Representations of climate change among Tunisian secondary school students

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ABSTRACT
Climate change education is of great importance for raising awareness among younger generations about environmental issues and supporting the ecological transition, in line with the Sustainable Development Goals, particularly SDGs 4 and 13. In Tunisia, however, this education remains marginal in school curricula, with no explicit teaching on climate change. In this context, this exploratory research aims to identify the social representations of climate change among Tunisian secondary school students. The study was conducted among 300 second-year secondary school students (science section) using a questionnaire. The data collected were subjected to quantitative and qualitative analyses focusing on representations, knowledge, sources of information, and emotions. The results show that the majority of students surveyed recognize the existence of climate change, but develop fragmented representations of it, mainly focused on observable local manifestations. These representations reveal a lack of understanding of the scientific mechanisms of the phenomenon. In the absence of structured teaching, the media and the Internet are the main sources of information, while a feeling of concern remains widely expressed.

KEY WORDS
Climate change, climate change education, social representations, climate knowledge, High school students

RÉSUMÉ
L'éducation au changement climatique revêt une grande importance pour sensibiliser les jeunes générations aux enjeux environnementaux et soutenir la transition écologique, conformément aux Objectifs de développement durable (ODD), en particulier les ODD 4 et 13. En Tunisie, cependant, cette éducation reste marginale dans les programmes scolaires, sans enseignement explicite sur le changement climatique. Dans ce contexte, cette recherche exploratoire vise à identifier les représentations sociales du changement climatique chez les élèves tunisiens du

secondaire. L'étude a été menée auprès de 300 élèves de deuxième année du secondaire (section sciences) à l'aide d'un questionnaire. Les données recueillies ont fait l'objet d'analyses quantitatives et qualitatives axées sur les représentations, les connaissances, les sources d'information et les émotions. Les résultats montrent que la majorité des élèves interrogés reconnaissent l'existence du changement climatique, mais en développent des représentations fragmentaires, principalement centrées sur des manifestations locales observables. Ces représentations révèlent un manque de compréhension des mécanismes scientifiques du phénomène. En l'absence d'un enseignement structuré, les médias et Internet constituent les principales sources d'information, tandis qu'un sentiment d'inquiétude reste largement exprimé.

MOTS-CLÉS
Changement climatique, éducation au changement climatique, représentations sociales, connaissances climatiques, élèves du secondaire

INTRODUCTION

Climate change is now considered an urgent global issue (McHugh & al., 2021). Scientific observations show an increase in average temperatures and changes in climate patterns (Romm, 2022). These changes are affecting natural environments, water resources, agriculture, health, and people's living conditions (Balsari & al., 2020; Fuglie, 2021; Kundzewicz, & al., 2018; Worm & Lotze, 2021). The impacts of climate change affect the entire planet, with varying effects depending on geographical, social, and economic contexts.

In scientific literature, responses to climate change essentially revolve around two complementary dynamics: mitigation and adaptation. Mitigation measures refer to all interventions aimed at slowing down the phenomenon by reducing anthropogenic greenhouse gas emissions or strengthening carbon sinks, in particular through the decarbonization of energy systems, the use of renewable energies, and the transformation of transport and industrial production systems (Fawzy & al., 2020; Le Quéré & al., 2019). Adaptation measures refer to actions designed to limit the vulnerability of human and natural systems to the impacts of climate change, such as integrated water resource management, adaptation of agricultural systems, land-use planning, and resilience of critical infrastructure (Kwakye & al., 2023; Piggott-McKellar & al., 2019). According to some research, the effectiveness of these approaches requires political will to act and economic and institutional support to enable different local communities around the world to adapt to climate change (Gemeda & al., 2023). In this context, education is increasingly recognized as an important factor in climate action, as a means of disseminating scientific knowledge, developing the skills needed for ecological transition, and supporting the social acceptability of climate policies (Cordero & al., 2020; Feinstein & Mach, 2020).

