

# Initial training of biology teachers: analysis of the approach to the theme of environmental degradation and emerging epidemics

## ABSTRACT

In recent years, the debate surrounding environmental degradation and the emergence of epidemics has gained prominence, prompting a reflection on how human actions influence natural cycles and can trigger diseases. The initial training of Biological Sciences teachers proves to be crucial in this context, aiming to address such issues in the classroom. This study investigated how this training is conducted at the University of Brasília, analyzing the presence of the theme in curricular documents and teachers' pedagogical practices. Using a qualitative approach, the National Common Curricular Base (BNCC, in Portuguese), the Moving Curriculum of the Federal District, relevant course outlines, and interviews with teachers were examined. Additionally, a questionnaire was administered to undergraduate students in Biological Sciences, seeking to understand how the theme is approached in their education. Data were analyzed according to the nature of the questions: closed questions were analyzed by descriptive statistics, while open questions were subjected to content analysis. The results indicate a general awareness of the importance of the interconnection between environmental degradation and epidemics, but reveal an insufficient initial training to deal with such issues in a thorough and connected manner. Educational documents do not directly address the theme, which may result in a mistaken perception of its relevance. Therefore, it becomes necessary to overcome technicist approaches, empowering future teachers as agents of social transformation and promoting a critical and interdisciplinary discussion that integrates different areas of knowledge.

**KEYWORDS:** environmental context; initial teacher training; environment; curricular contents.

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# A formação inicial de professores de ciências biológicas: análise da abordagem do tema degradação ambiental e novas epidemias

## RESUMO

Nos últimos anos, o debate em torno da degradação ambiental e do surgimento de epidemias tem ganhado destaque, promovendo uma reflexão sobre como as ações humanas influenciam os ciclos naturais e podem desencadear doenças. A formação inicial de professores de Ciências Biológicas se revela crucial nesse contexto, visando abordar tais questões em sala de aula. Este estudo investigou como essa formação é conduzida na Universidade de Brasília, analisando a presença do tema nos documentos curriculares e nas práticas pedagógicas dos professores. Utilizando uma abordagem qualitativa, foram examinadas a Base Nacional Comum Curricular (BNCC), o Currículo em Movimento do Distrito Federal, ementas de disciplinas pertinentes e entrevistas com docentes. Além disso, um questionário foi aplicado aos estudantes de licenciatura em Ciências Biológicas, buscando compreender como o tema é abordado em sua formação. Os dados foram analisados conforme a natureza das perguntas: as questões fechadas foram analisadas por estatística descritiva, enquanto as questões abertas foram submetidas à análise de conteúdo. Os resultados indicam uma consciência geral sobre a importância da interconexão entre degradação ambiental e epidemias, porém revelam uma formação inicial insuficiente para lidar de maneira aprofundada e conectada com tais questões. Os documentos educacionais não abordam diretamente o tema, o que pode resultar em uma percepção equivocada de sua relevância. Diante disso, torna-se necessário superar abordagens tecnicistas, capacitando os futuros professores como agentes de transformação social e promovendo uma discussão crítica e interdisciplinar que integre diferentes áreas do conhecimento.

**PALAVRAS-CHAVE:** contexto ambiental; formação inicial do professor; meio ambiente; conteúdos curriculares.

## INTRODUCTION

Environmental degradation is a growing threat to human health worldwide. According to Rabello and Oliveira (2020), diseases occur naturally on the planet and thrive in their balanced cycles within wildlife. The issue arises when these natural cycles are disrupted due to human interference, which can lead to the emergence of pathogens capable of infecting humans who lack adaptation or immunity to these diseases. As ecosystems are destroyed or altered, exposure to pathogens and their transmission vectors increases, which can lead to the emergence of new epidemics (Baker et al., 2022). The initial formation of Biology undergraduates is crucial in addressing this issue, as they will be responsible for developing knowledge and practices regarding the relationship between the environment and human health in the education of basic education students. An analysis of academic production in biology teaching, as investigated by Slongo (2004), demonstrates how the different demands in the training of biology teachers guide curriculum and pedagogical updates.

In this sense, future Biology teachers must be well-informed about the causes and consequences of environmental degradation, as well as strategies to minimize its effects on human health. Moreover, they need to know how to integrate this knowledge into their educational practice to raise awareness among students about the importance of environmental preservation in preventing epidemics. Thus, it is fundamental that the initial formation of Biology undergraduates encompasses a transdisciplinary approach, proposing a dialogue with different areas of Biology, such as ecology, microbiology, and public health, to transform students' perceptions and behavior. According to Macedo (1999), cross-cutting themes are attempts to associate different disciplines, explicitly described in the curriculum, aiming to address social reality in a complementary manner. Lanes et al. (2014) draw attention to the flexibility and contextualization of these themes, which are part of students' daily lives.

The analysis of new trends in science education, as discussed by Gil-Pérez (1996), offers important insights for the training of Biology teachers, responding to emerging demands, and promoting updated and effective pedagogical practices. Thus, the initial training environment is relevant for preparing future teachers who will work in basic education, as it allows them to acquire specific knowledge and experience different forms of learning, developing the skills and competencies necessary for their educational practice (Barcelos & Villani, 2006). Due to the interaction between undergraduates and the university, it is relevant to analyze the approach to this topic and how it is done to assess whether the initial training of teachers in the field of Biology is meeting the needs of society regarding the issues of these themes.

