we had a psychologist assisting in the discussion. The meetings lasted 1 hour and thirty minutes (7:00 p.m. to 12:30 p.m.). The three meetings were held to bring scientific information to basic education teachers.

These themes were important because we believe that we are in a necessary moment of dynamic and transversal interactions.

The use of themes in a transversal way and the integration of the school universe, family, transdisciplinary team and individual strategies are excellent ways of cultivating critical cultures of reality.[16]

The teaching of the scientific area in the school contributes to the understanding of the world and its transformations, recognizing man as part of the universe and as an individual. In addition to providing all citizens with the knowledge and opportunities to develop the necessary skills to orient themselves in a complex society, understanding what is going on around them and taking a stand and intervening in their reality. [13,14]

Planning, organization, time management, memory and control of emotions are related to the prefrontal area of the brain and neurophysiology. The amygdalas are two spherical structures in the neuroanatomy of the limbic system, they are responsible for emotional responses related to the social behavior of humans and other mammals. These are also the main areas of aggression control.[17]

The booklet included content to explain how the functioning of the nervous system can be affected by the use of alcoholic beverages; understanding the changes caused to the functioning of the nervous system by alcohol intake; equipping teachers with one more pedagogical resource (booklet to help them discuss and approach the theme); promotion and sensitization of students regarding the negative aspects of alcohol use and prevention of young people regarding the use of alcoholic beverages (Figure 1).

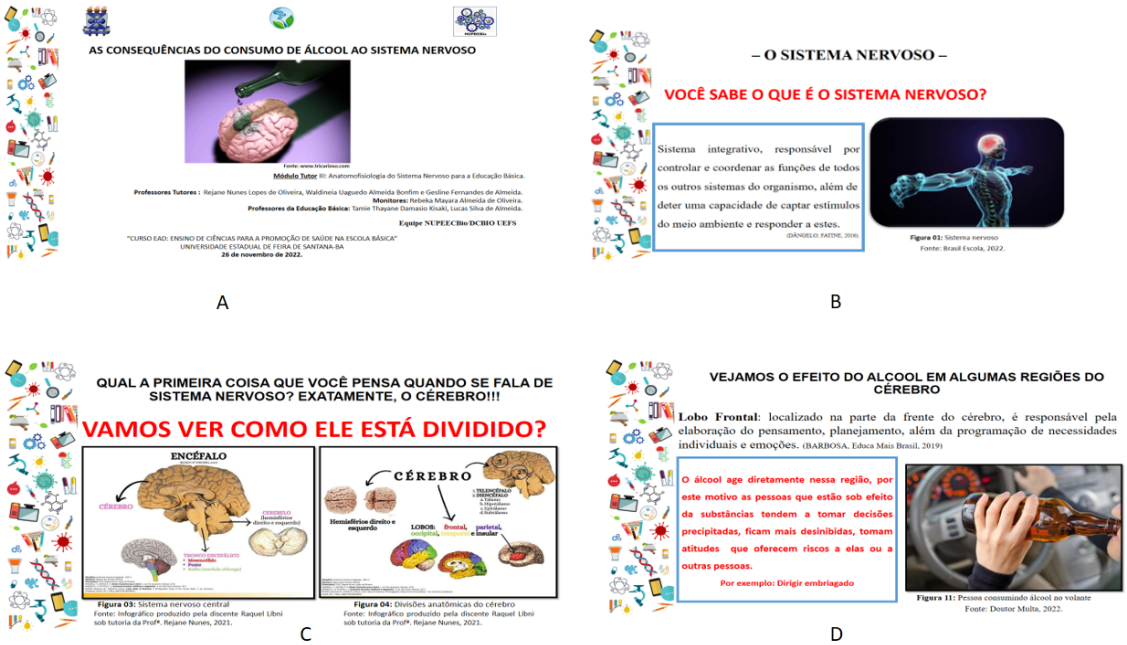

Figure 1- Images of the booklet constructed A: Cover with information about the authors; B: page with information about the nervous system; C: Division of the brain; D: Effect of alcohol on some regions of the brain. CANVA Link: https://www.canva.com/design/DAFvRjbEMLE/hTuDF4FC3OEcTtD0vDAmbQ/edit .