In Tunisia, the effects of climate change are increasingly noticeable through more frequent droughts, water scarcity, rising average temperatures, and the increased vulnerability of certain agricultural areas (Baouab & Cherif, 2015; Dahech & Ghribi, 2017). As in many countries, raising awareness about climate change among young people has become essential, as they represent future social and political actors who will face its long-term consequences. However, climate change education remains insufficiently institutionalized and explicitly integrated into education policies. In primary and secondary school curricula, while certain environmental concepts are addressed in a cross-curricular manner in subjects such as natural sciences or geography (Alaya, 2010; Hamdi, 2007), they often remain fragmented, poorly contextualized, and rarely linked to contemporary climate issues. This lack of climate change

education could limit the Tunisian education system's ability to fully play its role in preparing young people for future climate challenges. It can also contribute to directing these young people towards extracurricular sources of information, particularly digital and media sources, whose reliability varies, sometimes promoting erroneous or controversial representations of the climate phenomenon. It is in this context that it is interesting to explore Tunisian students' representations and knowledge of climate change, to better understand how they perceive this phenomenon and to identify any misunderstandings, thereby gaining a clearer picture of their needs in terms of climate change education.

THEORETICAL FRAMEWORK

Young people facing climate change

Today's young people are the ones who will suffer the increasingly significant impacts of climate change and who will have to take action to reduce its effects and help preserve life on our planet. Understanding climate change is therefore an important issue for young people, as recognition of this phenomenon determines the terms of social and civic engagement and motivates adaptation and resilience.

Research shows that even though the sometimes-dramatic consequences of climate change have helped to make this phenomenon observable on an international scale, understanding of it remains uneven, particularly among younger generations. Indeed, despite the fact that young people in many international contexts consider climate change to be a real problem, mainly caused by human activity, and express strong concern about it, their knowledge of the subject and their perceptions of the phenomenon depend on several factors such as age, educational level, and social or geographical context (Lee & al., 2020; Tapia-Echanove & al., 2025). Data from the Program for International Student Assessment (PISA 2015) reveal significant variations in students' knowledge of this subject, depending on the country, level of scientific literacy, and socioeconomic context (Oliver & Adkins, 2020). According to Oliver & Adkins (2020), these same data seem to show that students' awareness of climate change could be linked to their individual academic performance, but also to the educational policies in place in their countries. Indeed, not all young people have equal access to scientific resources on climate change in the school setting. High-income countries generally have a more structured educational framework for integrating climate issues into school curricula. However, inequalities can exist within the same country. For example, an Indonesian study (Martha & al., 2025) showed that climate literacy among adolescents was significantly higher among those attending public schools than among those attending private or vocational schools. In addition, young people in more developed regions of the country had higher levels of knowledge than those in less developed regions.

Research also shows that climate change evokes an emotional response in young people, which, among other things, plays a role in their climate engagement. Climate change is sometimes experienced as a real threat, generating emotions such as fear, sadness, anger, or helplessness in young people (Galway & Field, 2023; Meo & al., 2025). This phenomenon is often referred to as “eco-anxiety,” which encompasses anxiety and distress related to the ecological crisis (Kurth & Pihkala, 2022; Ojala, 2018; Pihkala, 2020). This type of anxiety is not generally pathological but can be a source of suffering and sometimes requires psychological help (Baudon & Jachens, 2021; Brophy & al., 2023). Young people's feelings about climate change influence how they perceive the issues, make decisions, and engage in action in response to this crisis (Lukacs & al., 2023; Turcotte-Tremblay & al., 2024). The emotional dimension is sometimes expressed through forms of engagement and moral responsibility, which are powerful drivers of climate mobilization.

Social representations

Social representations are forms of social knowledge that enable individuals and groups to make sense of their everyday reality. Constructed from lived experiences, social practices, and language, they guide behaviors and attitudes toward situations, events, and objects in the social world (Moscovici, 1984; 2013).

In line with this general definition, social representations are not solely cognitive in nature but play a central role in social action. Indeed, Jodelet (1989) emphasizes that social representations play a structuring role in guiding individual and collective behavior. According to Moscovici (1961), the construction of a social representation is based on two fundamental processes: objectification and anchoring. Objectification consists of transforming complex knowledge into concrete and accessible images, through sorting information in accordance with the group's norms and values, forming a coherent figurative core, and naturalizing it, which makes these elements obvious to individuals. Anchoring, which is closely linked to objectification, corresponds to the integration of this representation into the existing system of thought, enabling it to become a framework for interpreting and categorizing reality, while guiding social behavior and relationships. Building on these foundational processes, subsequent work sought to understand the internal organization of social representations.