The initial training of the teacher is essential to prepare them to deal with complex issues in the environmental context, especially related to the environment. This involves transmitting knowledge about relevant curriculum content and developing skills and competencies to address such topics in an interdisciplinary and contextualized manner. Curriculum content should include a deep understanding of contemporary environmental challenges, empowering future teachers to promote quality education. Integrating the environmental context into teachers' initial training programs is crucial to ensure that educators

are prepared to address environmental issues meaningfully and impactfully in their pedagogical practices.

By understanding how teacher training addresses these critical issues, the study contributes to the broader landscape of science education research in Brazil, understanding how this area has been developing and responding to contemporary challenges (Megid-Neto, 2007). In this context, this work seeks to understand how the initial training of Biology undergraduates addresses the theme of environmental degradation and new epidemics and whether these undergraduates have acquired this knowledge during their training through the disciplines offered by the university. Therefore, this research aims to qualitatively analyze the approach to the theme of environmental degradation and new epidemics in the initial training of teachers in the undergraduate course of Biological Sciences at the University of Brasília (UnB).

## **METHODOLOGY**

The present research is characterized as qualitative, aiming to explore and describe the studied phenomenon. According to Minayo (2009), qualitative research is an approach that seeks to understand and interpret the social, cultural, and subjective reality of a group or individual. This approach seeks to comprehend how people interpret and give meaning to their reality, and how this interpretation affects their behavior and social relations.

To identify elements regarding the initial training of teachers on environmental degradation and new epidemics, we initially used document analysis. Thus, the objects of this analysis were the curricular documents, namely the National Common Curricular Base (BNCC, in Portuguese) and the Curriculum in Movement (CM) of the Federal District. In the BNCC, we analyzed which described skills fit into the emergence of new epidemics. In the CM of the Federal District, we analyzed which learning objectives fit into the theme. During the exploration of both documents, different keywords were used to guide the search for documents, including "environmental degradation," "environmental impact," "environmental," "epidemic," "pandemic," "health," "environment," "virus," "pathogens," and "microorganisms." After that, it was defined in which occurrences of these words the relationship was direct, indirect, or unrelated to the theme of environmental degradation and new epidemics, to delimit and compare with what is proposed in the training of future teachers at UnB.

We also analyzed the syllabi of the following disciplines in the undergraduate curriculum of the Biological Sciences course at UnB: cytology, population and community ecology, physical environment and ecosystems, microbiology, and molecular biology. These disciplines were chosen for analysis because they are mandatory in the undergraduate curriculum and involve important aspects related to the theme in question, such as the biology of pathogenic agents, ecological interactions between species, and environmental preservation. The delimitation of disciplines for the syllabus document analysis was performed to align with the microbiological, molecular, and ecological aspects of the emergence of new pandemics and environmental degradation.

The participant group of this research consisted of undergraduate students in Biological Sciences at UnB who were enrolled from the fifth semester onwards, as from this semester, the mandatory subjects related to the theme were taken by the majority of undergraduates within the standard flow of the curriculum. Participation in the study was optional, meaning that participants had the freedom to refuse the invitation to collaborate or withdraw from the research at any time during the questionnaire completion. For participation in the study, all participants agreed to an Informed Consent Form at the beginning of the questionnaire.

For data collection from students, we used a semi-structured questionnaire, through the Google Forms platform, composed of three types of questions related to the objectives of this research: i) multiple-choice sociodemographic questions, aiming to collect data on the profile of study participants; ii) questions related to the approach in the initial training of teachers on the emergence of new epidemics, aiming to identify if the theme of environmental degradation and new epidemics is addressed during their training, as well as the possible approach to these topics in the classroom; iii) questions consisting of true and false statements about the emergence of new epidemics, aiming to identify possible conceptual errors on the topic.

The semi-structured interview was conducted with two lecturers from the Biological Sciences course at the University of Brasília, one of them teaching the physical environment and ecosystems discipline and the other teaching microbiology. Hence, the interview was recorded, transcribed, and analyzed to understand how the theme of environmental degradation and new epidemics is addressed in the initial training of Biological Sciences undergraduates. To ensure the quality of the instruments used in this research, both the questionnaire and the interviews underwent a validation process conducted by three experienced researchers in the field. This involved a careful analysis of the questionnaire questions and interview script to ensure their suitability for the research objectives and their ability to capture relevant information. After this initial analysis, the instruments were revised and improved based on the feedback from the researchers, ensuring their validity and reliability.

Data analysis was conducted considering the nature of the questions. In the case of multiple-choice questions, the responses were analyzed using descriptive statistics. Responses of the same nature were organized and quantified based on the frequency of each selectable option chosen, presented through the total number of responses and the proportion in percentage. Discursive responses were analyzed using Bardin's content analysis (2011), which is an approach aimed at analyzing the content present in the target material. In this case, we used this analysis on the discursive responses from the questionnaires and interviews. In the first phase, we conducted a pre-analysis, which consisted of performing a floating and attentive reading of the material, seeking to identify central ideas, categories, and relevant themes. In the second phase, we conducted an exploration of the material, which consisted of making notes, markings, and clippings of the material and highlighting the elements that are related to the categories and themes identified in the previous phase. Finally, in the third phase, we conducted the treatment of the results, where the collected

information is analyzed, and inferences are made about the content, based on the relationship between the elements present in the data.