The control of emotions has been the subject of discussions in the scientific community and the stress of modern life promotes stress and physiological responses such as visceral and somatic that reverberate in interpersonal relationships and in the meaning of life. There are several successful experiences that can be stimulated with healthy habits for good mental health, such as: physical activity, healthy eating, support networks, long-term memory stimulation and conversation circles.

The remote teaching model was further strengthened during the pandemic, on an emergency basis, to try to minimize the damage to the students' learning process. The classes were important because they consisted of providing spaces for discussion by bringing together various actors, including teachers, trainers, tutors and students who were in different locations. Although challenging, the EaD 2022 Course brought advances to education, including the self-training of the participating teachers, immersion in the technological educational world and the need to perceive the student in their socio-educational context, continuing the educational process in an innovative and interactive way.

The experiences were in courses aimed at professional improvement in the health area with the use of free software, to support learning, executed in a virtual environment, containing support materials and space for interaction between teachers, tutors and students.

The experience in the distance education course provided the opportunity to get closer to the experiences of basic education teachers and the possibility of sharing scientific knowledge focused on the contents of module 3. In addition, the mentoring was important to assist in the reception of the ideas shared in the group and in the alignment for the execution of the intervention proposal, which takes place, albeit online, with the use of TIDCS (Digital Information and Communication Technologies).

The nervous system shown in figure 1 is an integrative system, responsible for controlling and coordinating the functions of all other systems of the organism, in addition to having the ability to capture stimuli from the environment and respond to them.[8] The understanding of the organization of the nervous system and the functionalities of its structures are fundamental to the understanding of the human body and its behaviors. The way information is transmitted from the brain to the body and vice versa is due to neurons, through the transmission of nerve impulses.[18]

Alcohol abuse can result from depression. Depression is a multifactorial pathology, involving neurotransmitters, with several symptoms promoted by physiological, genetic, environmental and pathological factors and need to be diagnosed and treated efficiently. Research is being developed on this topic to aid in the diagnosis and bring to the general public, in general, greater information about depression and its risks, such as cardiac, immunological and, especially, suicide.[19]

Feelings related to emotions drive us to live and these factors listed above and the knowledge of the neural bases, shape and areas of the brain have always been the guidelines for science to be able to solve these problems. Anger, fear, and aggressive behaviors are related to functions in the amygdala as a result of connections to the hypothalamus and other structures. Reward centers and punishment centers mediate feelings of pleasure and emotions in the brain.[17]

The booklet is interesting because it caters to an audience that is starting its adult life and critical thinking even before drinking alcohol will provide better decisions. In this sense, interdisciplinary interaction between professionals from the various areas of education and health are elementary to aggregate the prevention of alcoholism. In addition, it is interesting to highlight that alcohol intoxication results in several neurological alterations with direct pharmacological effects and it is up to the General Practitioner to recognize and approach the initial treatment, achieving success in the treatment.[20]

Final Considerations

In the present work, the experience of teacher training, through a course and a virtual tutorial, was successful, as it was able to enable the improvement of teaching practice for the use of educational booklets and mind maps.

In view of the above, it is important to observe the importance of developing strategies for the training of teachers in basic education, on a continuous basis, so that these professionals can have the opportunity to learn about the various didactic resources and educational tools that can expand learning and promote the awareness of different actors in the educational context. Thus, the production of booklets and mind maps are important sources of knowledge and application of the knowledge developed during their school education.

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Correspondent Author
Juliana Nascimento Andrade
Universidade Estadual Feira de Santana.
Transnordestina Avenue, s/n. Novo Horizonte.
ZIP: 44036-900. Feira de Santana, Bahia, Brazil.
juliandradeluz@gmail.com