The structural approach developed as an extension of Moscovici's work and formalized by Abric (1994, 2001) provides an interesting conceptual framework for analyzing social representations. This approach is based on the idea that the elements of a representation do not all occupy the same place and that they play different roles in the construction of meaning. According to the structural approach, a social representation is composed of a central core and peripheral elements. The central core brings together the elements most shared by the members of a group. It is relatively stable and linked to the values, norms, and social history of the group. It gives a common meaning to the representation and organizes the relationships between the different elements that compose it. The peripheral elements, on the other hand, are more numerous and more sensitive to context. They allow individuals to adapt the representation to concrete situations in everyday life, while maintaining the coherence of the whole.

STATEMENT OF THE PROBLEM AND RESEARCH QUESTIONS

Climate change remains insufficiently addressed in Tunisian secondary school curricula. Although certain environmental topics are introduced in subjects such as natural sciences and geography, they often remain fragmented, poorly contextualized, and rarely explicitly connected to contemporary climate issues. As a result, students may construct their understanding of climate change through extracurricular sources, particularly digital media and online platforms, whose scientific reliability may vary.

This situation may contribute to the development of fragmented, emotional, or scientifically inaccurate understandings of climate change. In this context, analyzing Tunisian secondary school students' representations of climate change is essential for understanding their ways of thinking, identifying conceptual gaps, and guiding the development of pedagogical approaches adapted to relevant and contextualized climate change education. This research therefore seeks to answer the following questions:

- What are the social representations of climate change among Tunisian secondary school students?
- What knowledge do these students have about the causes and consequences of climate change?

- What are the main information sources consulted by these students to learn about climate change?
- What emotions do these students associate with climate change?

METHODOLOGY

This study is exploratory in nature and adopts a mixed-methods approach, combining both qualitative and quantitative methodologies. The sample consists of 300 second-year secondary school students (science track), drawn from multiple classes across seven public secondary schools in the Greater Tunis area, and selected on a voluntary basis. Data collection was conducted in a school setting using a questionnaire administered under the supervision of the researcher, while the classroom teacher adopted a non-interventionist role to minimize any potential bias that could influence students' responses. Prior to participation, students were informed about the objectives of the study, and their involvement was entirely voluntary. The questionnaire was fully anonymous and designed to include both open-ended and semi-closed questions.The questions included in the questionnaire were as follows:

1a. What words or expressions come to mind when you think of "climate change?" (Please list between 5 and 10 words.)
1b. From the words or expressions, you have listed, select the five that best characterize "climate change" according to you, and rank them in descending order of importance (No. 1 being the most important).
2. What are the causes of climate change?
3. What are the consequences of climate change that you have observed in your region (where you live), and those you are aware of at the global level?
4. What are your sources of information about climate change?
Television, Teachers, Internet, Other (please specify)
5. Does the phenomenon of climate change frighten you? Why?

The first question is designed to explore students' social representations of climate change. In the first step, students were asked to produce between 5 and 10 words or expressions following the principle of free and spontaneous association. In the second step, they were asked to select five items from their initial list and rank them in descending order of importance, corresponding to a phase of conscious and structured prioritization.

The questionnaires collected were coded from E001 to E300 to ensure anonymity and facilitate data processing. Data analysis followed a mixed approach: free associations were subjected to a structural analysis of social representations, inspired by the work of Abric and Vergès, based on the cross-tabulation of frequency of occurrence and mean rank of importance, enabling the identification of a central core and peripheral systems. Open-ended and semi-closed responses were analyzed using thematic content analysis, combined with descriptive statistical procedures based on the calculation of frequencies and percentages.