For the questionnaires, two categories were created: the first, *environmental degradation and new epidemics in initial training*, gather the responses that relate to the theme of environmental degradation and new epidemics and how it was addressed during the initial training of the participants, including questions about their understanding of the theme and the importance attributed to it as future biology teachers. This category aimed to capture participants' perceptions, experiences, and reflections on the inclusion of this theme in their professional training. The second category, *undergraduate students' knowledge of the theme*, aggregates the understanding and familiarity of the participants with the concepts related to environmental degradation and new epidemics. For the interviews, we created the category, *practice of university professors in the classroom*, which gathers the testimonies of professors about how the theme is discussed, taught, and incorporated into the curriculum of the course, as well as the professors' perception of the importance and relevance of this theme in the training of future teachers.

## RESULTS AND DISCUSSION

### Guiding documents for education in Brazil and the Federal District

The BNCC and the CM are the guiding documents for education in Brazil and the Federal District. Therefore, it is important to explore these to understand how the theme of environmental degradation and new epidemics is addressed. By searching for keywords in these two documents, occurrences were found as described in Table 1. Subsequently, an analysis was carried out regarding the context in which the theme of environmental degradation and new epidemics appeared in the documents and they were categorized as having a direct relationship, an indirect relationship, or no relationship.

**Table 1**

*Occurrences of the theme of environmental degradation and new epidemics in the BNCC and CM*

Keywords	Occurrences		Direct Relationship		Indirect Relationship		No Relationship	
	BNCC	CM	BNCC	CM	BNCC	CM	BNCC	CM
environmental degradation	1	0	0	0	0	0	1	0
virus	1	1	0	0	1	0	1	1
microorganism	3	0	0	0	1	0	1	0
environment	5	36	0	0	1	12	4	24
pathogen	0	1	0	0	0	0	0	1

	Occurrences		Direct Relationship		Indirect Relationship		No Relationship	
environmental	43	49	0	0	13	12	30	37
health	60	27	0	0	11	5	49	22

Source: Authors' work (2024).

When we look at the BNCC, it is notable how the theme of environmental degradation and new epidemics is not directly addressed. However, we can observe several parts where the theme is implicitly and indirectly treated as a sub-theme, such as in the excerpt concerning the general competencies of basic education:

To argue based on facts, data, and reliable information, to formulate, negotiate, and defend common ideas, points of view, and decisions that respect and promote human rights, socio-environmental awareness, and responsible consumption at the local, regional, and global levels, with an ethical stance regarding self-care, others, and the planet (Brazil, 2019, p. 9, authors' translation).

Additionally, one of the skills (EM13CNT203) in the Natural Sciences area also presents an indirect relationship with the theme:

To evaluate and predict the effects of interventions on ecosystems, and their impacts on living beings and the human body, based on the mechanisms of life maintenance, matter cycles, and energy transformations and transfers, using representations and simulations about such factors, with or without the use of digital devices and applications (such as simulation software and virtual reality, among others) (Brazil, 2019, p. 555, authors' translation).

Furthermore, the BNCC (Brazil, 2019) presents Transversal Contemporary Themes (TCT), with a focus on environmental education and health. Thus, the TCT aims to promote the integral education of students, going beyond the specific content of each discipline. The objective is to stimulate reflection on the importance of preventing new epidemics for human health, with environmental degradation being the main factor for the emergence of these epidemics. Thus, environmental education not only aims to preserve nature but also to care for public health comprehensively.

When specifically addressing the Federal District, the CM also purposefully addresses environmental degradation and new epidemics in a transversal manner. Through the transversal axes in the section that brings constitutional guarantees of rights such as "*health*, housing, food, transportation, environment, security, as well as protection against gender, race, creed, sexual orientation, cultural violence, among others" (Federal District, 2021, p. 23, authors' emphasis).

Thus, both the BNCC (Brazil, 2019) and the CM incorporate transversal themes, but at no point is the theme of environmental degradation and new epidemics explicitly presented. Therefore, it may give future teachers the impression that this theme is of lesser importance, which could imply that this theme continues to be addressed in basic education only in a parallel and occasional manner (Bomfim et al., 2013). Thus, there is a need for this theme to

be addressed more prominently in these documents to demonstrate its importance and the need for it to be systematically discussed and addressed during classes on the contents presented in the curriculum documents.

### **Environmental degradation and new epidemics in initial training**

After the data collection via questionnaire was completed, 15 responses were obtained. The majority of the students who responded identified as female (n=10, 66.7%), while 5 identified as male (33.3%). The questionnaire was answered by at least one person from each semester above the 5th, except for the 6th semester, which had no responses. Most participants indicated they were in the 9th semester or above (53.3%). In contrast, 2 participants marked themselves as being in the 5th semester (13.3%), 2 participants in the 7th semester (13.3%), and 2 participants in the 8th semester (13.3%), with only 1 person indicating they were in the 9th semester (6.7%). All questionnaire participants had already taken at least one of the mandatory subjects related to the theme. Thus, all participants (n=15) responded that they had taken the subjects of Cytology and Physical Environment and Ecosystems, 13 (86.7%) Microbiology and Molecular Biology, and 12 (80%) Population and Community Ecology.

This result demonstrates how the majority of participants have completed a large part of the subjects in the cellular biology and ecology axes of the mandatory course curriculum. Therefore, they have a more advanced education in the curriculum and have had more contact with what is offered mandatorily regarding cellular biology and ecology during the initial training of biology teachers at the University of Brasília.

Following the demographic questions, the questionnaire was divided into two parts: the first part questioned how the theme of environmental degradation and new epidemics was addressed in the participants' initial training, asking about their understanding of the theme and its importance to them as future biology teachers. In the second part, statements about environmental degradation and new epidemics were presented to analyze the participants' basic knowledge of this theme.

When asked about the participants' previous exposure to environmental degradation and new epidemics, 10 (67.7%) stated they had encountered it through media (TV, newspapers, YouTube, podcasts, etc.), 9 (60% each) responded that they had encountered it both in university courses and on social media, 6 through lectures (40%), 4 (26.7%) through articles or scientific texts, 2 (13.3%) through school classes, and two participants selected "other" options. One of them stated that they had addressed the topic in curricular work, and the other had encountered the topic through an internship. None of the participants responded that they had not encountered the subject up to the time of the questionnaire.

When asked to explain the term "environmental degradation", 3 (20%) participants provided partial and incomplete definitions, with none of the participants providing a wrong definition. However, 12 (80%) responses defined it correctly. This result demonstrates how the concept of environmental



degradation is well-established in the participants' repertoire, indicating its relevance and interest among the students. It also shows that, as future teachers, they play an important role in combating future socio-environmental crises through student awareness (Silva & Mauro, 2018), as well as possessing specific concepts that were well-addressed during their training process, which is extremely important for the construction of their professional identity (Lima, 2008).

When prompted to explain the process of the emergence of new epidemics, 9 (60%) of the participants correctly explained how the process occurs. None of the participants provided an incorrect explanation, while 6 (40%) participants provided an incomplete explanation. This is evident in responses such as those from participants P4 "When a pathogen emerges and infects several people in a particular region" and P8 "Diseases that spread among humans and cause a large number of infections." These incomplete responses demonstrate that the participants understand the definition of an epidemic but cannot explain where the new pathogens, which previously did not circulate in the human population, come from. This may be a reflection of a technician education; however, it is necessary to understand that this technical knowledge is not sufficient, requiring training that addresses the content in an expanded manner and with constant updates of contents and priorities (Carvalho & Gil-Pérez, 2011; Goodson, 2013). On the other hand, the majority of participants provided satisfactory explanations, as evident in the response from participant P9:

P9: The emergence of new epidemics is closely related to *environmental degradation and imbalance in nature*. Pathological factors spread due to the high proximity of humans with these factors, whether through urbanization, uncontrolled biological food consumption, animal trafficking, habitat loss, or biodiversity reduction.

Comprehending that several diseases have emerged from the contact between wild animals and humans is essential to understanding the importance of studying these cases and how environmental degradation can influence the emergence or worsening of new epidemics, as well described in the cases of Dengue and Ebola viruses (Leroy, 2009; Butterworth, 2017). Additionally, addressing these topics provides an updated perspective on various issues and contextualizes knowledge, making it more engaging (Lanes et al., 2014). The analysis of approaches to complexity in socio-environmental issues, as explored by Watanabe and Rodríguez-Marín (2018), highlights the importance of teacher education in Biological Sciences that incorporates understanding and the ability to deal with the interconnection of various factors in contemporary environmental problems. Thus, the authors demonstrate the importance of curriculum and pedagogical adaptation, aiming to prepare future teachers to tackle the complex and constantly evolving challenges in the teaching of biological sciences.

We also asked students to indicate if they had encountered the topic at the University and in which disciplines, if applicable. The responses were categorized according to the mention of a discipline. Thus, the discipline of Cytology was mentioned only once (6.7%); there were 2 (13.3%) mentions for disciplines such as Population and Community Ecology, Immunology, Microbiology, Evolution, Comparative Virology, Wildlife Conservation, Organography, and Phanerophytic Systematics; 4 (26.6%) mentions for Physical Environment and Ecosystems; and 5

(33.3%) respondents stated that they had not encountered the topic in University disciplines.

The majority of the mentioned disciplines fall within the subfields of Cellular Biology or Ecology, demonstrating that the students have, to some extent, encountered this essential topic in their initial education. This shows a concern for addressing transversal and contextualized themes that will help them not to have a solely technician way of thinking as teachers in basic education (Flores, 2010). On the other hand, a significant number of students claim to have never encountered the topic during their education. We consider this situation problematic, considering that during initial education, teachers come into contact with various themes, concepts, and content, creating the capacity to appropriate this knowledge for future use in their professional practice (Barcelos & Villani, 2006).

Next, we asked whether, during their training as graduates, they had addressed epidemics that arose or were exacerbated by environmental degradation and which ones. Thus, 8 (53.3%) licensure students affirmed that such examples had been addressed during their education, while 7 stated that they had not been addressed. In the affirmative responses, some epidemics are mentioned multiple times, as we can observe from the responses of the following participants:

P1: COVID-19 was a topic that emerged strongly, but little attention was given to the systematic emergence of epidemics and their relationship with the level of environmental degradation in disease epicenters or globally.

P14: Yes, epidemics of influenza and SARS-CoV-2 were addressed.

The recent SARS-CoV-2 pandemic has been mentioned several times, likely due to its global presence and significant impact on everyone's lives, making it a commonly used example. The bubonic plague epidemic has also been frequently cited, probably because of its great historical importance in the medieval era, where it caused intense cultural and societal changes, influencing beliefs and the collective imagination, and continues to appear as a theme in movies, series, and books. Another epidemic that has been repeatedly mentioned is the flu, a disease very present in daily life and one of the deadliest in human history, justifying its frequent citation. In the 7 negative responses, the lack of standardization in disciplines is evident, showing that these examples are not always addressed, which may reflect on a basic education teacher who, initially, may not be able to bring the content in a contextualized and satisfactory manner regarding cross-cutting themes in the classroom.