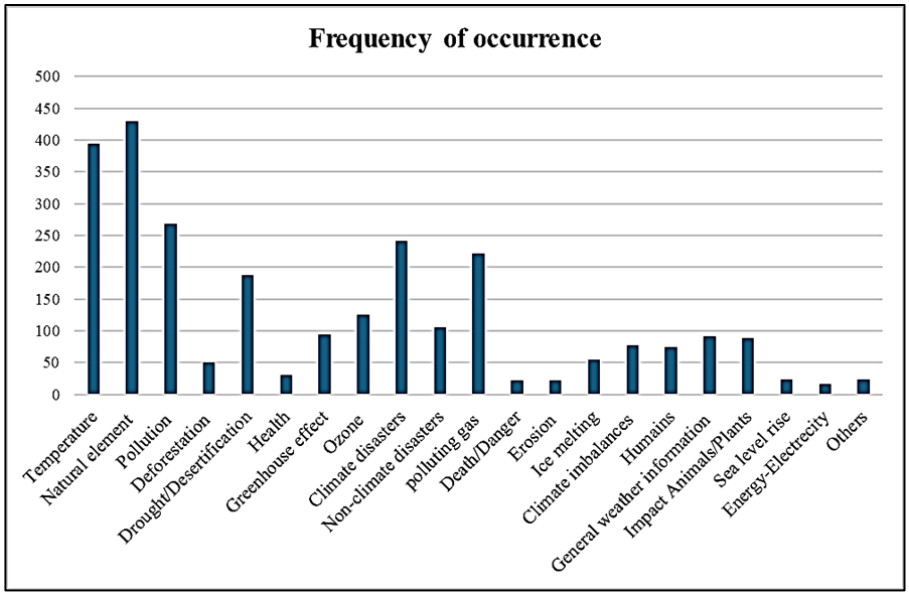
Finally, this research complies with the ethical principles governing school-based studies, particularly those related to confidentiality and anonymity, which were strictly guaranteed throughout the entire research process.

RESULTS

The social representation of climate change and the question of evocation
Part 1: Results of free association

In this section, we asked students to describe the meaning of climate change in their own words or expressions. This first phase of the open-ended question allowed us to determine the total frequency of each word or expression in the entire corpus collected. The following figure summarizes the results obtained:

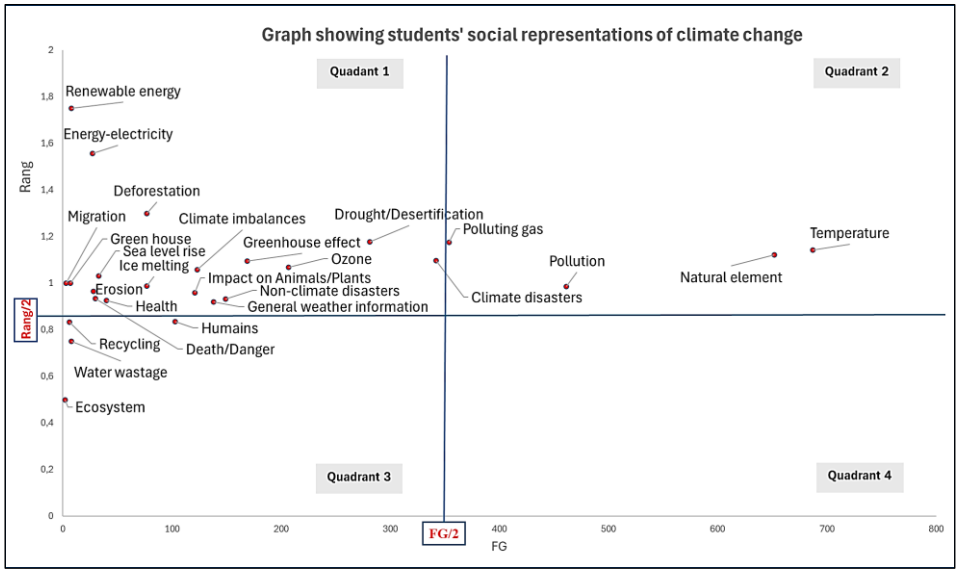
FIGURE 1



Frequency of occurrence of words and expressions obtained on climate change

Part 2. Second part of the question of evocation

FIGURE 2



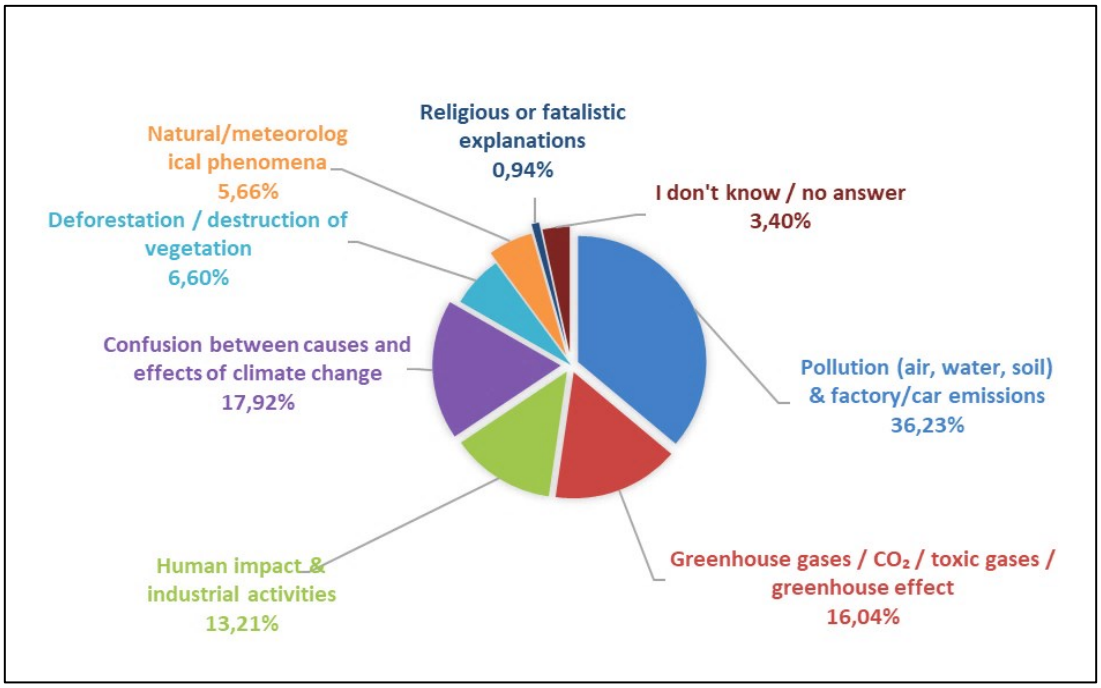
The structure of students' social representations of climate change

This part corresponds to the conscious and hierarchical choice of students' responses to the question. To this end, the order of appearance of each item was recorded for each participant, and then an average rank was calculated for the entire sample. Statistical processing was performed using Excel software (Office 365). The curve below illustrates the distribution of the

items mentioned, showing for each item its frequency of mention (on the x-axis) and its average rank of importance (on the y-axis):

Students' responses on the causes of climate change
The results obtained are shown in the following figure:

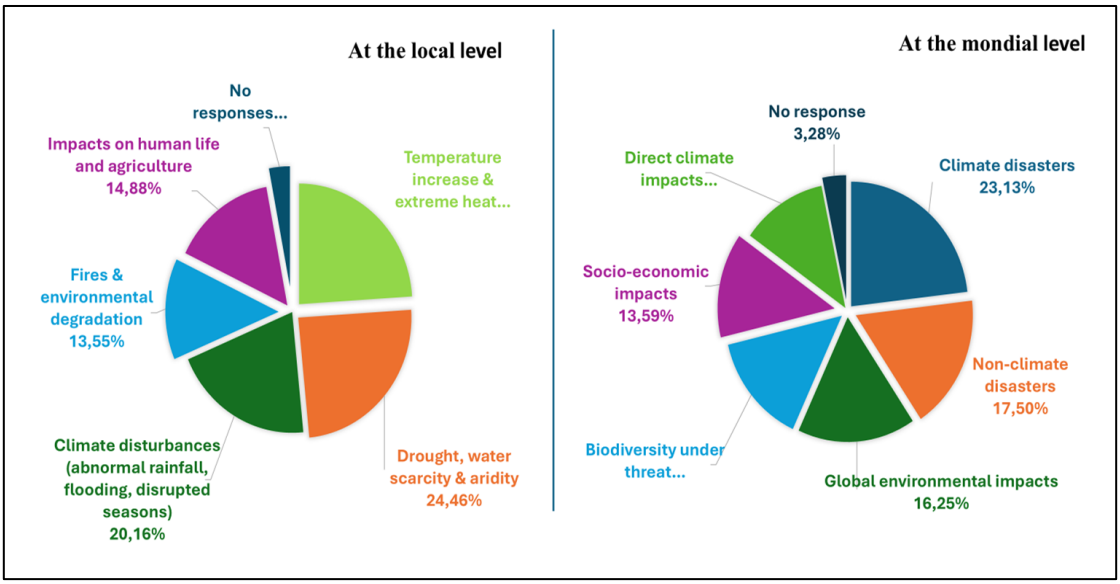
FIGURE 3



Students' responses on the causes of climate change

Students' responses on the consequences of climate change at global and local levels
The results obtained are shown in the following figure:

FIGURE 4



Students' responses on the consequences of climate change

Students' responses regarding sources of information on climate change

This question aims to identify the main sources of information used by students to learn about climate change. The categories of responses obtained are shown in the following table:

TABLE 1

Students' responses about their sources of information on climate change

Categories	Examples / Description	Answers	Percentage (%)
Digital media	Internet, YouTube, TikTok, online documentation, National Geographic	261	48.7
Television	TV, weather, movies, documentaries	107	19.96
Education	Teachers, courses, school modules	96	17.91
Written sources	Newspapers, magazines, books, encyclopedias, science, library	72	13.43
Total	-	536	100

Students' responses regarding fear related to climate change

The question asked was whether climate change frightens them, and if so, why? 208 students answered yes, and the reasons for their fears are detailed in the following table:

TABLE 2

Students' responses on the emotional dimension of climate change

Catégory	Examples / Description	Number of responses	Percentage (%)
Climate disasters	Floods, fires, storms, tornadoes, rising temperatures, tsunamis	85	40.87
Non-climate disasters (confusion)	Earthquakes, volcanic activity (wrongly attributed to climate)	38	18.27
Impacts on Humans/Animals/Plants	Death, extinction, migration, threat to human, animal, or plant life	39	18.75
Overall environmental impacts	Melting ice, rising sea levels, disappearing islands	22	10.58
Socio-economic/Health impacts	Famine, water scarcity, disease, agriculture, security	14	6.73
Direct climate impacts	Unbearable heat, weather variation, drought	6	2.88
Unjustified general fear	"It's dangerous," "He scares me," fear without justification	4	1.92
Total	-	208	100

DISCUSSION OF RESULTS

Regarding the analysis of free evocations related to climate change, our results show a total absence of elements in the central core quadrant (quadrant 4), characterized by high frequency and low evocation rank. This indicates that students do not share a consensus-based core concept around climate change. The absence of elements in the core quadrant constitutes one of the most significant findings of this study. In social representation theory, the core ensures the coherence, stability, and overall meaning of the representation. Its absence suggests that these high school students' representation of climate change is poorly structured and unstable. This finding can be interpreted as reflecting a lack of shared scientific conceptualization,

probably linked to the absence of explicit and systematic teaching of climate change in school curricula. Students thus seem to draw on fragmentary knowledge, probably from sources outside school.

The first periphery (quadrant 2), defined by elements that are frequently mentioned but have a high evocation rank, is dominated by concepts such as temperature, pollution, and climate disasters. Although these elements are frequently cited, they do not constitute central cognitive landmarks, revealing a primarily descriptive and event-based understanding of climate change.

The contrasting periphery (quadrant 3), combining low frequency with low evocation rank, includes the categories "water waste," "recycling," and "ecosystem." These elements are mentioned by a limited number of students, but early on in their evocation. This distribution highlights the existence of minority representations that are more scientifically sophisticated. Some students establish a link between climate change, natural resource management, and ecological balance. However, the marginal nature of these categories indicates that these concepts remain relatively uncommon and do not shape the collective representation of the group.