We asked students how the topic of environmental degradation and the emergence of new epidemics was addressed during their teacher training and whether this approach was sufficient to prepare them to address this topic adequately in the classroom. Two (13.3%) participants responded that it was enough to prepare them to address the topic in the classroom, and 13 (86.7%) responded that it was not enough to prepare them. Regarding how it was addressed, 2 (13.3%) responded that it was directly addressed, while the other 8 (53.3%) responded that it was indirectly addressed, and 5 (33.3%) did not take a position. Thus, we note that the majority of students do not feel prepared to

address this topic in their future teaching practice, and the subject was indirectly addressed, as we can see in the participants' responses:

P13: It was not systematically addressed, only the relationship was mentioned, so I don't feel adequately prepared to address the topic in a class.

P7: I think this topic is approached in a cross-cutting manner with little focus, and therefore sometimes some examples as well as ways to explain the phenomenon are overlooked. Therefore, I don't think we would be prepared to address it adequately, since many times, we don't examine it closely or with the proper attention, it deserves.

These statements demonstrate how in the initial teacher education there is a bias and prioritization towards specific knowledge at the expense of contextualized and cross-curricular knowledge, showing how this leads to the neglect of certain contents in the training of future teachers (Bomfim et al., 2013). Thus, the initial teacher education course continues to repeat the same technical training and does not promote reflection on the social role of the teacher as an educator. Precisely at the current moment, when this role is extremely important for a more contextualized education, preparing students to think critically and complexly about the world to perceive the interdependence of various areas of our society (Flores, 2010).

When asked about the importance of addressing, in basic education, environmental degradation related to the emergence of new epidemics, unanimously, all 15 participants responded that there are two important aspects in developing this theme in basic education. Namely: raising awareness among students about the importance of environmental preservation and demonstrating how the relationship between human health and epidemics is linked to environmental preservation. The following response exemplifies this:

P9: I think it's important because it's a topic that affects us, and sometimes we don't realize how epidemics and environmental degradation are interconnected. Therefore, understanding this would enable us to look at reality differently, and bringing this to the students' reality can make them think more about it and address the problem accordingly.

The perspective of these pre-service teachers demonstrates a concern to convey to their future students the importance of the topic, as they perceive and understand how nature and human well-being are interconnected. Thus, environmental impacts not only harm the environment but also end up affecting human society itself (Mendonça, 2000). Additionally, they emphasize the importance of understanding and conveying knowledge about the topic critically and updated (Flores, 2010).

When asked about how they intended to apply this theme in their future teaching practices, varied responses were obtained through the question. Therefore, they were categorized according to the way of presenting the content. Accordingly, 1 (6.7%) pre-service teacher responded that they would use debates and expository classes on the topic, 3 (19.6%) would employ participatory classes, 5 (33.3%) would utilize additional materials as didactic resources, 6 (40%) would incorporate historical and everyday life contextualization, and finally, 10 (66.7%) would address it in a cross-curricular manner.

In light of these responses, it is evident how pre-service teachers understand that the theme of environmental degradation and new epidemics is neither isolated nor irrelevant. It is necessary to bring a critical and participatory perspective on the topic, as in this way students can develop a sense of collective care for human and environmental health (Silva & Mauro, 2018). According to the responses, many pre-service teachers propose to address the theme in a cross-curricular manner in their classes, although they do not use the word "cross-curricular", they describe it as an approach to be used, as can be seen in the responses of the following participants:

P1: I find it very important when discussing health to integrate the environment, as one thing cannot be dissociated from the other. Therefore, contextualizing as much as possible with everyday experiences and attitudes. Correlating ecologically correct existence along with the characteristics of pathogens (such as in microbiology classes), thus making the content visible in students' lives, contextualized, and more integrated. It's worth noting that various resources can be used, such as games, documentaries, and debates, to further improve the approach to the topic.

P4: I plan to present this topic along with the part about human influence on environmental impacts and when addressing the part about pandemics and epidemics in diseases.

The proposal to address cross-cutting themes is described both in the CM as transversal axes (Distrito Federal, 2021) and in the BNCC as TCT (Brazil, 2019). This demonstrates that the initial training of the students is aligned with what is proposed by the two documents that guide basic education in Brazil and the Federal District. Furthermore, the prospective teachers have recognized the importance of contextualizing and demonstrating how this theme is closely linked to the recent changes our world and society are undergoing (Mendonça, 2000). Thus, the teacher plays a crucial role in arousing motivation in basic education students regarding the topic (Darling-Hammond, 2015). For this to happen, the prospective teachers realize that it is necessary to bring the topic in a motivating way and connect to the mandatory curriculum content discussed in the classroom (Lanes et al., 2014).

### **Undergraduate students' knowledge of the theme**

The first and second statements about the presented theme to the participants were "Environmental degradation is the main cause of the emergence of new epidemics" and "There are ways to mitigate the chances of new epidemics emerging." These statements are true, as various studies point to environmental degradation as the crucial point for the emergence of new epidemics and the worsening of these epidemics, and environmental preservation as a way to combat this adversity (Mora et al., 2022; Altizier et al., 2013). Thus, the majority agreed with the statement, demonstrating that although participants did not have in-depth exposure to the topic at university, as evidenced by the analysis of course syllabi and the statements of interviewed professors, at least this basic knowledge was conveyed during their education, whether through lectures or other means.

Next, the statement "Lack of awareness and education about preventive measures increases the risk of epidemics" was put to judgment. This is a true

statement as it is necessary to instill a sense of change in society through environmental issues and to emphasize that environmental preservation is not only necessary for the survival of other living beings but also crucial for human survival (Silva & Mauro, 2018). All participants agreed with the statement, showing that everyone understands the importance of awareness to advance environmental and epidemic prevention agendas. Research on everyday themes in the production of socially relevant knowledge, as highlighted by Content and Sales (2022), demonstrates the growing need for teacher education in biological sciences to integrate practical and contextualized approaches, equipping educators to address relevant and contemporary issues in their educational practices.

The next five statements were presented to assess participants' knowledge of what measures are necessary to prevent or favor the emergence of new epidemics. Two of them were: "The study and monitoring of new pathogens should be avoided to prevent the emergence of a new epidemic" and "Public policies are extremely important for combating environmental degradation and the emergence of new epidemics." Regarding anthropogenic activities that favor the emergence of new epidemics: "There is no relationship between intensive agriculture and livestock farming and the emergence of new epidemics"; "There is no relationship between mining and the emergence of new epidemics"; and "There is no relationship between hunting and trading of animals and the emergence of new epidemics." The first statement is incorrect and the second is correct; likewise, the majority of participants answered both the first and second statements correctly. However, some participants disagreed with the first statement. This may be because studying these pathogens requires scientists and researchers to have controlled contact with them, which may raise concerns about exposing individuals who could carry these pathogens into human environments.

Despite this concern, the benefits of monitoring these pathogens outweigh the potential harm (Rozenfeld, 2000). The majority of correct responses show that participants know extremely important measures that should be encouraged to prevent the future emergence of epidemics. Regarding the third, fourth, and fifth statements about economic activities that favor the emergence of new epidemics, as in the previous statements, the majority of participants responded correctly to all three statements. However, in the statement linking mining with the emergence of new epidemics, a quarter of participants were unable to answer the question. This result may be due to many participants not understanding how mining activities work; however, as we already know, all anthropogenic actions that destroy natural habitats increase the interaction between humans and wild animals, whether through anthropogenic activity itself or the adaptation of such animals to the anthropized environment (Volpato et al., 2020).

The next two statements were presented to assess whether participants know country-level conditions that make them more susceptible to the emergence of new epidemics. These statements were: "There are geographical and climatic conditions that make countries more susceptible to the emergence of new epidemics" and "There are socioeconomic conditions that make countries more susceptible to the emergence of new epidemics." Both statements are

correct. The majority of participants answered both statements correctly, demonstrating that they understand that there are factors that make countries more sensitive to the emergence of new epidemics, with these factors being more prevalent in emerging countries with low economic and social development, marked by inequality (Mora et al., 2022; Altizer et al., 2013). Therefore, new epidemics have a greater impact on these countries, justifying the need to build education with a more transversal approach, bringing these themes more relevantly and contextually into the classroom. This is not just about parallel projects but about integration into disciplines and content as a way of critically contextualizing students' reality (Bomfim et al., 2013).

### **The practice of university professors in the classroom**

When asked, both teachers expressed that in their disciplines they do not delve deeply into the topic, making only brief mentions or using the theme as contextualization. Additionally, the teachers see their mandatory disciplines as the foundation and prioritize core concepts, using epidemics and environmental degradation only as motivators. Therefore, it makes sense that the majority of students expressed in the questionnaire that the topic was addressed indirectly and that the disciplines did not prepare them for future approaches in the classroom. This highlights a noticeable lack of teacher training to address cross-cutting themes, which can lead to insufficient attention to these topics in basic education (Bomfim et al., 2013; Carvalho; Gil-Pérez, 2011).

When asked if there is room within the discipline to address the topic, both interviewed teachers stated that there is not much space. Both only intend to use the theme in mandatory disciplines as a way to contextualize and motivate students. However, both stated that they discuss environmental degradation and new epidemics in elective courses offered by each of them and in their view, this is the best way to address this topic in a more systematic and in-depth manner, as exemplified by the following statement:

E1: The way I use it there is as a motivator for epidemics, you know? Understanding and being motivated to discuss something or something like that, maybe it's more like that. This is an opinion from someone who doesn't understand much about it. Now, maybe it would be better in an elective or a microbiology class, for example, if I give another discipline, which is the applied microbiology discipline, then maybe there is more space because these disciplines have a more flexible curriculum, so I can bring in more diverse topics and, including, applied microbiology, we sometimes vary the theme throughout the semesters.

It becomes clear that the mandatory disciplines offered in the curriculum have little room for change. On the other hand, university students are aware that it is an important theme for the initial training of teachers, as it is at this moment that the teacher builds their knowledge base and professional identity (Barcelos & Villani, 2006; Lima et al., 2008). Thus, the interviewed professors seek to use environmental degradation and epidemics as contextualizers and offer elective courses that delve more deeply into the subject. However, this demonstrates how the priority once again turns to specific knowledge during teachers' initial training courses, leaving transversal themes marginalized (Mellini & Ovigli, 2020).

Both professors stated that they relate new epidemics and environmental degradation in their classes, but this relationship is not deepened, being only briefly mentioned. When asked if they use any examples of epidemics that have occurred, Interviewee E1 said that he mainly uses the COVID-19 pandemic as it is a recent pandemic experienced intensely by everyone, and the bubonic plague epidemic. This last one, according to the interviewee, is addressed because it is a classic example when talking about epidemics, due to its great impact on the history of medieval European societies. Similarly, Interviewee E2 also expressed using Covid-19 for the same reasons described by Interviewee E1 but also used avian malaria as a different example from the better-known ones.