Finally, the second periphery (quadrant 1), characterized by low frequency and high evocation rank, brings together a heterogeneous set of categories. It is an accumulation of scattered information, mixing partial scientific concepts, environmental and social consequences, emotional dimensions, and possible solutions. This dispersion highlights a fragmented and poorly hierarchical representation. Furthermore, the low centrality given to humans and mitigation or adaptation actions highlights a representation that is not particularly oriented towards human responsibility and civic engagement.

Regarding knowledge of the causes of climate change, our results show that most students surveyed attribute it to pollution and visible emissions, demonstrating an understanding focused on concrete and directly observable causes. The mention of greenhouse gases and human activities indicates a partial understanding of the scientific mechanisms, which is still insufficiently structured. We also note frequent confusion between causes and consequences, revealing gaps in their knowledge on the subject. More complex factors, such as deforestation or global climate processes, are rarely mentioned. These results reflect an incomplete and poorly structured understanding of the causes of climate change.

Regarding the consequences of climate change, our results show that, at the global level, students associate this phenomenon with extreme events such as floods, fires, and storms. Some confuse them with geological disasters such as earthquakes or volcanoes, showing a conflation of climatic and geological processes. Less frequent responses mention melting ice, rising sea levels, or declining biodiversity, but this knowledge remains in the minority. At the local level, students mainly identify drought, water shortages, aridity, and heat waves, which correspond to their direct experience. We can therefore conclude that, although some global impacts are recognized, understanding remains focused on concrete manifestations, both globally and locally.

Given that the students surveyed have not received formal education on climate change, and that they draw on knowledge that is sometimes correct and sometimes incorrect, it is relevant to question the source of their information. Analysis of the responses shows that these students mainly obtain information about this phenomenon through digital media. Television is the second most frequently cited source, while school comes in third place. Interestingly, students identified school as a source of information despite the absence of explicit climate change instruction. They seem to attribute indirectly acquired knowledge to school, for example through activities or discussions about the environment, and this also shows the importance they attach to school as a place of learning, especially when it comes to scientific topics.

When it comes to the emotional dimension of climate change, most students surveyed admit to feeling afraid of this phenomenon. The results indicate that these fears are mainly associated with climate disasters. This focus reflects an emotional representation centered on extreme events perceived as threatening. The fear expressed also includes the impacts on living organisms, with the presence of non-climate-related disasters, which shows that there is confusion, probably due to a lack of knowledge about what climate change is. The global environmental and socio-economic dimensions remain secondary, suggesting once again a partial understanding of the subject. Overall, the picture is one of a representation dominated by emotion but lacking scientific structure.

At the end of this analysis, we can say that in the absence of climate change education, students build their knowledge from extra-curricular sources, which leads to incomplete and poorly structured knowledge about the phenomenon. The absence of a core social representation, confusion between causes and consequences and types of disasters, and the strong emotional charge reported highlight a mainly event-based and superficial understanding of the phenomenon. These results are consistent with numerous international studies (Lee & al., 2020; Leščešen et al., 2024; Ofori & al., 2023) showing that, without explicit teaching about climate change, young people develop unstable representations of the phenomenon with fragmented and often erroneous knowledge.

CONCLUSION

In the current global context marked by the intensification of the effects of climate change, education on this issue is of great importance. It plays a key role in helping young people understand climate mechanisms and consequences. It also supports informed decision-making, civic engagement, and resilience in the face of environmental challenges.

This study on Tunisian high school students' social representations of climate change shows that, in the absence of institutionalized teaching on climate change in schools, young people often draw on imprecise and unstructured knowledge on the subject, generally gathered from digital media. The phenomenon is mainly understood through its visible, local, and widely publicized manifestations. The emotional dimension, particularly fear, plays an important role in students' discourse; however, this fear is sometimes based on confusion between climate disasters and other types of natural disasters. These results highlight the need to strengthen climate change education in the Tunisian education system through explicit teaching based on scientifically contextualized data. In this regard, the prospects for this work consist of designing and testing teaching methods that integrate the cognitive, emotional, and civic dimensions of climate change, with the aim of promoting a systemic understanding of climate issues among young people and encouraging them to develop behaviors that contribute to sustainable climate resilience.

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