As a result, these examples are remembered by the teacher trainees when we observe the question asked in the questionnaire on the same aspect; several participants responded that they remembered the use of bubonic plague and COVID-19. Furthermore, the professors presented their experiences in the classroom by citing these examples. Professor E1 stated that students engage in debate when addressing COVID-19, however, he feels a certain saturation on the part of students due to the recent pandemic experienced intensely (Conceição, Santos & Soares, 2020). On the other hand, Professor E2 reports that he does not feel the students are saturated with the subject, but rather that the teacher trainees appreciate discussing and debating the topic.

The issue of the prior knowledge that undergraduate students presented during classes was also addressed. Both interviewees reported that some students bring prior knowledge about the relationship between environmental degradation and new epidemics, but for many, it is a novelty. However, during the elective courses offered by the two professors, there is greater prior knowledge, and many students already understand the relationship between these two themes.

Thus, it is possible to understand that students already have prior knowledge and that this subject is even addressed outside the university. This conjecture is also pointed out in the questionnaire applied to teacher trainees, where the vast majority responded that they had contact with this subject through media and social networks. However, it is necessary to understand that this is not enough, and the training of future teachers in basic education cannot be limited to a technician formation but must promote knowledge in an expanded way (Carvalho & Gil-Pérez 2011).

When asked about the importance of this subject being addressed by teacher trainees in basic education classrooms, the interviewees highlighted the impact on society. They described that this theme should be one of the main focuses to be addressed in teaching because it is very important in today's society, bringing with it an integrative aspect between various areas. According to the interviewees, the theme brings up issues that go beyond the biology content in basic education, bringing with it public health and political issues.

Thus, university professors who prepare future teachers are aware of how important this theme is to be addressed. However, a large number of teacher trainees stated in their responses that they do not feel prepared to address the theme as teachers in basic education, thus demonstrating a contradiction. Above all, it is notable, even among university students, that this theme is of great

importance, as it brings a more critical reflection of everyday life and integrates various knowledge in a transversal way, enabling students to gain greater awareness of the world they live in (Mendonça, 2000).

## FINAL CONSIDERATIONS

The initial training of a teacher plays a fundamental role in preparing and developing qualified and competent professionals to work in the field of education. It is during this period that future teachers acquire the theoretical and practical knowledge necessary to teach and deal with the challenges of the school environment. However, the training and classroom practice of science and biology teachers have been limited to the technical transmission of content, thus the theme of environmental degradation and new epidemics ends up being underexplored.

The results from the research showed that the majority of teacher trainees and professors understand the theme as important to be addressed. Furthermore, it is a theme that has been increasingly addressed in different spaces, and that teacher trainees have significant exposure to. Thus, university professors tend to address this theme in their classes, but only in a non-systematic way to contextualize the content to be taught. When we pay attention to the guiding documents of Brazilian basic education and the Federal District, the BNCC, and the CM respectively, we observe that the theme is not addressed directly. Thus, it may give the false idea that the content is less important in the student's formation. On the other hand, in both documents, the theme is indirectly presented, with the most important part being the transversal themes of both, due to the transversal characteristics of the theme itself that incorporates different areas of knowledge within the field of biology and natural sciences.

Therefore, the need for a more in-depth debate on the theme becomes evident, which during the research was described by the participants and interviewees as extremely important for the formation, of both the teacher trainees and the future students of basic education. However, this theme is not addressed systematically and emphatically by the professors during the initial training of the teacher trainees in the mandatory disciplines of the biology teacher training course, which results in a lack of appropriation of the content by the teacher trainees. Consequently, they do not feel prepared to bring up the theme during their future teaching practice in schools. On the other hand, the teacher trainees understand the social and environmental importance of the theme, as well as how human health is interconnected with environmental preservation. Although, according to the reports of the participants during the research, the theme was not centrally or systematically addressed in the initial training course, the vast majority have basic knowledge about the theme. This is due to the significant exposure that the teacher trainees had to the content through other means of communication, such as different types of media and social networks.

Finally, it is worth emphasizing the importance of the theme, as the curriculum of basic education, as well as Brazilian education in general, has been undergoing various changes, especially with a depoliticized and decontextualized



perspective of our way of life and the social, political, and economic system. Therefore, it is necessary to counter this trend and bring forward content that is overlooked and not only focus on technical content, aiming to approach content in a critical and complex manner, bringing interaction between different areas of knowledge, not underestimating students' ability to understand.

## REFERENCES

- Alitizer, S., Ostfeld, R. S., Johnson, P. T. J., Kutz, S., & Harvel, C. D. (2013). Climate change and infectious diseases: From evidence to a predictive framework. *Science*, 341(6145), 514-519.
- Baker, R. E., Mahmud, S. M., Miller, I. F., Malavika, R., Rasambainarivo, F., Rice, B. L., ... & Metcalf, C. J. E. (2022). Infectious disease in an era of global change. *Nature Reviews Microbiology*, 20(4), 193-205.
- Barcelos, N. N. S., & Villani, A. (2006). Troca entre universidade e escola na formação docente: Uma experiência de formação inicial e continuada. *Ciência & Educação*, 12(01), 73-97.
- Bardin, L. (2011). *Análise de conteúdo*. São Paulo: Edições.
- Beirigo, A. P. T., Pereira, I. da S., & Costa, P. S. (2017). Influenza A (H1N1): Revisão bibliográfica. *SaBios-Revista de Saúde e Biologia*, 12(2), 53-67.
- Bomfim, A. M. do, Anjos, M. B. dos, Floriano, M. D., Figueiredo, C. S. M., Santos, D. A. dos, & Silva, C. L. de C. da. (2013). Parâmetros curriculares nacionais: Uma revisita aos temas transversais meio ambiente e saúde. *Trabalho, Educação e Saúde*, 11, 27-52.
- Brasil. Ministério da Educação. (2019). *Base Nacional Comum Curricular*.
- Butterworth, M. K., Morin, C. W., & Comrie, A. C. (2017). An analysis of the potential impact of climate change on dengue transmission in the southeastern United States. *Environmental Health Perspectives*, 125(4), 579-585.
- Carvalho, A. M. P., & Gil-Pérez, D. (2011). *Formação de professores de ciências: Tendências e inovações*. São Paulo: Cortez.
- Conceição, D. S. da, Santos, M. B. dos, & Soares, M. J. N. (2020). Impactos causados pela COVID-19: Um estudo preliminar. *Revista Brasileira de Educação Ambiental (RevBEA)*, 15(4), 128-147.
- Contente, M. P., & Sales, E. R. de. (2022). A investigação de temáticas cotidianas na produção de conhecimentos socialmente relevantes. *ACTIO*, 7(3), 1–20. <https://doi.org/10.3895/actio.v7n3.15263>
- Darling-Hammond, L. (2015). A importância da formação docente. *Cadernos Cenpec*, 4(2). <http://dx.doi.org/10.18676/cadernoscenpec.v4i2.303>.
- Distrito Federal. Secretaria de Estado de Educação do DF. (2021). *Currículo em Movimento do Novo Ensino Médio*. Brasília.
- Flores, M. A. (2010). Algumas reflexões em torno da formação inicial de professores. *Educação*, 33(03), 182-188.

- Gibert, C. R. i. (2019). La peste a lo largo de la historia. *Revista Enfermedades Emergentes*, 18(3), 119-127.
- Gil-Pérez, D. (1996). New trends in science education. *International Journal of Science Education*, 18(8), 889–901.  
<https://doi.org/10.1080/0950069960180802>
- Goodson, I. (2013). *Currículo: Teoria e história* (14ª ed.). Petrópolis: Editora Vozes.
- Lanes, K. G., Lanes, D. V. C., Pessano, E. F. C., & Folmer, V. (2014). O ensino de ciências e os temas transversais: Práticas pedagógicas no contexto escolar. *Revista Contexto & Educação*, 29(92), 21-51.
- Leroy, E. M., Epelboi, A., Mondonge, V., Pourrut, X., Gonzalez, J. P., Muyembe-Tamfum, J.-J., & Formenty, P. (2009). Ebola outbreak resulting from direct exposure to fruit bats in Luebo, Democratic Republic of Congo, 2007. *Vector-borne and Zoonotic Diseases*, 9(6), 723-728.
- Lima, M. S. L. (2008). Reflexões sobre o estágio/prática de ensino na formação de professores. *Revista Diálogo Educacional*, 8(23), 195-205.
- Macedo, E. F. de. (1999). *Parâmetros Curriculares Nacionais: A falácia de seus temas transversais*. In A. F. B. Moreira (Org.), *Currículo: Políticas e práticas* (pp. 43-58). Campinas, SP: Papirus.
- Megid-Neto, J. (2007). *Três décadas de pesquisas em educação em ciências: Tendências de teses e dissertações (1972-2003)*. In R. Nardi (Ed.), *A pesquisa em ensino de ciências no Brasil: Alguns recortes* (pp. 341–355). Escrituras.
- Mellini, C. K., & Ovigl, D. F. B. (2020). Identidade docente: Percepções de professores de biologia iniciantes. *Ens. Pesqui. Educ. Ciênc.*, 22.  
<https://doi.org/10.1590/1983-21172020210117>.
- Mendonça, F. (2000). Aspectos da interação clima-ambiente-saúde humana: Da relação sociedade-natureza à (in)sustentabilidade ambiental. *Raega-O Espaço Geográfico em Análise*, 4.
- Minayo, M. C. S. (Org.). (2009). *Pesquisa Social. Teoria, método e criatividade*. Petrópolis, RJ: Vozes.
- Mora, C., McKenzie, T., Gaw, I. M., Dean, J. M., Hammerstein, H. von, Knudson, T. A., ... & Patz, J. A. (2022). Over half of known human pathogenic diseases can be aggravated by climate change. *Nature Climate Change*, 12(9), 869-875.
- Rabello, A. M., & Oliveira, D. B. de. (2020). Impactos ambientais antrópicos e o surgimento de pandemias. *Unifesspa: Painel Reflexão em tempos de crise*, 26, 1-7.
- Rozenfeld, S. (2000). *Fundamentos da vigilância sanitária*. SciELO-Editora FIOCRUZ.

Silva, C. C. M., & Mauro, G. (2018). Mudanças climáticas, saúde e educação ambiental como política pública em tempos de crise socioambiental. *Revista de Políticas Públicas*, 22, 1151-1170.

Slongo, I. I. P. (2004). *A produção acadêmica em ensino de biologia: Um estudo a partir de teses e dissertações* [Tese]. Universidade Federal de Santa Catarina.

Volpato, G., Fontefrancisco, M. F., Gruppuso, P., Zocchi, D. M., & Pieroni, A. (2020). Baby pangolins on my plate: Possible lessons to learn from the COVID-19 pandemic. *Journal of Ethnobiology and Ethnomedicine*, 16(1), 1-12.

Watanabe, G., & Rodríguez-Marín, F. (2018). Aspectos da complexidade nas questões socioambientais: As abordagens no Brasil e na Espanha. *Ciência & Educação*, 24(3), 543–562. <https://doi.org/10.1590/1516-731320180030002>

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